

REGULATORY IMPACT STATEMENT

PROPOSED
PROTECTION OF THE ENVIRONMENT OPERATIONS
(HUNTER RIVER SALINITY TRADING SCHEME)
REGULATION 2001



ENVIRONMENT PROTECTION AUTHORITY

Submissions

The Environment Protection Authority invites you to make written submissions on this Regulatory Impact Statement and on the proposed *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2001*.

Submissions should be made in writing and sent to:

The Executive Director
Economics and Environmental Reporting
NSW Environment Protection Authority
PO Box A290
Sydney South 1232

Submissions will be accepted up until the close of business on Friday 4 May 2001.

This publication is also available on the EPA's website at www.epa.nsw.gov.au

Published by:

Environment Protection Authority
59–61 Goulburn Street, Sydney
PO Box A290
Sydney South 1232
Phone: (02) 9995 5000 (switchboard)
Phone: 131 555 (information & publications requests)
Fax: (02) 9995 5999
Email: info@epa.nsw.gov.au
Website: www.epa.nsw.gov.au

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ISBN 0 7313 2766 7
EPA 2001/19
March 2001

Printed on recycled paper

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Acknowledgements

Mackie Environment Research, Wahroonga

Department of Land and Water Conservation, Newcastle office

SUMMARY

A pilot Hunter River Salinity Trading Scheme has been in operation in the Hunter catchment since 1 January 1995.

Under the Scheme, discharges of saline water to the Hunter River are managed so that they do not cause river salinity levels to exceed 600 electrical conductivity units (EC) at Denman and 900 EC at Singleton. This is achieved through the use of a system of:

- discharge scheduling that allows discharge only at times when the river's flow and salinity level are such that salt can be discharged without breaching the salinity targets
- sharing the allowable discharge according to dischargers' holdings of tradeable salinity credits.

The Scheme has allowed major industries (coal mining and power generation) in the catchment to continue to discharge saline water to the river on a managed basis, and so has reduced the significant costs of water storage or treatment that would otherwise have been incurred by those industries under the previous discharge management system. It has also allowed new facilities to be established within the catchment, which may not have been possible under the previous management system.

At the same time, the Scheme has protected the environment. Since the Scheme's commencement, the frequency with which the salinity target at Singleton was exceeded decreased from 33% before the Scheme to around 4% currently. None of the current exceedances are due to discharges by licensees.

An examination of a wide range of alternatives to the pilot Scheme shows that most would deliver either poorer environmental outcomes or similar outcomes at much greater cost. It is therefore recommended that a salinity trading scheme continue as the basis for managing salt discharge into the Hunter River.

The proposed *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation* will permanently implement the existing pilot Scheme and place the Scheme into a firm legislative framework. The principal purpose of the Regulation is to ensure the achievement of the water quality objectives for the Hunter River catchment that were set through the original stakeholder consultation process on the pilot Scheme and, more recently, incorporated in the Interim Water Quality Objectives (EPA, 1999b). Specifically, those objectives are to keep river salinity below 600 EC at Denman and 900 EC at Singleton.

A key change since the establishment of the pilot Scheme is the significant expansion of mining that is taking place in the Upper Sector of the catchment. To achieve the water quality objectives, the proposed Regulation will retain the structure of the pilot Scheme but will increase 'flood flow' thresholds in the Upper and Middle Sectors of the Scheme.¹ On average, this would mean that for a further 2% of all flows in the Upper Sector, and for just under a further 1.5% of all flows in the Middle Sector, discharge would be managed in accordance with credit holdings instead of being unrestricted as at present.

The incremental cost (that is, the cost above that of the existing pilot Scheme) of the proposed Regulation is expected to lie in the range of \$0.27 to \$0.90 million per year. Over 5 years, this is equivalent to an economic cost of \$1.2 to \$3.8 million in present value terms.

Almost all of this cost is the economic cost that Scheme participants will incur to adjust to the increased flood flow thresholds that are necessary to meet the water quality objectives. The

¹ The section of River that is covered by the Scheme is divided into Upper, Middle and Lower Sectors.

benefit of the change is that water quality will be protected even with the anticipated large increase in coal mining in the Upper Sector of the catchment.

The proposed Regulation will also introduce the following operational and administrative changes to the Scheme:

- The creation of 1 000 tradeable salinity credits, each having a lifespan of 2 to 10 years, and their allocation without charge to existing pilot Scheme participants in accordance with pilot Scheme credit holdings.
- The expiry of 20% of the credits every 2 years and the reallocation of those credits by public auction, with each credit then valid for 10 years.
- The creation of a new administrative role of ‘Services Coordinator’, which will be responsible for providing the river monitoring, modelling and River Register services necessary to run the Scheme. The Services Coordinator will be able to contract out its functions and will have the power to recoup its costs from Scheme participants.
- The creation of a new stakeholder committee called the Hunter Valley Salinity Trading Scheme Operations Committee, which may take on the role of Services Coordinator.

These administrative changes will bring about the following benefits additional to those of ensuring that the salinity targets for the catchment are not exceeded:

- Increased transparency and accountability with respect to funding and service quality of river monitoring, modelling and River Register provision.
- Increased certainty that market imperfections will not occur through inefficient credit allocation or distribution methods, non-availability of credits to new market entrants or unnecessary restrictions on eligibility to hold credits.
- Increased certainty that the Salinity Trading Scheme will continue to function on a firm regulatory basis, hence reducing the risk associated with investing in credits as an alternative to increased water storage or treatment capacity.

While these latter benefits cannot be readily quantified, the EPA believes them to be significant. Increased certainty about the continuation of the Scheme and its placement onto a firm regulatory basis provides investors with a longer planning horizon and reduces the risk associated with investment in saltwater management infrastructure. The introduction of competitive processes into credit allocation is expected to contribute to the wider economic efficiency gains achievable under the National Competition Policy.

In addition, the changes introduced to the Scheme will allow it to be adaptable and robust and to continue to protect water quality despite significant and continued development in the Hunter Valley.

The improved operation of the Scheme, combined with the achievement of the water quality objectives for the catchment, is sufficient to conclude that the proposed Regulation is superior to the existing pilot Scheme arrangements. It is therefore recommended that the proposed Regulation be made.

INTRODUCTION

1.1 Purpose and content of this document

The pilot Hunter River Salinity Trading Scheme has been in operation since 1 January 1995. Under the Scheme, salt discharges into the Hunter River are managed to keep the river's salinity within agreed limits. The NSW Environment Protection Authority (EPA) administers the Scheme through conditions on the environment protection licences of the two electricity generating companies and the 20 coal mines that currently participate in the Scheme.

The EPA is proposing to make a new Regulation to provide a statutory basis for the existing Salinity Trading Scheme, to ensure that the Scheme's objectives continue to be achieved, and to improve some of the current arrangements relating to the Scheme. The new Regulation proposes the following principal changes to the existing Scheme:

- An increase in the river flow thresholds above which unlimited salt discharge is allowed ('flood flow thresholds') in the Middle and Upper Sectors of the Hunter catchment.
- The creation of 1 000 tradeable salinity credits, each having a lifespan of 2 to 10 years, and their allocation without charge to existing pilot Scheme participants in accordance with pilot Scheme credit holdings.
- The expiry of 20% of the credits every 2 years and the reallocation of those credits by public auction, with each credit then valid for 10 years.
- The creation of a new administrative role of 'Services Coordinator', which will be responsible for providing the river monitoring, modelling and River Register services necessary to run the Scheme². The Services Coordinator will be able to contract out its functions and will have the power to recoup its costs from Scheme participants.
- The creation of a new stakeholder committee called the Hunter Valley Salinity Trading Scheme Operations Committee, which may take on the role of Services Coordinator.

The proposed Regulation (Appendix 4) sets out the Scheme in its entirety, including the principal changes described above.

Under the *Subordinate Legislation Act 1989*, the EPA is required to prepare a Regulatory Impact Statement (RIS) setting out the EPA's assessment of the economic, social and environmental costs and benefits of the proposed Regulation and its alternatives. The purpose of the assessment is to ensure that the proposed Regulation provides the greatest net benefit or least net cost to the community, compared with the alternatives to the Regulation.

This RIS:

- provides background information on salinity in the Hunter catchment and the development of the Salinity Trading Scheme (Chapters 2 and 3)
- explains the need for changes to the pilot Scheme (Chapter 4)
- sets out the objectives to be achieved and describes the legislative requirements and powers available to help achieve them (Chapter 5)
- reviews and assesses proposals for the river flow thresholds at which unlimited salt discharge can occur (Chapter 6)

² The River Register shows the classification of each 'block' of river flow (classified as low, high or flood) and shows how much salt can be discharged during high flows so that the salt targets are not exceeded.

- reviews and assesses options relating to the allocation of credits and the operation of a tradeable emissions scheme (Chapter 6)
- describes administrative arrangements to apply to the Scheme (Chapter 6)
- sets out a summary and conclusions regarding the proposal (Chapter 7).

1.2 Proposed consultation

The EPA consulted informally with the Department of Mineral Resources, the Department of Land and Water Conservation, the Hunter Catchment Management Trust, Rio Tinto, Macquarie Generation, Bengalla Coal and the NSW Minerals Council at the beginning of the development of the Regulation.

The EPA proposes to undertake a 4-week period of consultation with all stakeholders, which will include workshops. Consultation will focus on proposed changes to the pilot Scheme, particularly:

- changes to flood flow thresholds
- credit auctions
- scheme administration and funding.

The consultation will include a public seminar to present the proposed Regulation, and meetings with various interest groups where aspects of the Scheme that are of particular interest can be explored in more detail. The interest groups will include Scheme participants, water users and environment groups. The aim of the meetings will be to hear the community's initial response to the proposed Regulation and to help it prepare written submissions commenting on the Regulation.

Submissions are invited on the proposed *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2001*. Submissions should be made in writing and sent to:

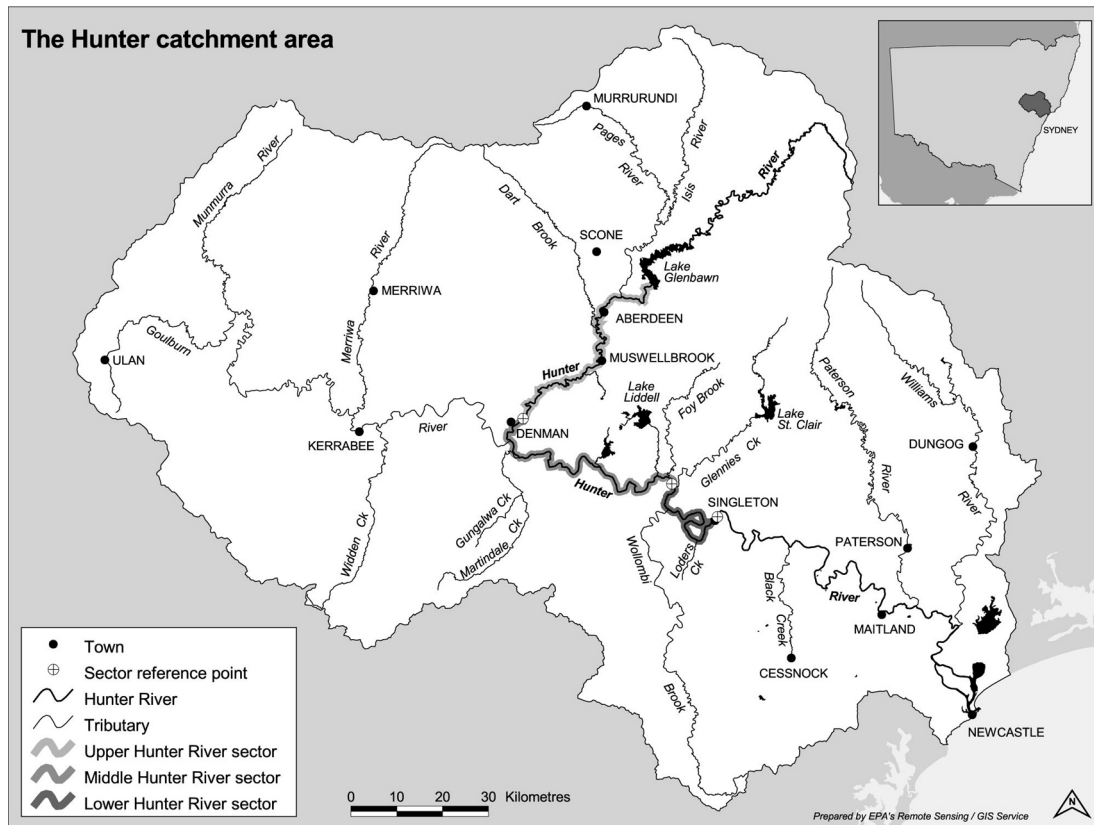
The Executive Director
Economics and Environmental Reporting
NSW EPA
PO Box A290
SYDNEY SOUTH NSW 1232

Submissions will be accepted up to the close of business on Friday 4 May 2001.

2. THE HUNTER CATCHMENT

The Hunter River catchment covers an area of 22 000 square kilometres on the NSW Coast (Figure 1). Its most westerly point is 250 km from the coast. The catchment has a population of 300 000. (EPA, 1994a; ABS, 1996). Industries in the region include dryland and irrigated agriculture, winemaking, coal mining and electricity generation. Newcastle, at the mouth of the Hunter River, is the world's largest coal export port by volume (Smith, 1995).

Figure 1: The Hunter River catchment.



2.1 Economic activity

Agriculture

Agricultural production in the Hunter catchment above Singleton was valued at over \$275 million in 1996–97. This included over \$100 million from over 24 000 ha of irrigated agriculture including dairying (ABS, 1996). The principal agricultural activities were dairying, beef cattle production, viticulture and vegetable cropping.

Mining

Coal mining is a major industry in the catchment. The contribution of black coal mining to the Australian economy is 1.09% of GDP, which is very large relative to other industries in Australia (IBIS, 1999).

The Hunter coalfield, which extends upstream from Maitland, was the fastest growing area of coal production in NSW in the decade to 1998. There are currently 20 operating coal mines in the Hunter catchment upstream of Singleton. In 1997–98, these mines collectively employed over 5 500 people and produced over 61 million tonnes of coal, of which approximately 50 million tonnes were exported. At an average (free-on-board) value of \$58.6 per tonne, the

economic value of export coal production in 1997–98 was an estimated \$2.9 billion. Since that time the value of coal has dropped, but production increases mean that the total value of export coal production from the upper Hunter is still in excess of \$2.6 billion per year.

The development of new coal mines is continuing in the Hunter Valley. Within the area that is subject to the Salinity Trading Scheme, at least 6 new mines were being considered as at December 1999 (ABARE, 1999). Table 2.1 lists these.

Table 2.1: Potential new mining developments in the Hunter River Salinity Trading Scheme area (Based on ABARE, 1999, p. 710).

Project	Location	Status	Expected start-up	New capacity (annual)	Capital expend.	Employment (operating)
Mt Arthur North	5 km SW of Muswellbrook	New project, committed	2001	3.0 Mt by 2003	\$500m	300
Glendell open cut	17 km NW of Singleton	New project, under review	Next 5 years	n.a.	n.a.	n.a.
Glennies Creek longwall	12 km NW of Singleton	Expansion, feasibility study under way	2001	3 Mt	\$200m	140
Howick open cut	25 km NW of Singleton	Expansion, under review	2002	3.75 Mt	\$100m	30
Kayuga open cut	10 km NW of Muswellbrook	New project, feasibility study completed	n.a.	1.6 Mt	\$43m	70–100
Mt Pleasant open cut	5 km W of Muswellbrook	New project awaiting mining approval	2002	7 Mt	\$300m	300

Electricity generation

Macquarie Generation operates 2 coal-fired power stations in the mid Hunter catchment: Bayswater and Liddell. In 1997–98, these power stations employed 688 people and consumed 11 million tonnes of coal to produce 22 700 GWh of electricity. This represented 40% of the NSW electricity supply and was valued at \$695 million, on which Macquarie Generation made \$46.6 million profit (Macquarie Generation, 1999).

In addition, Redbank 1 Power Station is in the process of starting operations in the mid catchment, and will have an expected output of 1048 GWh of electricity per year. A second unit for Redbank power station is under consideration; the proponents have sought director's requirements from the Department of Urban Affairs and Planning before preparing an environmental impact statement.

The major industries described, along with urban areas and smaller industries, rely on the Hunter River and its tributaries for water supply, wastewater discharge or both. Point source discharges of pollutants can potentially occur in all weather and river flow conditions, and diffuse source pollutant runoff occurs in wet weather when river flow is generally higher. One of the most significant pollutants of the Hunter River is salt, which is described next.

2.2 River salinity

The Hunter River displays generally increasing salinity along its length. The EPA estimates that 80% of the salt content in the river is due to natural sources (EPA, 1994a). Because much of the catchment's geology consists of marine sediment deposits, tributary flows into the Hunter River (and the river itself under natural low flow conditions) can be very saline. For example, Muscle Creek and Saltwater Creek have in the past displayed natural salinities of 4000 and 8000 EC³ respectively. A salinity model described by Croft & Associates (1983) suggests that there are roughly equal amounts of salt entering the Hunter River from sources upstream of Denman, from the Goulburn River and its tributaries, and from sources between the Goulburn River and Singleton.

If natural unregulated flow conditions were to prevail, the conductivity of the Hunter River's main stream would not fall below 600 EC most of the time. In dry weather when the river flow is naturally low, flow is sustained by groundwater inflows that commonly have conductivities of 1 000 to 3 000 EC (AGC Woodward-Clyde, 1992). However, under high flow conditions, when groundwater is supplemented by rainwater and runoff, mainstream conductivity can fall as low as 350 EC. To put this in context, the Water Quality and River Flow Interim Environmental Objectives for the Hunter River Catchment set 1 500 EC as the upper limit for acceptable salt levels in drinking water (EPA, 1999b).

In practice, flows in the Hunter River are regulated. Releases are primarily from Glenbawn Dam but are also from Glennies Creek Dam. Both dams store low-salinity water that is released to meet irrigation, town water, industrial, stock and riparian uses. Typical releases lie in the range of 350 to 750 ML per day to achieve a residual flow of 50 to 100 ML/day at Greta (AGC Woodward-Clyde, 1992, pp. 4–6).

The typical salinity of water draining from the upper reaches of the Hunter River is around 350 to 400 EC (EPA, 1994a). Upstream of Muswellbrook, natural salinity stays below 700 EC most of the time and exceeds this level only under extreme low-flow conditions. At Singleton in the 15 years prior to the start of the Salinity Trading Scheme, mean monthly conductivity levels averaged 845 EC; with 33% of months exceeding 900 EC and 1 month reaching 1 800 EC.

The potential effects of elevated river salt levels are to render water undrinkable for people and stock, reduce agricultural yields, cause accelerated corrosion of domestic and industrial pipework and appliances, and affect aquatic ecosystems. The principal areas of benefit from the control of salinity in the Hunter River are:

- irrigated agriculture, including viticulture, in all sectors
- town and domestic water users in the Upper Sector
- aquatic life along the length of the river.

2.3 Principal salt discharges in the catchment

Although most of the salt in the Hunter River comes from natural sources, discharges from human activity can periodically cause significant short-term increases in river salinity. In addition, the mean river salinity level showed a gradually increasing trend until the early 1990s. The principal human activities that release salt into the Hunter River are coal mining, electricity generation and agriculture.

³ 'EC' refers to electrical conductivity, a measure of salinity, measured in microsiemens per centimetre ($\mu\text{S}/\text{cm}$). Hence, '350–400 EC' means 350–400 $\mu\text{S}/\text{cm}$. At the conductivity levels described in this report, 1 EC unit is equivalent to approximately 0.6 mg/L of dissolved salt. For the purpose of this report, the term 'salinity' is used to refer to measures of both conductivity and dissolved salts.

At 1 January 2001, 10 of the 20 coalmines above Singleton had environment protection licences that authorised discharge of saline water to the Hunter River or its tributaries. Coalmines in the Hunter catchment accumulate water as the workings intersect saline groundwater and, if open-cut, from rainwater as the mine operations expose salt-bearing rocks to erosion and leaching. Much of this water is reused within the mines. However, some of the mines generate more water than they can reuse and must discharge the excess to the Hunter River or its tributaries if they are to continue operating. The mean salinity of water discharged from mines varies but has been estimated at around 4 500–5 000 EC (Mackie Environmental Research, 2000; AGC Woodward-Clyde, 1992). Since 1 January 1995, mine water has been discharged in accordance with the pilot Hunter River Salinity Trading Scheme (see Chapter 3).

Macquarie Generation operates 2 power stations, Bayswater and Liddell, which abstract water from the Hunter River for cooling. The production of steam for electricity generation concentrates natural salts in the power stations' waste water. That saline water is stored in Macquarie Generation's storage dam (referred to as Lake Liddell) for management or disposal. Macquarie Generation operates a waste management strategy, including the use of brine concentrators, which reduces the need to discharge saline water from Lake Liddell to the Hunter River (via Bayswater Creek). Although it has the technical capacity to operate without discharge, the discharge of saline water saves Macquarie Generation between \$100 and \$400 per million litres discharged and hence is of significant benefit to Macquarie Generation. (EPA, 1994a; Watt, 1992). Since 1 January 1995, discharges from Lake Liddell have been carried out in accordance with the pilot Hunter River Salinity Trading Scheme.

It is likely that the new Redbank Power Station will also receive a significant benefit through avoiding the costs of alternative salt management systems that would have been required in the absence of the ability to discharge saline water.

Agricultural activity can also result in saline water intrusion into fresh surface waters. In the case of the Hunter catchment, this is likely to occur either through land clearing or through irrigation water reaching groundwater. Land clearing can contribute to both dryland and river salinity by increasing the amount of rainfall that reaches the watertable and hence shifting the groundwater equilibrium. Irrigation water that reaches groundwater in the Hunter usually does so via river alluvium. The downwards-percolating irrigation water displaces highly saline groundwater, pushing it through the alluvium into the river (EPA, 1994a). These discharges, along with discharges from natural causes, are known as diffuse or non-point-source discharges and are not currently regulated.

3. THE PILOT SALINITY TRADING SCHEME

The pilot Salinity Trading Scheme was established as a mechanism to address the problem of increasing salinity in the Hunter River. The increase was caused by a combination of the physical characteristics of the Hunter catchment and the activities of agricultural, mining and electricity generation industries, all of which rely on the river for water or for discharge.

3.1 History of the pilot Scheme

The average conductivity of flows in the Hunter River increased throughout the 1970s and 1980s. This is believed to have been primarily a result of human activities. By 1992 a serious conflict had developed between irrigators and mining companies over salinity levels (EPA, 1999a).

The EPA and its predecessor, the State Pollution Control Commission, had followed a traditional licensing strategy that required industries to minimise discharges (EPA, 1999a). That licensing strategy failed to contain salinity increases in the river for a number of reasons. Foremost among these was the system of combined ambient and incremental limits, known as the trickle discharge system: licences entitled licensees to discharge a small volume of saline water to the river at all times, regardless of river flow and salinity conditions. This meant that at times of low river flow and high ambient salinity, river salinity could reach excessive levels. It also provided insufficient opportunities for dischargers to meet reasonable needs, and the trickle discharge volumes prevented licensees from taking full advantage of the dilution capacity of high river flows (Smith, 1995, p. 51).

Consequently, by 1992 the EPA required all new licensees to operate without the need to discharge saline water into the river.

The development of real-time salinity monitoring for the river enabled the then Department of Water Resources to collect data and model salinity changes in the river. This showed that greater salt discharge was possible during higher river flows (Smith, 1995). Because there is a broad link between river flow and salinity, salinity levels were particularly high during periods of dry weather and low river flows; higher flow usually meant lower salinity due to dilution by rainwater inflows.

In 1992–93, representatives of agriculture, environment groups, mining interests, the electricity industry and Government met and agreed to carry out a discharge scheduling trial. The success of the trial led the key stakeholders to agree to a pilot scheme for managing salt discharge to the river (Smith, 1995).

Structured discussions among the stakeholders throughout 1993 established key salinity objectives and discharge flow criteria that were supported by the community.

River flows were divided into 'low', 'high' and 'flood' flows, with discharge prohibited during low flows and unlimited discharge allowed during flood flows. When discharge was occurring, river salinity was not to exceed 600 EC at Denman, or 900 EC between Denman and Singleton. Those salinity levels were agreed in consultation with stakeholders because:

- they were believed not to exceed the long-term natural averages that would occur in the absence of point source discharges
- water users would not accept further deterioration of water quality beyond those levels.

Since that time, the pilot Scheme's salinity targets have been incorporated in the Water Quality and River Flow Interim Environmental Objectives (EPA, 1999b) prepared for the Hunter River catchment as part of the NSW Water Reform process. This process included widespread public consultation and opportunity for submissions.

In 1994, at the request of participating groups, the EPA produced a scoping paper and draft operational plan for the Salinity Trading Scheme. After some modifications, those documents were followed by a Guideline and Rulebook (EPA, 1995), which established the pilot Scheme largely as it operates today.

It is important to note that the pilot Scheme is not the only possible salt management system that could be used in the Hunter catchment. Many options for managing excess salt have been proposed and reviewed at different times, such as:

- nil discharge, including shutdown of facilities that cannot avoid discharge
- pipeline to the sea
- evaporation basins
- deep well injection
- desalination
- discharge under a traditional licensing approach
- discharges into special releases of dilution water
- variations on discharge scheduling.

The merits of those options have been reviewed in various studies, for example Croft & Associates (1983), AGC Woodward Clyde (1992), EPA (1994a) and Smith (1995).

The EPA reviewed the findings of those studies before preparing this RIS. The review showed that, of the options examined in those earlier studies, discharge scheduling such as that provided by the Salinity Trading Scheme would remain the most cost-effective method of meeting the environmental objectives for the catchment. For comparison, the estimated costs of the next least-costly options (where these are certain of meeting the environmental objectives) are:

Desalination: \$30–\$50 million capital plus \$4.2 million annual cost

Pipeline to sea: \$30–\$50 million capital plus easements and operating costs

No new development: Opportunity cost very conservatively \$10 million per year.⁴

The other options were more expensive or technically infeasible. For reference, the alternative options are outlined in Appendix 1 but are not considered further here.

As a result of that review, and from its experience in developing and administering the pilot Scheme, the EPA has drawn several conclusions about the management of salt in the Hunter River:

- Adequate salt management requires salinity targets to be set for the river.
- Compliance monitoring is required at a number of points along the Hunter River to ensure that salinity targets are met.
- The most cost-effective way to meet the salinity targets is to schedule salt discharge so that it occurs at times of higher flow when the salt dilution capacity of the river is greater.
- A tradeable credits scheme has proved to be a successful means to share the scheduled salt discharge opportunities.

⁴ Assumes lost gross operating surplus equal to 5% of turnover for 2 mines that would otherwise be constructed with a turnover of \$300 million per year, 33% Australian ownership and no multiplier effects.

3.2 How the pilot Scheme works

The pilot Scheme commenced on 1 January 1995 and remains in operation. The Scheme's objectives are:

- To manage saline water discharges so as to minimise impacts on irrigation, other water uses, and on the aquatic ecosystems of the Hunter River catchment.
- To achieve the above objective:
 - at least overall cost to the community
 - in an equitable and flexible manner
 - in a way that provides ongoing financial incentives to further reduce pollution.

To achieve those objectives, the Scheme's operating conditions are designed:

- To eliminate discharges during periods of low river flow (when their environmental impact is greatest).
- To manage the total of individual discharges at other times, so that the target salt levels are not exceeded, the limits being:
 - 600 EC at the Denman gauging station (upstream of the junction of the Goulburn and Hunter Rivers)
 - 900 EC at the junction of Glennies Creek and the Hunter River
 - 900 EC at Singleton.
- To allow trading of high flow discharge entitlements between licence holders, such that the target salt levels are not exceeded and tributaries conveying the discharges to the river are protected.
- To maximise the use of flood flows for necessary saline discharges when their environmental impact is minimal.

Discharges are regulated according to the flow rate of the river:

- Low flow—during which no discharges are permitted.
- High flow—during which discharges are permitted using tradeable credits.
- Flood flow—during which no volume discharge limit applies.

For both high and flood flows, licensees must not discharge in excess of any limit specified in their licence to protect a tributary carrying a discharge to the main river.

During high flows, a total allowable salt discharge is calculated for the river and is shared among licensees according to their credit holdings. There are 1 000 credits in total, with each credit authorising discharge of 0.1% of the total allowable salt discharge into a specific 'block' of water. (A 'block' is defined as the amount of water that passes Singleton in a 24 hour period.)

The total allowable salt discharge is equal to the amount of additional salt that could be added to a block of water such that the salinity level of the block would not exceed 900 EC at Singleton. Discharges from industry are also managed so that they do not cause the river to exceed 900 EC at Singleton and Glennies Creek, and 600 EC at Denman. The Scheme provides that, if necessary, a 'sector credit discount factor' can be applied to protect water quality in a particular sector (e.g. where too many credits are acquired by participants in that sector). The discount factor effectively limits the number of credits that a participant may use to discharge into a block as it passes through the sector, so that total discharges in that sector do not result in the salinity target being exceeded.

The pilot Scheme is implemented through conditions of environment protection licences that are held by coal mining and electricity generating companies. The EPA initially allocated the salinity credits according to a formula that accounted for environment protection measures, saline mine water 'make' (i.e. need to discharge) and economic output of industry. Subsequent reallocations of credits have simply rolled over licensees' existing holdings.

The pilot Scheme is a practical application of the theory that emissions trading schemes offer a more efficient way of achieving specific environmental objectives than does traditional regulation. An emissions trading scheme means that potential dischargers can choose to buy salinity credits rather than pay for alternative water management systems if this is in their interest, and can sell salinity credits if they are no longer needed. This is important because, in the case of the Hunter, some mines could not avoid the need to discharge even if they made significant investment in other management options. The result of the Scheme should therefore be the minimisation of industry compliance costs and optimal outcomes for the economy and the environment.

The salinity credits under the Scheme are valid for each high flow event, meaning that they are not extinguished by use as in some other types of emissions trading schemes around the world. Credits may be transferred to other participants permanently, entitling them to discharge in all future high flow events, or entitlements to discharge during only a particular high flow event or for a particular season may be transferred. The Scheme allows for payment to be made for credit trades, but the Scheme does not require disclosure of prices paid, if any.

3.3 The pilot Scheme's effectiveness

3.3.1 Environmental outcomes

Since the pilot Scheme's inception, river salinity levels have not exceeded the salinity targets as a result of licensees' discharges (DLWC & EPA, 1998). A very small number of short-term exceedances have occurred owing to natural factors. For example, the mean monthly salinity at Singleton reached a maximum of 921 EC in December 1998. However, this was a result of natural low flows as, under the rules of the Scheme, discharges by Scheme participants were not permitted at that time.

As shown by Figure 2, the mean monthly salinity at Singleton has shown a declining trend since the Scheme's inception in 1995.

Figure 2: Electrical conductivity at Singleton 1980 to 2000 (monthly means).

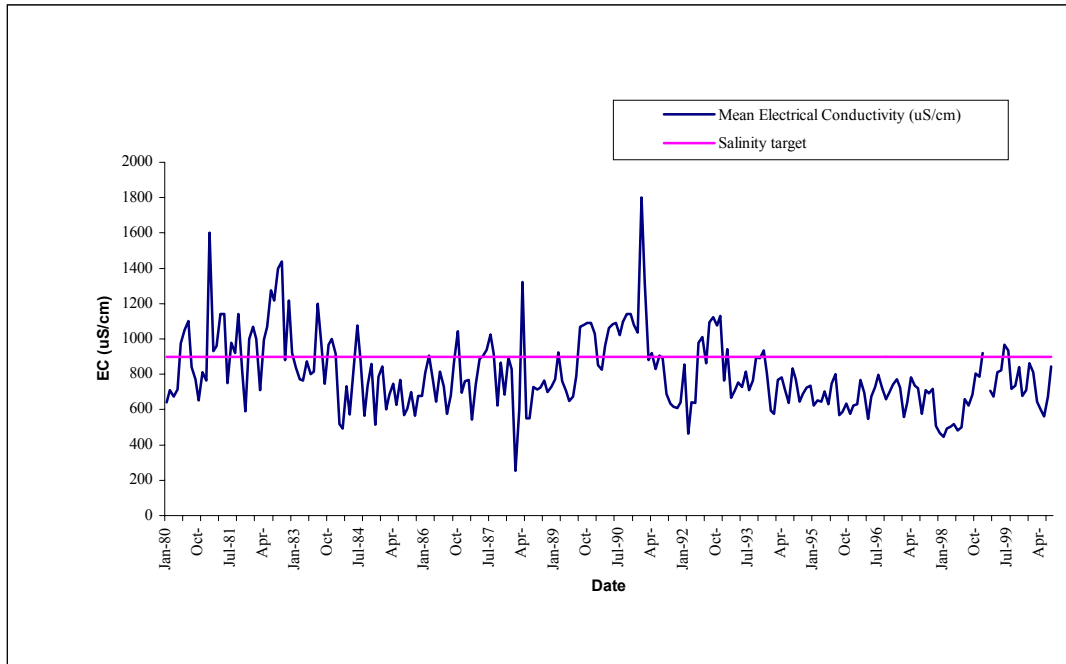
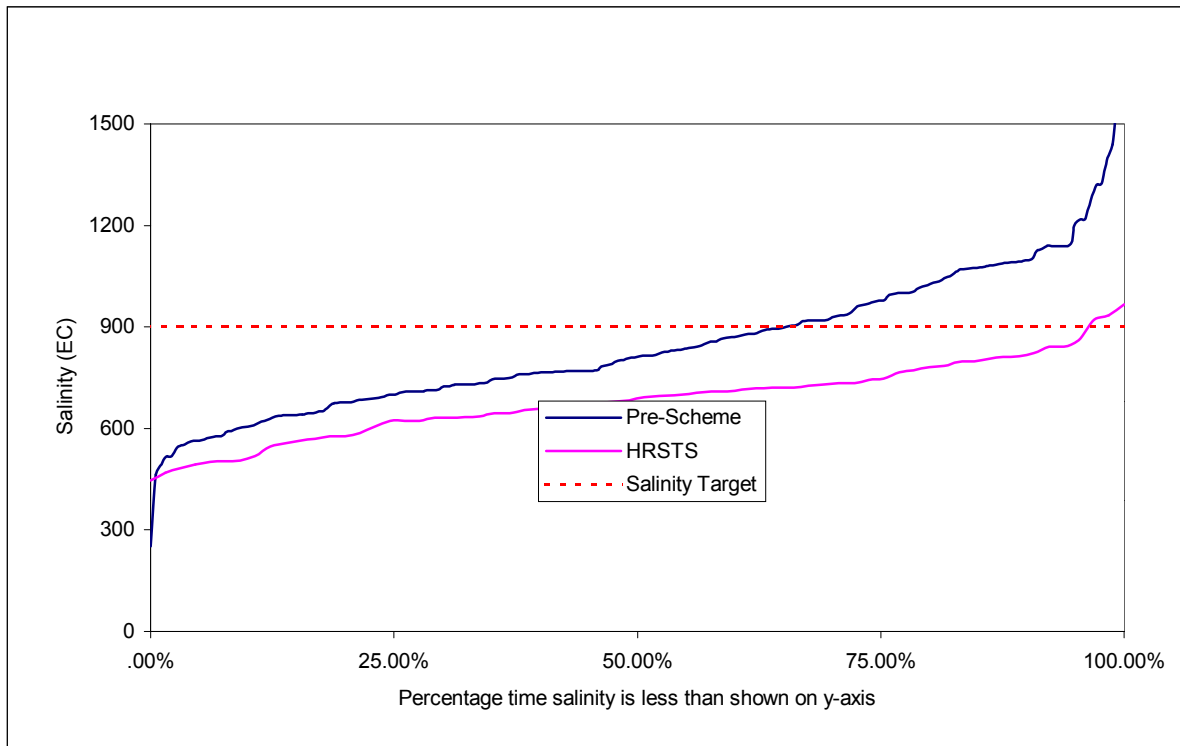


Figure 3 shows salinity under the Scheme in a different way. In the fifteen years before the Scheme, salinity at Singleton exceeded 900 EC around 35% of the time. Since the Scheme’s commencement, this has been reduced to 4% of the time. The EPA and DLWC believe that the lower salinity under the Scheme has occurred despite the occurrence of drier weather that would previously have been associated with increasing salinity levels (DLWC & EPA, 1998).

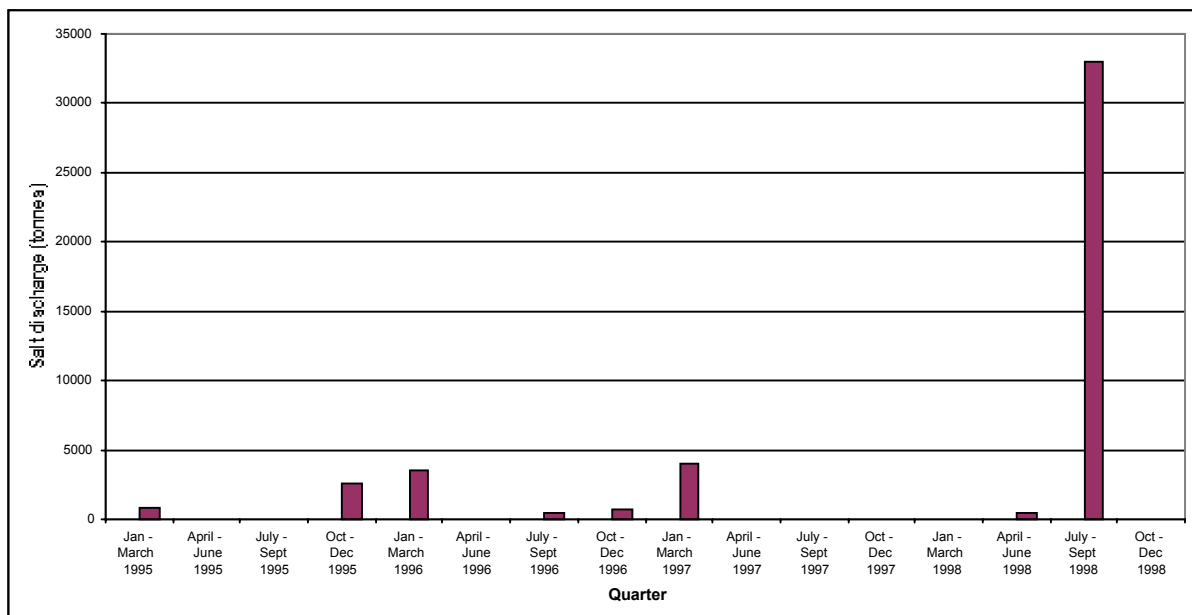
Figure 3: Pre-Scheme and post-Scheme monthly salinity levels at Singleton.



Historical records show that, over the long term, the river is in low flow 89% of the time, in high flow 7% of the time and in flood flow 4% of the time. However, these averages disguise the significant variability in river flow levels, in particular the potential for prolonged low flow periods associated with El Niño events.

Figure 4 illustrates this. Between 1 January 1995 and 31 December 1998, the river was in low flow 92% of the time, in high flow 5% of the time and in flood flow 3% of the time. A total of 45 500 tonnes of salt was discharged by licensed dischargers during this period. However, nearly 33 000 tonnes (72% of the total) were discharged in a single quarter in 1998. In contrast, no discharge occurred at all for the year from April 1997 to March 1998.

Figure 4: Quarterly salt discharge under the pilot Scheme, 1 January 1995 to 31 December 1998.



3.3.2 Additional capacity

To the end of 1998, only 20% (on average) of the total allowable high flow discharge had been used when examined on a quarterly basis (excluding data for the abnormally wet third quarter of 1998).

More significantly, on a daily basis there were significant fluctuations in usage of allowable high flow discharge, but no more than 43% of the total allowable discharge was ever used on a single day. This occurred on 16 September 1998, when 5 mines and Macquarie Generation discharged salt at levels generally above 75% of their individual allowable discharges. Despite that, only 52% of the *useable* (i.e. non-EPA) credits were held by those dischargers, and 262 credits remained completely unused at other facilities.

3.3.3 New developments

The pilot Scheme has enabled the development of new mining and power generation projects that might not otherwise have been possible under the previous licensing system because that system restricted new salt discharges into the catchment (as discharges were already adversely affecting river salinity and threatening agriculture). The Scheme manages the cumulative impact of saline discharges and is thus able to accommodate new development while also ensuring that water quality is protected.

One of these new developments is Bengalla Coal Mine, which was developed at a cost of around \$300 million. The mine employs 300 people and has a projected coal output of nearly 6 Mt per year. The value of this output is around \$300 million per year at current prices.

Another new development that may not have been possible without the Scheme is Redbank Power Station, which was also established at a cost of \$300 million. The power station will employ 50 full-time employees and will have a power output of 130 MW.

The Scheme has allowed these economic benefits to be achieved without losses to other sectors or water quality in the Hunter River, and has also enabled developers to consider new proposals such as those shown in Table 2.1.

3.3.4 Credit trading

Credit trading under the Scheme has been carried out successfully to date, although it is possible that the existing paper-based trading mechanism has inhibited the potential volume of trades. There were relatively few trades in the early years of the pilot Scheme, partly owing to inexperience with the Scheme and partly to a lack of opportunities for discharging salt in 1997. However, in the last two and a half years the number of trades has increased substantially, with 31 trades in 2000 (Table 3.1).

Table 3.1: Credit trading history.

Year	Number of trades
1995	1
1996	2
1997	0
1998	20
1999	18
2000	31

In August 2000, the EPA began a trial of a new website to allow on-line credit trading. At the time of writing, the pilot Scheme participants are being trained in the use of the website before official commencement. The use of an on-line website provides a central place for trading, removes the need for the EPA to manually process credit trades, and should reduce search time and costs associated with buying and selling credits. This means that 24-hour instantaneous credit trading will be possible, which will also enable participants to make trades at short notice when discharge opportunities occur out of office hours. Increased trading will enhance the capacity of the Scheme to deliver cost-effective water management. The website address is <http://www.epa.nsw.gov.au/hrsts>.

The Department of Land and Water Conservation, which is responsible for river monitoring, modelling and River Register provision under the pilot Scheme, is also in the process of introducing an on-line River Register website at <http://www.hits.nsw.gov.au> ('hits' stands for Hunter Integrated Telemetry System).

3.3.5 Summary

The pilot Scheme is supported by the Scheme participants and by the wider community in the Hunter Valley. It has successfully achieved its objectives in controlling river salinity, while allowing new developments that may not otherwise have been possible without significant environmental harm and effects on agriculture. It has also provided for trading in discharge opportunities between participants (with potential cost savings) that would not have been possible under the previous licensing system.

4. THE CASE FOR CHANGE

The previous chapter described the pilot Scheme, and in particular identified the Scheme's success in terms of community support, environmental outcomes and allowing new development. The Scheme is functioning well in its pilot form at present. However, it is now clear that there are a number of risks and pressures on the horizon that the Scheme will not be able to deal with in its current form. This chapter describes those risks and pressures and outlines the case for change.

4.1 Catchment development pressure on environmental targets

As described in Chapter 2, the development of new coal mining operations and power stations in the Hunter Valley has continued since the start of the pilot Scheme, and is likely to continue. The rate of growth of coal output in the catchment can be seen in Table 4.1, which shows the annual production from the Singleton–North West coalfields since 1989.

Table 4.1: Annual coal production from Singleton–North West coalfields.

Year	Saleable coal output (kilotonnes)
1988–89	26 669
1989–90	32 909
1990–91	34 915
1991–92	37 237
1992–93	39 053
1993–94	42 240
1994–95	47 119
1995–96	46 758
1996–97	55 050
1997–98	62 754

As shown by Table 4.1, saleable coal output more than doubled over the decade shown. While growth in coal output may not necessarily continue at the same rate, ABARE has projected an increase of 4.6% (8 Mt) in Australian coal exports in 2000–01. In addition, Port Waratah Coal Services at Newcastle has invested hundreds of millions of dollars expanding its coal loading terminals in the last 4 years. It is currently constructing a loading capacity of 89 Mt per year, and may increase that to 100 Mt in the next few years. These factors, along with the new mining proposals identified in Chapter 2, strongly suggest that there could be increased demand for the discharge of salt into the Hunter River.

The new mining developments are generally located in the upper part of the catchment, and this trend is expected to continue. An analysis of the changes in total discharge capacity and the location of potential dischargers within the catchment suggests that the pilot Scheme's 600 EC salinity target in the Upper Sector will be increasingly at risk as new developments discharge under pilot Scheme rules.

When the pilot Scheme began, the combined discharge capacity of all discharging participants within the Scheme was around 1 500 ML/day, of which only 0.1% was located in the Upper Sector. The current discharge capacity is around 1870 ML/day, of which 11% is located in the Upper Sector.

It is projected that further discharge capacity, of at least 445 ML/day and possibly up to 845 ML/day, will be introduced into the Upper Sector within the next 5 years. A smaller amount will be introduced into the Middle Sector, taking the total discharge capacity within the Scheme to around 2 300–2 700 ML/day, including 640–1 000 ML (i.e. 28%–37%) located in the Upper Sector.

The Upper Sector has a discharge rule that allows unlimited salt discharge into a river block provided that the block size will exceed 2 000 ML/day at Denman, 6 000 ML/day at Glennies Creek and then 10 000 ML/day at Singleton.

However, the Upper Sector also has a salinity target of 600 EC (at Denman) and flows are generally much smaller than downstream. This means that discharge opportunities are significantly smaller than in the Middle and Lower Sectors.

At a flow of 2 000 ML/day at Denman, and subject to ambient river salinity and discharge salinity, a discharge of only 90–150 ML may be sufficient to exceed the 600 EC limit, whereas the maximum discharge capacity in that sector could easily reach 650–850 ML per day.

The projected increase in salt discharge capacity in the Upper Sector is likely to cause the environmental objective (i.e. the 600 EC target) to be exceeded at Denman in some future flood flow discharges. If combined Upper Sector saline water discharges were 640 ML/day in flood flow conditions, a river flow of around 10 000 ML/day would be required to ensure that the salinity target was not exceeded. However under the existing rules of the pilot Scheme, it is possible for a 640 ML discharge to occur into a river flow of only 2 000 ML/day. If such a discharge were to occur, river salinity would approach an unacceptable 1 400 EC.

This strongly suggests the need to increase the range of flows in which discharge is managed through the credit system, rather than being unrestricted. This could most readily be implemented by increasing the flood flow thresholds in the Upper and Middle Sectors.

4.2 Availability of credits

The pilot Scheme involves 1 000 tradeable salinity credits, of which 800 were issued to Scheme participants in 1995 and 200 remained with the EPA as provision for new development. Since that time, Bengalla Mine, Redbank Power Station, Peabody Resources and Nardell have been granted 113 credits in total from the EPA reserve, leaving 87 credits available for new developments.

At the time of writing, there were at least 7 projects either under way or under consideration for new, potentially salt-discharging facilities in the Hunter catchment. The 7 consist of 1 new power station and 6 coal mining developments. The EPA has estimated, based on average credit requirements and knowledge of some projects' discharge needs, that these projects will together request in excess of 200 credits.

Therefore the EPA expects to run out of credits for new developments within a short time if it continues to use the pilot Scheme's credit allocation system.

Analysis of credit trading patterns suggests that a large number of credits remain unused during discharge events and some are never used at all. Those unused credits mean that the pool of available credits is actually larger than indicated by the EPA reserve. Despite these unused credits, there does not appear to be great liquidity in the credit market under the current trading framework, even allowing for recent increases in trading activity.

This suggests that if new developments need to discharge salt after the EPA credit reserve is exhausted, the options available under the pilot Scheme are for those developments to discharge during flood flows only or to acquire credits from existing credit holders. This may create operating difficulties and additional costs for new development, leading to demands for

the retirement and reallocation of existing credits so that existing Scheme participants are not seen to have an unfair advantage over new developments.

Proponents of new development might also call on the EPA to create additional credits in order to accommodate new Scheme entrants. However, such an approach would have the effect of devaluing all credits held by incumbents, thereby reducing the amount that may be discharged per credit and undermining the Scheme's goal of facilitating cost-effective water management.

To remain viable, the Scheme needs to ensure that credits are made available in a way that effectively meets the interests of both incumbents and proponents of new developments.

4.3 Certainty about the Scheme

Some participants are likely to have concerns about the longevity of the Scheme while it remains in pilot form. To maintain an acceptable level of commercial risk, Scheme participants may make greater investments in water management systems than would be necessary if there were more confidence that they would be able to discharge saline water during the lifetime of their water management infrastructure.

However, salt credits are currently allocated to participants only for 1 or 2 years before they expire and are reallocated by the EPA. While the EPA could, in theory, allocate credits to the Scheme for longer periods, this could raise problems for both existing and new developments wanting access to credits, given low credit market liquidity and the likelihood that the EPA will run out of credits early in the period. The pilot arrangements therefore impose a cost on industry that is akin to a risk premium. This cost could be reduced if the Scheme were able to sustain long-term credits in combination with a mechanism to improve credit market liquidity.

4.4 Administrative arrangements

The pilot Scheme is based on an informal system for funding the provision of river monitoring and modelling services, in which each participant's contribution is determined by the number of credits that the participant holds. Because of this, it is possible that licensed dischargers could choose to 'free ride' by divesting themselves of credits and discharging only during flood flows, thereby using the Scheme's monitoring and modelling service but not paying for that use.

Further, a participant's failure to pay a contribution does not at present constitute a breach of regulatory requirements. Nor is there a mechanism for calculating interest payable on late payments, or for automatically enforcing the payment of contributions (e.g. via credit forfeiture or debt recovery). Some participants have, in the past, expressed concerns about the transparency and scope of the monitoring and modelling service. Payment has been delayed on occasion, although to date no participant has attempted to withdraw from the Scheme and its requirement to contribute to Scheme costs.

However, Scheme participants currently provide only \$170 000 (around 60%) of the estimated \$290 000 annual cost of the river monitoring and modelling service; the remainder is provided by the State. This level of subsidy is unlikely to continue, which will mean a move to full cost recovery if the Scheme is to continue.

There is therefore a case for introducing better administrative arrangements than currently exist under the pilot Scheme to enhance both cost recovery and accountability for service delivery.

5. THE PROPOSED REGULATION

The EPA has prepared a draft Regulation, the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation*. The proposed Regulation details a proposal for a permanent salinity trading scheme for consideration by the community that builds on the success of the pilot Scheme and makes the changes necessary to ensure that the Scheme remains viable and robust.

This chapter describes the objectives of the proposed Regulation and the features of the proposed Scheme.

5.1 Legislation and objectives

The *Protection of the Environment Administration Act 1991* sets the EPA the objective of protecting, enhancing and restoring the quality of the environment of NSW, having regard to the need to maintain ecologically sustainable development.

The *Protection of the Environment Operations Act 1997* provides the statutory tools through which environment protection objectives can be achieved. Parts 9.3 and 9.3A of the Act provide the EPA with the power to develop and implement schemes involving economic measures as a means of achieving cost-effective environment protection. Section 295C of the Act allows tradeable emissions schemes to be implemented by means of a Regulation under the Act. It is recommended that the proposed Regulation be made under Sections 295C and 323 and Schedule 2 of the Act.

The proposed regulatory objectives are:

1. To manage saline discharges so as to minimise impacts on irrigation, other water uses and on the aquatic ecosystems of the Hunter River catchment.
2. To achieve objective (1):
 - (i) at least overall cost to the community
 - (ii) in a way that provides ongoing financial incentives to reduce pollution.

Under the proposed Regulation, objective 1 will be achieved by ensuring that the discharge of salt does not cause river salinity to exceed 600 EC at Denman or 900 EC at Singleton. These salinity targets are the same as those under the pilot Scheme (which were subsequently incorporated in the Interim Water Quality Objectives: EPA, 1999b).

5.2 Overview of development process

There is a range of options that could be used to manage excess saline water in the Hunter catchment, and under the *Subordinate Legislation Act 1989*, the EPA is required to consider these as alternatives to (or within) any new regulation.

The choice of which salt management strategy to use has been reviewed a number of times since 1983 and resulted in the development and adoption of the pilot Scheme in 1995. As part of the development of this RIS the EPA re-examined the other salt management strategies possible for the catchment, and concluded that a salinity trading scheme remained the best approach. The options not chosen, and the reasons why, are outlined in Appendix 1.

The EPA also examined the features of the pilot Scheme to determine what changes would be needed to address the issues described in Chapter 4. Features that remain unchanged include:

- division of the river into Upper, Middle and Lower Sectors with salinity targets of 600 EC, 900 EC and 900 EC respectively

- the use of a total allowable discharge calculation (determined by the flow size and salinity of river blocks) to maintain ambient river salinity within the target levels
- the use of tradeable credits to determine individual dischargers' shares of the total allowable discharge, rather than other sharing mechanisms such as informal sharing or a roster system.

The features that do not represent any change from the status quo are not discussed further here.

The remainder of this chapter describes key changes to the Salinity Trading Scheme that the EPA considers necessary to address the issues raised in Chapter 4 and maintain a successful scheme. The effects of introducing these changes are assessed in Chapter 6.

5.3 Key changes to the Salinity Trading Scheme

In summary, the major changes to the Scheme are:

- increases in the 'flood flow' thresholds (beyond which unlimited discharge of salt to the river is allowed) for the Upper and Middle Sectors
- altered mechanisms for allocating, holding and trading credits, in particular moving from a system of administrative allocation of credits to a system of initial allocation based on current holdings (grandparenting) followed by 2-yearly credit auctions
- establishment of a Services Coordinator and an administrative framework under which stakeholders can be directly involved in Scheme management, funding and service quality levels.

In all other substantive respects, the proposed Regulation retains, clarifies and formalises the existing Salinity Trading Scheme.

5.3.1 River flow classification and discharge thresholds

The proposed Regulation provides for continuation of the classification of the river flow in each sector into categories of low, high or flood flow. This classification applies to a 'block' of river water, which is defined as the body of water that passes the DLWC gauging station at Singleton during a 24-hour period from midnight to midnight. However, under the proposed Regulation it is proposed to increase the flood flow thresholds for the Upper Sector to 20 000 ML/day and for the Middle Sector to 10 000 ML/day. The flow categories proposed for each sector are shown in Table 5.1.

Table 5.1: Current and proposed flow categories for each sector of the Hunter River (ML/day).

River sector	Low flow	High flow		Flood flow	
		Current	Proposed	Current	Proposed
Upper	< 600	600–2 000	600–20 000	> 2 000	> 20 000
Middle	< 1 800	1 800–6 000	1 800–10 000	> 6 000	> 10 000
Lower	< 2 000	2 000–10 000	2 000–10 000	> 10 000	> 10 000

The discharge rules remain the same. The proposed Regulation allows salt discharge that is unlimited during flood flows and regulated in proportion to credit holdings during high flows. It prohibits discharge during low flows, in excess of credit holdings during high flows, or in excess of 'tributary protection limits' during high and flood flows. (Tributary protection limits are volume discharge limits included in some licences to protect tributaries from erosion.)

The discharge rules are summarised in Table 5.2.

Table 5.2: Discharges allowed under differing flow conditions.

River flow category	Discharge rules
Low	No salt discharge permitted.
High	Controlled discharge—salt discharge permitted by licensees in accordance with their credit holdings (but not to exceed any tributary protection limit).
Flood	Unlimited discharge—salt discharge may be carried out without use of credits, subject to conditions of individual licences, including tributary protection limits.

These revised flood flow thresholds will have the effect of reducing the number of occasions on which unlimited salt discharges can currently occur, by setting limits on the total allowable salt discharge for a proportion of those occasions. Instead, discharge will be managed by the credit system on those occasions. This change will apply to approximately 2% of flows per annum (on average).

5.3.2 Calculation of total allowable discharge

The EPA also proposes to change the basis for the calculation of total allowable discharge (TAD). At present, the calculation of TAD for sectors in high flow is based on river flow and salinity at Singleton. Under this system, increasing the TAD at Singleton means that the TAD per credit increases throughout the entire Scheme. It is therefore possible, for example if the Lower Sector is in flood, to calculate a TAD at Singleton that would cause exceedance of salinity targets in the Upper and Middle Sectors—particularly in the Upper Sector, which has a more stringent salinity target. At present this is addressed through provision for a ‘sector credit discount factor’, which if invoked would discount the value of credit holdings by whatever factor is necessary to meet salinity targets.

The EPA considers that the risk of salinity target breaches may increase in the Upper Sector owing to increased discharge capacity in that Sector, the revised flood flow thresholds and the ability to trade instantaneously via the on-line credit exchange facility.⁵ Under the current rules, this risk would be addressed by the application of a sector credit discount factor. However, the use of such discount factors can introduce uncertainty and trading inefficiency. (For example, an Upper Sector participant might acquire credits in order to discharge into a high flow event. If the value of that trade is then written down by the imposition of a discount factor, the participant has incurred unnecessary cost.)

To minimise this uncertainty and inefficiency, the proposed Regulation introduces a new approach to setting TAD which has the effect of reducing the need to use discount factors to protect water quality. Rather than calculate TAD at Singleton (with its 900 EC target), it is instead proposed that TAD be calculated based on the furthest downstream sector that is still in high flow. For example, where the Upper Sector is in high flow and the Middle and Lower Sectors are in flood flow, TAD would be set at Denman (i.e. the bottom of the Upper Sector) based on the 600 EC target.

This would reduce the need to apply sector credit discount factors and would therefore provide greater certainty about the number of credits required for a given discharge volume. While the

⁵ By way of example: Assume the Upper Sector is in high flow and the Middle and Lower Sectors are in flood flow. In this scenario, dischargers in the Middle and Lower Sectors do not need their credits in order to discharge and could therefore trade them on-line to the growing number of participants in the Upper Sector. If too many credits are held and used by participants in the Upper Sector, the 600 EC target will be breached—*unless* a sector credit discount factor is applied.

proposed approach may necessitate increased trading,⁶ it would reduce the potential for uncertainty and inefficiency under the current system.

5.3.3 Salinity credits

As under the pilot Scheme, the proposed Regulation provides for the creation and allocation of 1 000 salinity credits. If a salt discharge licence is held, then (subject to the licence) 1 credit will allow the licensee to discharge 0.1% of the total allowable discharge during high flows. Credits are not needed for discharge into flood flow blocks, and discharge into low flow blocks is prohibited (hence credits are irrelevant for flood and low flows).

Ownership of the credits remains with the community, as represented by the State of New South Wales, which will effectively lease the credits out to credit holders. As such, holding a credit is equivalent to an authority to discharge salt to the Hunter River for a set period and in accordance with specified conditions.

5.3.4 Initial allocation of credits

Existing credit holders

The proposed Regulation provides for initial allocation of salinity credits, subsequent reallocation of credits upon their expiry, and longer credit 'lives'.

The initial allocation of credits will be based on the allocation of credits at the commencement of the pilot Scheme, adjusted to reflect 'permanent trades' and rounded to the nearest multiple of 5 (as explained below). The allocation of credits is set out in a schedule to the proposed Regulation, which also shows the EPA's reserve of unallocated credits.

The Schedule may be changed following the consultation period if credit holders indicate that they do not wish to be allocated credits (i.e. so as to avoid the administrative cost of holding them). Any credits not allocated as set out in the Schedule will be retained by the EPA as part of the credit reserve for new developments.

Credits held by the EPA may be allocated (upon application) to licensees entering the Scheme following commencement of the Regulation but before the first auction. Criteria to be considered by the EPA when determining an application for credits are set out in the proposed Regulation.

The proposed Regulation provides for the 'first issue' credits to expire at staged intervals after commencement of the Regulation (Figure 5). Two hundred credits (20% of the total) will expire 2 years after the Regulation commences. Every 2 years after that, another 200 credits will expire, as shown in Table 5.3, and will be reallocated by auction as described in Section 5.3.5.

⁶ This is because if, for example, TAD is calculated at Denman, each credit in the Scheme will be worth less in terms of salt discharge entitlement than if TAD were calculated at Singleton. An Upper Sector discharger may therefore wish to acquire additional credits to maximise their discharge opportunity.

Table 5.3: 'First issue credit' lifespans.

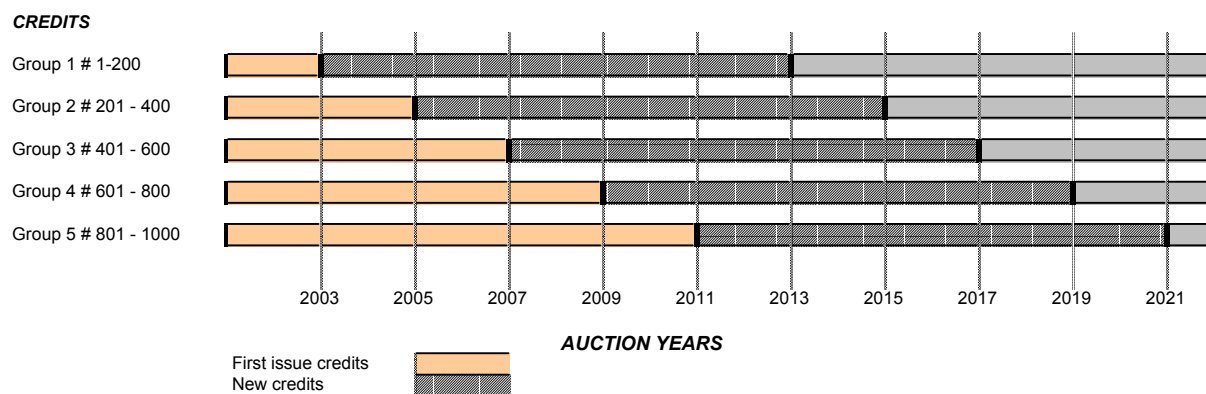
Credits	Lifespan
1–200	2 years
201–400	4 years
401–600	6 years
601–800	8 years
801–1 000	10 years

It is proposed that each initial credit allocation include equal proportions of 2-, 4-, 6-, 8- and 10-year credits. In this way, only 20% of any credit holder's initial allocation of credits will expire every 2 years. To provide for this, initial allocations to credit holders will be in multiples of 5.

It is proposed to round pilot Scheme participants' credit holdings to the nearest multiple of 5 as this has the least impact on the EPA reserve. (Under this approach, the EPA reserve is reduced from 87 to 85 credits). By contrast, rounding all credit holdings up to a multiple of 5 would mean that the EPA reserve would drop from 87 to 40 credits. This would adversely affect the ability of expanded or new developments to acquire credits before the first credit auction. The other option is to round all credit holdings down to the nearest multiple of 5, which would reduce all participants' credit holdings and increase the EPA reserve from 87 to 130 credits.

Each of these options will affect participants to a lesser or greater degree, depending on whether a participant's credit holding is greater than, less than or equal to a multiple of 5. In light of this, it is proposed to round existing allocations to the *nearest* multiple of 5, as this is seen to be the most equitable and efficient way to balance the impact on participants and the impact on the size of the EPA reserve.

Figure 5: Schematic of credit 'lives' and auctions.



- Credits will be divided into 5 groups with lives of 2, 4, 6, 8, and 10 years.
- They will be allocated to participants free of charge based on pilot Scheme credit holdings, with each participant receiving equal numbers of credits from each group of 2-, 4-, 6-, 8- and 10-year credits.
- Credits initially allocated ('first issue credits') cannot be purchased by the public and can be traded between licensees only.
- Every 2 years, 20% of first issue credits expire and are replaced by 200 'new credits' which have 10-year lives. New credits are sold at public auction.
- Ownership of and trading in new credits is unrestricted; e.g. even after 5 years, non-licensees can hold no more than 40% of the credits in the Scheme.

New developments before first credit auction

Upon commencement of the Regulation, the EPA will retain credits based on its pilot Scheme holding, rounded to the nearest multiple of 5 (85 at the time of writing). These 'residual' credits will be available, on application, for allocation to new or expanded developments that need to discharge salt to the Hunter River. Subject to credit availability and other considerations set out in the Regulation, the EPA may allocate credits to developments approved under the NSW Integrated Development Assessment Scheme.⁷ This arrangement will apply until 2 months before the first credit auction.

In determining an application for residual credits, the EPA will have regard to the criteria used to allocate credits to pilot Scheme participants and the need to maintain equity with pilot Scheme participants, together with other considerations set out in the proposed Regulation.

5.3.5 Subsequent allocation of credits

No further administrative allocations of credits will be made later than 2 months before the first auction. Instead, all reallocation after that date will be either by 2-yearly public auctions of 200 credits at a time (the EPA may sell by private treaty any credits that are not sold at auction), or through private transfer between Scheme participants.

Reallocation by public auction

It is proposed that, when credits expire, the EPA will reallocate 200 new credits with 10-year lifespans by means of a public auction. For example, 200 'first issue' credits would initially expire 2 years after they were created. Upon their expiry, 200 new credits would be created by the EPA and offered to the public by auction. Each new credit would have an expiry date of 10 years from the date that its lifespan commences. The auction may be held some time before the start of the new credits' lifespan to provide an orderly transition.

It is proposed that any person will be able to purchase credits at auction, regardless of whether that person is a credit-holder under the pilot Scheme or holds a licence to discharge saline water to the Hunter River. (As noted, regardless of credit holdings, discharge is not allowed unless an appropriate environment protection licence is also held.)

Though considered unlikely, it is possible that the EPA may still hold some unallocated credits (having lifespans that range up to 10 years from commencement of the Regulation) at the time of the first auction. The proposed Regulation provides that the EPA may sell any such credits at the first auction.

While the EPA will be responsible for the conduct of auctions, the Act (s. 295J) empowers the EPA to contract out the exercise of functions related to tradeable emission schemes, such as the conduct of auctions.

Finally, revenue from auctions will be returned to the State as manager—on behalf of the community—of the State's water resources.

Reallocation by trading

Under the proposed Regulation, credits may be obtained by purchase from credit-holders as well as by purchase at auction or through the initial allocation process.

⁷ A development is subject to Integrated Development Assessment (IDA) if it requires both a development consent and an environment protection licence. A scheme under the *Environmental Planning and Assessment Act 1979*, IDA streamlines development approval processes by coordinating the actions of multiple Government consent authorities, requiring agencies such as the EPA to provide an indication of their general terms of approval for an application before granting licences and setting conditions. An approximate credit allocation will be indicated in the general terms of approval.

The proposed Regulation specifies generic rules for trading in credits. In summary:

- Parties to a credit trade must be registered by the EPA (or its appointee) as a credit trader.
- Trades are to be effected by means of the on-line credit trading facility (in its training phase at the time of writing) or, if the on-line service is not available, by an alternative means approved by the EPA (e.g. the paper-based trading system used in the pilot Scheme).
- Credits may not be split; that is,
 - only whole credits (and not fractions of credits) can be traded,
 - a credit can be used only once in relation to a block, and
 - a credit can be used by only 1 discharge licence holder in relation to a block.
- Credits cannot be traded retrospectively; that is, a credit transfer may not take place once the transferee's site discharge period has finished.
- Credits cannot be traded into a sector for which a sector credit discount factor has been set in order to protect water quality in that sector. (If such trades were allowed they would undermine the accuracy and utility of the discount factor.)

To provide a staged transition from the pilot Scheme to a permanent scheme, it is proposed that (apart from the EPA) only persons who are holders of environment protection licences may hold or trade 'first issue' credits that are allocated to Scheme participants rather than auctioned. In contrast, any person may hold or trade in 'new' credits that are sold by the EPA at public auction. This means that access to credits is not completely open until 10 years after commencement of the Regulation.

Under the proposed Regulation, EPA approval of credit trades will no longer be required, and trades will become valid as soon as they are lawfully executed and recorded on the credit register (which, as described below, will soon be done over the Internet). This mirrors current administrative reality and the success of the Scheme rules.

5.3.6 Administration and funding

To ensure that administrative arrangements are in place, and to overcome the difficulties with administration that have been experienced under the pilot Scheme, it is proposed to establish a Services Coordinator (either the EPA or its appointee). The Services Coordinator's task will be to ensure that river flow and salinity monitoring and modelling are carried out and that a 'River Register' is provided in accordance with Scheme requirements.

The River Register is to contain information for licensees and the public regarding:

- the river flow classification of each block in each sector,
- the times at which discharge opportunities within high and flood flow blocks will begin and end for each discharging licensee, and
- details necessary to allow intending dischargers to determine their allowable discharge for high flow blocks.

The Services Coordinator will have the functions of:

- monitoring and gauging the flow of the Hunter River,
- establishing and maintaining the River Register,
- making the contents of the River Register available to the public, and
- any other function conferred upon it by the EPA.

While one body will have the role of Services Coordinator, it is possible that monitoring and River Register services may be provided separately. As such, it is proposed that the Services Coordinator be able to contract its functions to other parties (subcontractors) in accordance with relevant State guidelines relating to competitive tendering. Upon commencement of the Regulation, the Water Administration Ministerial Corporation (i.e. the Department of Land and Water Conservation) will be taken to have been appointed by the EPA as the Services Coordinator but the EPA may vary or terminate that appointment.

Where subcontractors are engaged, contracts must first be approved by the EPA (where the Services Coordinator is not the EPA) and must include such provisions as the EPA considers appropriate to ensure that:

- the aims and objects of the Scheme are attained
- the Services Coordinator and its subcontractors are accountable for their performance.

The proposed Regulation also provides for the creation of a body corporate to be known as the Hunter River Salinity Trading Scheme Operations Committee. It is proposed that the EPA appoint the 8 members of the Operations Committee to represent stakeholder interests, as set out in the Regulation. The member representing the Hunter Catchment Management Trust would chair the proposed Committee, which would advise the EPA on matters connected with the operation of the Scheme. It is proposed that the EPA may subsequently appoint the Operations Committee as Services Coordinator. This would allow stakeholders to be involved in the administration of the Scheme, thus enhancing transparency and accountability of Scheme administration. (The Operations Committee is constituted as a body corporate in the proposed Regulation so that it can, in the event that it is appointed as Services Coordinator, enter into contractual arrangements for the performance of functions relating to the River Register etc.)

Funding for the Hunter Scheme, including the annual costs of the EPA, the Services Coordinator and the Registrar, will be recovered from Scheme participants at the end of each Scheme year. Half the annual cost will be met by holders of EPA licences that authorise the discharge of saline water (each discharger paying an equal amount), and half by credit holders (each paying according to their average credit holdings during a Scheme year).

This represents a departure from current practice (whereby contributions to Scheme costs are based on credit holdings alone). The current approach means that any discharging licensees who do not hold credits but who take advantage of the Scheme's monitoring and modelling by discharging into flood flows are not required to contribute towards Scheme costs. This is considered inequitable and accordingly the proposed Regulation uses a 2-part formula, as outlined above, to determine contributions payable.

5.3.7 Enforcement and penalties

The proposed Regulation provides for the following enforcement mechanisms:

- Forfeiture of credits.
- Suspension of participants (by suspending some or all of their credits and prohibiting the person from trading).

The EPA may also take action (e.g. penalty notices and prosecutions) with respect to a breach of licence conditions relating to the Scheme. (The proposed Regulation prescribes several Scheme rules as licence conditions, breach of which is an offence under the *Protection of the Environment Operations Act 1997*.)

It is proposed that the EPA will be able to serve a written notice ordering:

- the suspension of some or all of the recipient's credits
- that the recipient refrain from trading in credits

- that some or all of the recipient's credits be forfeited to the EPA.

These powers may be used only if the person has:

- contravened a provision of the Regulation
- contravened a licence condition that relates to the Scheme, or
- failed to pay their contribution to the Scheme by the due date.

In all of these cases, any person whose credits have been suspended or forfeited would still be required to make contributions towards meeting the Scheme's costs. Where credits are forfeited, liability to contribute towards Scheme costs in respect of those credits ceases once they are sold by the EPA. (The proposed Regulation requires the EPA to sell credits that have been forfeited by auction or public tender.)

6. ASSESSMENT

This chapter identifies the impacts of the proposed Regulation against the option of continuing the pilot Scheme framework and other options in some cases. The assessment is a mix of qualitative and quantitative analysis. Costs and benefits, where quantified, are given as the difference in costs and benefits that would occur under the proposed Regulation when compared with the 'base case' that would occur if the pilot Scheme were to continue (Section 6.1). Although the proposed Regulation will not be subject to staged repeal under the *Subordinate Legislation Act 1989* (s. 295C(2) of the POEO Act), the Regulation includes provision for Ministerial review with public input provided via a consultation process prescribed by Section 295C(3)–(5) of the Act. (Regulations that give effect to tradeable emission schemes are exempt from staged repeal in order not to undermine Scheme certainty, thus facilitating cost-effective pollution reduction in the longer term.)

Costs and benefits are assessed over a 5-year timeframe. A discount rate of 7% is used.

6.1 Base case

While changes in the levels of catchment development and salt discharge cannot be predicted with certainty, this section describes likely developments and discharges over the next 5 years based on the information set out in Chapters 2, 3 and 4.

The following conditions are assumed in the catchment:

Upper Sector

- Discharge capacity from mines within the sector (currently 206 ML per day) will increase to 855 ML per day.
- Credits held in the sector will increase by 60, allocated from the EPA reserve.
- Flood flow discharge per mine will average 100 ML per discharge opportunity.

Middle Sector

- A new power station will commence with a 15 ML per day discharge capacity at 33 000 EC.
- Discharge capacity from mines within the sector (currently 850 ML per day) will increase to around 1050 ML per day.
- Credits held in the sector will increase by 25 allocated from the EPA reserve.
- Flood flow discharge per mine will average 100 ML per discharge opportunity.

Lower Sector

- Conditions will remain substantially unchanged owing to the absence of any planned major developments.

The average salinity of water discharged by Scheme participants is assumed to remain at around 4 500 EC from the mines and 1 800 EC from Macquarie Generation. Saline water discharges from Redbank Power Station are expected to have a salinity of around 33 000 EC, but with a maximum discharge capacity of only 15 ML per day.

The EPA will have disposed of all of its credit holdings within 2 years of gazettal or less.

6.2 Flow threshold options

As described in Section 4.1, the EPA's research suggests that the current flood flow threshold is not large enough to provide dilution of saline discharges sufficient to meet the salinity targets in all cases.

It is proposed to alter the flood flow thresholds for the Upper and Middle Sectors. In the Upper Sector, it is proposed to define flood flows at a flow of 20 000 ML/day or greater (provided that, as per the existing rule, the flow remains of flood size as the block moves through the downstream sectors). The EPA has also considered 3 other options:

- maintain the existing flood flow threshold in the Upper Sector (2 000 ML/day).
- raise the threshold to 10 000 ML/day.
- prohibit unlimited salt discharge in the Upper Sector.

The proposal and these 3 alternatives are assessed in the following section.

In the Middle Sector, it is proposed that the flood flow threshold be raised to 10 000 ML/day, provided that the flow remains of this size as the block moves through the Lower Sector. The EPA has also considered one other option: to do nothing and leave the flood flow threshold at 6 000 ML/day. The proposal and alternative option are assessed in the following section.

No change is proposed for the flood flow threshold in the Lower Sector, which is currently 10 000 ML/day.

The purpose of these proposals is to ensure that the river salinity targets are not exceeded as a result of licensees' salt discharges. The salinity targets were determined in consultation with stakeholders, as described in Section 5.1, and subsequently incorporated in the Interim Water Quality Objectives (EPA, 1999b). As such, the benefits of achieving the salinity targets have been considered, implicitly or explicitly, in other forums.

The use of a flood flow discharge rule means that there will always be some risk that the relevant salinity target will not be met, owing to possible changes in salt discharge capacity relative to the flood flow threshold after the rule is set.

Also, raising the flood flow threshold will not prevent discharge but will simply require that, when the river is at a level between the old and new thresholds, discharges are to be managed through the salinity credit system. This imposes an additional overall constraint only to the extent that unrestricted discharge would have caused exceedance of the salinity targets.

Assessment of this proposal therefore requires the following issues to be considered:

- The relevant salinity target for each sector.
- The degree of certainty (or risk) associated with meeting the salinity targets.
- The frequency of flow occurrence and cost impacts on dischargers.

6.2.1 Salinity target compliance

Given the 600 EC and 900 EC targets for the Hunter River, knowledge of salt discharge capacities from licensed sources within the catchment, and assumptions about discharge salinity and river salinity, the flow threshold for flood flow discharge was modelled using a formula provided by AGC Woodward-Clyde (1992).⁸

⁸ The formula used to calculate different resulting river salinities after discharge of saline water is $Q_R = Q_D(S_D - S_{Rd}) / (S_{Rd} - S_R)$, where Q_R is river flow in ML/day, Q_D is discharge volume in ML/day, S_D is discharge water salinity, S_R

The impacts on river salinity are summarised in Tables 6.2 and 6.3 using the expected future development conditions outlined in the base case. The assumption used is that individual dischargers are discharging at their expected flood flow discharge level (100 ML/day each). The assumption that all participants are discharging simultaneously is considered to be realistic in the Upper Sector. However, in the Middle Sector this is considered to be a worst-case scenario.

It is also assumed that ambient river salinity before discharge is 350 EC in the Upper Sector and 400 EC in the Middle Sector. The analysis shows that the results are highly sensitive to the assumptions about ambient river salinity (see also the detailed sensitivity analysis in Appendix 3).

Upper Sector

Under assumed ambient salinity and discharge conditions, the pilot Scheme threshold would not meet the salinity target in the Upper Sector. The other 3 thresholds examined would meet the salinity targets under those conditions. This is shown in the 'expected discharge' column of Table 6.1.

Table 6.1: Impacts of options on river salinity in the Upper Sector given expected catchment developments and salt discharges.

Option (ML/day flood flow threshold)	Salinity target (EC)	River salinity at flood flow threshold (EC)	
		Expected discharge¹	High case discharge²
2 000	600	891	1588
10 000	600	471	675
20 000	600	411	519
No unlimited discharge permitted	600	n.a. (discharges managed so as not to exceed 600)	

1. Based on emissions of 300 ML/day of saline water

2. Based on emissions of 850 ML/day of saline water

However, as noted above, the assumptions made for the Upper Sector are not particularly conservative. A sensitivity analysis of alternative discharge conditions for the Upper Sector shows that if high but not unreasonable discharges are assumed (850 ML/day, the feasible Upper Sector discharge capacity within 3 years), a flow of 10 000 ML/day would result in a salinity level exceeding the target. This is shown in the 'high case discharge' column in Table 6.2. Similar results apply for alternative assumptions in regard to ambient salinity (see Appendix 3).

Middle Sector

Table 6.2 shows that under discharge conditions that are conservative (i.e. tending towards a larger than average discharge), the existing flood flow threshold of 6 000 ML/day would still provide sufficient dilution to achieve the 900 EC salinity target in that sector.

is river salinity in mg/L before the addition of discharge water, and S_{kd} is river salinity after the addition of discharge water.

Table 6.2: Impacts of options on river salinity in Middle Sector given expected catchment developments and salt discharges.

Option (ML/day flood flow threshold)	Salinity target (EC)	River salinity at flood flow threshold	
		Expected conditions ¹	Worst case ²
6 000	900	888	1 054
10 000	900	714	892

1. Based on emissions of 1215 ML of saline water (2490 t of salt) and ambient salinity of 400 EC

2. Based on emissions of 1215 ML of saline water (2490 t of salt) and ambient salinity of 600 EC

Sensitivity testing (see Appendix 3 for more detail) shows that in the worst case, involving a pre-discharge river salinity of 600 EC and full discharge from the 3 largest dischargers in the Middle Sector, a river flow of 9 700 ML/day would be needed to meet the salinity target. This suggests that a flood flow discharge threshold of 10 000 ML/day could also be appropriate in the Middle Sector.

It should be noted that there cannot be absolute certainty that any threshold for flood flow discharge will be high enough. While thresholds under the proposed Regulation are appropriate under assumed base case conditions, there is always the possibility that new facilities will be developed in the catchment, with discharge capacities large enough to cause an exceedance of the salinity target at the chosen flood flow threshold.

There is ultimately a trade-off between risk and cost where a flood flow discharge threshold is used. The sensitivity analysis gives an indication of the risks of exceeding the salinity targets in each Sector at different threshold levels. Those risks can be considered in the light of the economic costs identified in the following section.

6.2.2 Indicative costs

Upper Sector

New developments

As a consequence of the altered flood flow threshold, dischargers would have fewer flood flow discharge opportunities (i.e. unlimited salt discharge) and more high flow discharge opportunities (salt discharge regulated according to credit holdings). Because dischargers can usually release more salt during flood flows than during high flows, the effect of the changed flood flow thresholds will be to require more storage or other salt management techniques by dischargers.

The EPA commissioned a modelling exercise to indicate the possible storage requirements and costs for a hypothetical new mine setting up in the Upper and Middle Sector catchments. The hypothetical mine was based on characteristics typical of new mining proposals, and had a periodic surplus of water that required discharge. Discharge of 100 ML per day of saline water was assumed for periods when flood flow discharge applied, and 10 ML per day in periods of high flow discharge. Characteristics of the hypothetical mine are given in Appendix 2. For the modelling exercise, high flow discharge began at the same levels as under the pilot Scheme and took place up to the flood flow thresholds specified in the modelling.

Indicative costs for water storage dams were provided by the Department of Public Works and Services, based on typical costs from its Register of Dams.

Table 6.3 shows the modelled results for the Upper Sector. Modelled outcomes are given for the current flood flow threshold of 2 000 ML per day, and estimates are given for the other 3 alternatives, including the proposed threshold of 20 000 ML per day. (These figures assume that the water storage is of a size such that there is a 10% chance of the storage overflowing in a 96-year period. It is also assumed that costs are not incurred until year 3 of the permanent Scheme.)

Table 6.3: Water storage requirements for a hypothetical Upper Sector mine under different scenarios.

Flood flow threshold (ML/day)	Flow duration frequency (% days/year)	Water storage requirement (ML)	Estimated present cost	Incremental cost above base	Annualised cost (10 years)
2 000	4% (2% in practice) ⁹	230	\$1.5m	0	0
10 000	0.75%	~480	\$2.8m	\$1.3m	\$0.20m
20 000	0.25%	~600	\$3.3m	\$1.8m	\$0.28m
No unlimited discharge permitted	0%	970	\$4.5m	\$3.0m	\$0.46m

These estimates of storage size and cost become increasingly imprecise as the flood flow threshold increases. This is because the assumption of a 10 ML/day high flow discharge volume does not allow for the possibility of larger high flow discharge sizes that may be possible if the Upper Sector is in high flow and the lower 2 sectors are in flood flow. (In this situation, credits are not required for discharges in the Middle and Lower Sectors and may therefore be traded to the Upper Sector, resulting in larger discharges by Upper Sector facilities.) As such, the cost estimates are overestimates. This is discussed further in the next section, in the context of existing developments.

Existing developments

In addition to impacts on new developments, the proposed Regulation will also affect discharges from existing facilities in the Upper Sector.

The EPA was not able to estimate the exact impacts on the existing facilities because each facility has unique circumstances that require site-specific modelling, such as spare capacity in existing water management systems. The EPA does not have the full range of required information about each facility and, where it does have information, that information is generally limited in scope and held commercial-in-confidence.

However, the EPA has reviewed the discharge records (where these exist) for each discharger during the first 4 years of the pilot Scheme to identify which existing dischargers had an apparent need to use the unlimited discharge allowed in flood flows.

The results of that review suggest that there would be a need for some extension of storage capacity in the Upper Sector. It is assumed that this extension is proportional to the increase in storage requirements for new facilities. Estimated total costs are shown in Table 6.4.

⁹ The Upper Sector cannot be in flood flow (i.e. unlimited discharge flow) unless the block of water will also be in flood flow as it passes through the Middle and Lower Sectors. Although the Upper Sector exceeds its flood flow threshold 4% of the time on a flow duration basis, those blocks do not always grow to exceed flood flow thresholds as they move downstream through the lower 2 sectors. In practice, flood flow is exceeded in all 3 sectors on around half the occasions that it exceeds the Upper Sector threshold, i.e. 2% of the time.

Table 6.4: Cost of total potential water storage requirements for existing facilities under different scenarios.

Flood flow discharge threshold (ML/day)	Flow duration frequency	Estimated incremental cost above base	Annualised cost (10 years)
2 000	4% (2% in practice)	0	0
10 000	0.75%	\$0.5m–\$1.8m	\$0.07m–\$0.26m
20 000	0.25%	\$0.5m–\$2.3m	\$0.07m–\$0.33m
No unlimited discharge permitted	0%	\$0.5m–\$3.7m	\$0.07m–\$0.53m

While the total annualised cost estimates shown are of an appropriate order of magnitude, the impacts on individual existing Upper Sector participants are likely to vary considerably. The EPA will be seeking more detailed estimates from the 3 discharging mines in question during the consultation period.

Effect of credit trading

The above costs are given as a range to account for different assumptions about credit trading and the effects of trading on high flow discharge volumes. The higher estimates assume that high flow discharge is a constant 10 ML/day per participant, and do not account for increases in high flow discharge that are possible with credit trading. The lower figures assume that average high flow discharge volumes will increase due to credit trading.

The EPA considers that there is considerable scope to use credit trading as an alternative to capital expenditure in order to manage excess saline water.

To illustrate the gains possible with credit trading, it is necessary to examine the high flow discharges that are possible under the different thresholds.

For example, as flows in the Upper Sector increase beyond 2 000 ML/day, it becomes increasingly likely that daily flows will exceed flood flow thresholds in downstream sectors of the Scheme. When flows reach 10 000 ML/day at Denman, it is almost certain that the flow (or 'block') will subsequently be in flood flow as it passes through the downstream sectors of the river. Under the proposed rules, when the downstream sectors are in flood flow, credits for high flow discharge would only be required by Upper Sector participants. Through credit trading, saline water discharge into the Upper Sector could be as high as 128 ML at a river flow of 2 000 ML/day.

The EPA believes that, with the availability of the on-line trading system and the apparent increase in willingness to trade, it should be possible for Upper Sector participants to obtain a large majority of the credits in the Scheme for such high flow discharge opportunities. At a flow of 10 000 ML/day, this would enable a discharge of up to 640 ML of saline water from the Upper Sector, which is the approximate combined discharge capacity of existing participants in that Sector. There is likely to be some economic cost associated with raising the flood flow threshold from 2 000 ML/day to 10 000 ML/day. However, raising the threshold above 10 000 ML/day (e.g. to 20 000 ML/day) may involve no additional economic cost other than the transaction costs associated with obtaining the credits.

These discharge possibilities suggest that existing Upper Sector participants could discharge from 60 to 320 ML/day each in high flow events, rather than the 10 ML/day that was assumed for modelling the required storage sizes. Under these circumstances, the EPA believes that the likely cost impact would be nearer \$500 000 over 10 years, rather than \$1.8 million.

New developments

The modelling included an examination of current requirements for a hypothetical mine in the Middle Sector, and an assessment of storage requirements for that mine if all discharges were required to take place during high flows, with no flood flow discharge rule. The results, calculated on the same basis as those for the Upper Sector, are shown in Table 6.5.

Table 6.5: Water storage requirements for a hypothetical Middle Sector mine under different scenarios.

Flood flow discharge threshold (ML/day)	Flow duration frequency	Water storage requirement (ML)	Estimated cost	Incremental cost above base	Annualised cost (10 years)
6 000	3.5%	175	\$1.2m	0	0
10 000	2.2%	230	\$1.5m	\$0.3m	\$0.05m

Because the modelled situation is for a hypothetical mine, these costs cannot be directly transferred to any specific mining proposals in the catchment. However, the costs given indicate the likely order of magnitude of costs for new mining developments. It is assumed that these costs would not be incurred until the third year of the permanent Scheme.

Existing developments

A review of dischargers' behaviour suggests that there would be some impact on those facilities that have historically discharged a large proportion of their capacity during most flow events. However, because the salinity target in the Middle Sector is 900 EC rather than 600 EC, the impacts are not as great as in the Upper Sector owing to the greater ability for high flows to transport salt. The EPA estimates the additional costs of a 10 000 ML/day flood flow threshold in the Middle Sector to be \$360 000 per year if no credit trading takes place.

Effect of credit trading

The costs above represent *maximum* estimated impacts. As noted in Section 3.3.2, high flow discharges have been well below total allowable discharges, with actual discharges amounting to only 20% (on average) of the total allowable discharge. This suggests that there is considerable capacity to use credit trading to increase discharges during high flows. If credit trading is used in this way, it will offset the impact of the reduced frequency of flood flow discharge events by allowing larger discharges during high flows. This means that there will be no need for additional capital expenditure in the Middle Sector. That is, Middle Sector dischargers can obtain sufficient credits on a permanent or temporary basis to compensate for lost flood flow discharge opportunities through larger high flow discharges. To date, an average of 80% of credits are not used for discharges into high flow events.

Summary of environmental and economic impacts

The environmental and economic impacts of different combinations of alternatives for the Upper and Middle Sectors are shown in Table 6.6.

Table 6.6: Environmental and economic impacts of proposed flood flow thresholds.

Upper Sector threshold	Middle Sector threshold	Can meet salinity targets if maximum sector discharge occurs?	Can meet salinity targets under all other sensitivities? (Appendix 3)	Present value of estimated costs over 5 years (\$ million)	
				Lower	Upper
2 000	6 000	No	No	0	0
2 000	10 000	No	No	0	1.58
10 000	6 000	No	No	0.74	1.52
10 000	10 000	No	No	0.85	3.10
20 000	6 000	Yes	No	0.92	1.70
20 000	10 000	Yes	Yes	1.02	3.56
No unlimited discharge permitted	6 000	Yes	No	1.34	3.22
	10 000	Yes	Yes	1.44	4.80

The shaded row is the recommended option, as set out in the proposed Regulation.

Distributional impacts

Despite the broad estimates of cost given above, it is not possible to precisely quantify the impact of the proposed flood flow thresholds on existing facilities. This would require detailed knowledge of all facilities' water management systems, spare storage and treatment capacity, and other options for salt water management. The EPA does not have access to this information.

The proposed credit allocation should result in the effects being equitably shared between existing and new participants.

Uncertainties

There are limitations to the analysis in this section. In particular:

- For impacts on existing facilities, the analysis relies on the historical discharge record from the pilot Scheme. This record is not fully representative of the longer-term variability that can occur in rainfall and river flow patterns but it is consistent with long-term averages and shows some of the expected variability. The longer-term variability is the most important determinant of storage requirements.
- The historical discharge record gives 100% accurate hindsight of discharge events. Therefore, reliance on that record carries an implicit assumption that all events in the record were accurately *forecast* ahead of time *and* that sufficient advance notice was given for dischargers to make use of those opportunities. The proposed Regulation should improve the provision of such services through the formalisation of administrative arrangements. The expanded use of electronic information and transaction facilities will also enhance the delivery of such services.
- The impacts on mines are estimated from the modelled impact of the regulatory proposal on a hypothetical mine. The characteristics of the modelled mine may differ from those of an actual new mine and do differ somewhat from those of existing mines. As such, while the order of magnitude of costs that a new or existing mine could face is believed to be correct, the precise figure could differ somewhat from that suggested in the analysis.
- The extent to which credits can enhance high flow discharge opportunities relies on assumptions about river salinity and discharge water salinity. Although the assumptions

used—4 500 EC discharge water and 350–400 EC receiving water in high and flood flows—are believed to be reasonably robust, the allowable discharge volumes are sensitive to relatively small changes in these variables.

- The analysis assumes rational behaviour with respect to future credit trading, including an assumption that there is no strategic advantage in refusing to trade credits. While there is a wide range of possibilities with respect to future credit trading behaviour, trends to date suggest an increasing preparedness to trade.
- Credit trading imposes its own economic costs. These are transaction costs of trading, comprising the costs of finding other parties with whom to trade, negotiating the transaction, preparing letters or paperwork, and making payments. It is unclear what these costs will be but it is expected that transaction costs will be significantly reduced by the on-line trading system being completed by the EPA.

Assessment

Modelling of possible discharge patterns and resulting river salinity impacts suggests the following conclusions.

Options with an Upper Sector flood flow threshold of 2 000 ML/day appear unlikely to meet the salinity targets under maximum discharge conditions.

Options with an Upper Sector flood flow threshold exceeding 20 000 ML/day, or replaced by high flow discharge only, will meet the salinity targets under conditions of maximum discharge in the Upper Sector.

The sensitivity analyses in Appendix 3 suggest that, under some discharge and ambient river salinity conditions examined, only a flood flow threshold of more than 20 000 ML/day in the Upper Sector, and 10 000 ML/day in the Middle Sector, will achieve the salinity targets. This finding is based on reasonable assumptions for the Upper Sector, but for the Middle Sector is based on unfavourable conditions that may occur only very infrequently.

The objective of the proposed Regulation is to achieve the salinity targets under all conditions. The EPA considers that only flood flow thresholds of 20 000 ML/day in the Upper Sector and 10 000 ML/day in the Middle Sector will meet the objectives with a high level of confidence and therefore considers that these revised flood flow thresholds should be adopted.

This proposal achieves the salinity target but does so at a lower cost than the alternative of abandoning flood flow discharge for the Upper Sector and replacing it with high flow discharge (subject to salinity constraints) for all river flows above 600 ML/day. The proposal should avoid the need to reset the flood flow threshold within 5–10 years, thus maximising certainty for existing and prospective Scheme participants.

The alternative of setting flood flow thresholds at 10 000 ML/day in both the Upper and Middle Sectors may result in salinity targets being exceeded in less than 1% of total flows, at maximum, but is estimated to reduce compliance costs by \$0.2–\$0.5 million over 5 years.

6.3 Credit allocation and trading

This section assesses the proposals for credit allocation and trading under the proposed Regulation. Because credit allocation and trading rules have the potential to restrict competition, the assessment of proposals is made in terms of the 1995 Competition Principles Agreement between the Commonwealth Government and the States and Territories. The Agreement states that legislation should not restrict competition unless it can be demonstrated that:

- the benefits of the restriction to the community as a whole outweigh the costs, and

- the objectives of the legislation can only be achieved by restricting competition.

In considering benefits and costs under the Competition Principles Agreement, a number of matters are to be taken into account where relevant. Those matters include:

- Government legislation and policies relating to ecologically sustainable development
- social welfare and equity considerations, including community service obligations
- economic and regional development, including employment and investment growth
- the competitiveness of Australian businesses
- the efficient allocation of resources.

The Report of the Independent Committee of Inquiry into National Competition Policy (the Hilmer Report) considered that the promotion of effective competition and the protection of the competitive process were generally consistent with maximising economic efficiency. Through enhancing economic efficiency, competition provides higher returns to producers in aggregate, provides higher real wages, spurs innovation and invention, and helps create new jobs and new industries. The Committee considered that increased economic efficiency helps to make the economy more resilient and robust, and better able to adjust to changes in global economic conditions (Hilmer, 1993, p. 4).

6.3.1 Eligibility to hold credits

There are 4 broad possibilities as to who should be eligible to hold credits:

- licensed dischargers only
- licensed dischargers and other (non-discharging) licensees who participated in the pilot Scheme
- persons who intend to become licensees
- anyone

Licensed dischargers

Licensed dischargers that hold credits in the pilot Scheme need to continue to hold credits to be able to discharge in accordance with Scheme rules. However, if *only* licensed dischargers are able to hold credits, companies that are not licensed to discharge salt and proponents of new development would not be able to hold credits under this option. Existing non-discharging mines that hold pilot Scheme credits would not receive credits under the proposed Regulation. Neither they nor any other parties would be able to hold credits without first obtaining an environment protection licence authorising the discharge of salt.

Licensed dischargers and non-discharging pilot Scheme participants

Alternatively, eligibility to hold credits could be open to licensed dischargers as well as to non-discharging licensees who were pilot Scheme participants. While non-discharging licensees do not require credits for discharge purposes, pilot Scheme credits were allocated to these licensees in recognition of the fact that their operations did not affect water quality. To allocate credits—which have a market value—to discharging licensees but *not* to non-discharging licensees would have the effect of rewarding dischargers and penalising non-dischargers, whose activities have less impact on water quality, often as a result of considerable investment and responsible environmental management.

Consistent with this approach, non-discharging licensees should continue to be eligible to hold credits. To exclude non-discharging licensees from holding credits once the Scheme is formalised would mean that they are not able to realise the value of those credits that they were

allocated in recognition of their environmental performance. Non-discharging licensees may also wish to hold credits in case they need to discharge salt in future (subject to their licence being varied by the EPA to authorise the discharge of salt). This is a fairly routine operational change for coal mines given that, as they mine through changing strata, mine water 'make' can increase dramatically.

Persons intending to become licensees

One of the limitations of the pilot Scheme is that development proponents cannot secure financing without approvals (including salinity credits) but credits cannot be allocated to non-licensees. The potential for this 'Catch 22' creates uncertainty and delays in new project start-ups. There is clearly a need to provide for development proponents to be able to secure access to credits.

Anyone

Alternatively, credit holding could be open to all parties. It is possible that non-discharging parties may legitimately wish to buy credits. For example, a group may wish to set up as an intermediary credit trader; alternatively, agricultural or environmental interests may wish to reduce the salt volumes discharged to the river. Allowing intermediary credit traders or 'brokers' to participate is characteristic of emission trading schemes in the USA and is acknowledged as a factor which allows participants to manage risk, to facilitate trade and to lower the overall cost of trading. An open market is also less likely to be subject to anti-competitive manipulation.

The amendment of the *Protection of the Environment Operations Act* in November 2000 clearly signalled Parliament's expectation that members of the public should be able to participate in emissions credit trading.

Transition mechanism

If the proposed Regulation were to introduce a fully open credit market directly upon commencement, existing participants could be exposed to short-term uncertainty regarding credit price and availability. Such a change would represent an important departure from the way that the pilot Scheme has operated to date and could adversely affect participants' ability to plan cost-effective wastewater management in the medium term.

To provide a staged transition from the pilot Scheme to the formalised Scheme, it is proposed that—apart from the EPA—only persons who are holders of environment protection licences (i.e. the second option above) may hold or trade 'first issue' credits—being those credits which are allocated to Scheme participants rather than auctioned. In contrast, any person (including persons who intend to become licensees) may hold or trade in 'new' credits that are sold by the EPA at public auction.

Restricted versus open credit market

The objectives of the proposed Regulation are set out in Chapter 5 of this Impact Statement. Broadly, those objectives are:

- to prevent river salinity exceeding the 600 EC and 900 EC targets
- to minimise the impact of saline water discharges on irrigation, other water uses and aquatic ecosystems at least overall cost to the community and in a way that provides ongoing financial incentives to further reduce pollution.

Restricting the eligibility of parties to hold credits is not necessary to achieve either objective, and may even work against the second. Therefore, in the context of the Competition Principles Agreement, the question is whether a restriction on credit holdings would be necessary to ensure that the environmental objectives are achieved at least overall cost to the community.

A possible concern is that 1 or 2 organisations may attempt to acquire all credits and so interfere with those existing and future industries whose most efficient salt management method is scheduled discharge. While this is possible, a number of features of the proposed Scheme make it unlikely that such a move would succeed:

- The initial allocation of ‘first issue’ credits across existing participants means that there will be a spread of ownership from the start of the formalised Scheme, and those owners will have an interest in preventing monopoly interests from developing. As a transitional arrangement, trading of these credits is to be restricted to licensees that are authorised to discharge salt to the Hunter River and those non-discharging licensees that were in the pilot Scheme.
- The 2-yearly expiry of 20% of credits (which will be reissued by auction) suggests that acquiring sufficient credits for market dominance is likely to span a number of auction periods and entail significant risk of losing the position of dominance at each subsequent auction. The credits held by any would-be monopolist will also expire at the end of their lifespans and be reissued via auction.
- The introduction of open auctions will likely increase the number of Scheme participants, thereby reducing the risk of monopolistic behaviour.
- Holding credits incurs annual costs, since the proposed Regulation requires participants to contribute to Scheme costs. These costs will act as a disincentive to hoarding and monopolistic behaviour.
- The nature of credits, whereby they may be used for each high flow event (and do not expire upon use), means that a decision to withhold a credit from use or trade represents an opportunity cost to the credit holder. The scarcer credits become, the greater this opportunity cost. Thus, the pressure against maintaining monopoly credit holdings will increase over time.

Notwithstanding these features, there is a theoretical risk that individuals may seek to dominate the credit market. The Commonwealth *Trade Practices Act 1974* contains provisions that allow the Australian Competition and Consumer Commission to prevent a party or parties from obtaining a dominant position in a market where the effect is to gain an advantage over competitors in that market. However, as with all cases under this Act, action is at the discretion of the Commission and depends on the Commission’s assessment of the potential market dominance issue.

Assessment

Placing a restriction in the Regulation on the eligibility of parties to hold credits would be interpreted under the 1995 Competition Principles Agreement as a restriction on competition. In accordance with the NSW Government’s obligations under that Agreement, such a restriction may only be sanctioned if it is necessary to meet the objectives of the legislation. Because the risk of market dominance can be addressed through the design of the Scheme and the protection potentially provided by the *Trade Practices Act*, restriction of Scheme participation beyond the transitional period cannot be sanctioned because it is not considered necessary to meet the objectives of the legislation. Consequently, it would be preferable, in accordance with the Competition Principles Agreement and the direction set by Parliament in the *Protection of the Environment Operations Act*, to allow any party to hold credits.

6.3.2 Allocation of credits

General allocation issues

For an effective and successful trading scheme to operate, the best method of allocating salinity credits must be selected. Research by the OECD into different types of tradeable credit schemes

has shown that the initial allocation has a significant effect on how the costs of a scheme are distributed. This in turn affects the acceptability of the Scheme to affected firms and the community (OECD, 1991).

In addition, it is important to ensure that an appropriate mechanism exists for new market entrants to gain access to credits, and to reduce the chance that one party can gain control of most or all of the credits to the detriment of other parties.

There are 3 basic approaches to the allocation of credits:

- administrative allocation, or 'grandparenting', where credits are allocated free of charge according to a predetermined rule
- selling the credits, for example through an auction
- a combination of these 2 approaches.

These can be applied to either the initial allocation only, or to both initial allocation and subsequent reallocations if necessary.

Grandparenting

Grandparenting usually explicitly recognises the past discharge patterns of the dischargers, and is the preferred method of allocation in tradeable credits schemes in the USA. Grandparenting was a component of the method used to allocate salinity credits under the pilot Scheme for the Hunter River, although there was a focus on 'rewarding' good environmental management rather than 'compensating' those with existing large discharges.

Incumbent firms generally prefer grandparenting, as it maintains the status quo, minimises commercial risks to those firms, and does not require any initial payment to the government.

There are 3 potential disadvantages of this system. First, a 'new source bias' can occur because new entrants must purchase their credits from existing firms, putting new entrants at a cost disadvantage (Commonwealth of Australia, 1992).

Second, depending on how the credits are distributed, market power could become a problem, which could then affect credit price movements.

Third, because the environment that receives pollution is a 'public good' in economic terms, free allocation of discharge credits effectively provides a significant, uncompensated wealth transfer from the wider community to the credit holders.

Auctioning

Under this system, credits are allocated to those who offer the highest bid at an auction.

Auctioning returns revenue to the community in exchange for allowing the use of a public good, and eliminates the new source bias of grandparenting. Competitive auctions also serve to reduce the number of trades after initial allocation. However, some research suggests that the overall private costs of compliance can be greater for auctioning than for grandparenting or a well-planned direct regulatory approach (Commonwealth of Australia, 1992, Klaassen, 1996).

The empirical evidence referred to suggests that when a traditional auction is used for the initial allocation of credits, credit expenditures are frequently larger in magnitude than control costs. The use of auctions is inhibited in the USA because of this (Tietenberg, 1998). Other disadvantages of auctions are that prior emission allowances of existing firms are not recognised by an auction process, and auctioning may be interpreted as a tax on industry (Young et al., 1998).

However, Cramton and Kerr (1998) argue that auctioning:

- provides greater incentives for innovation,

- provides more flexibility in distribution of costs, and
- reduces the need for politically contentious arguments over the allocation of valuable rights.

Cramton and Kerr argue that the retention of auction revenue by the Government is ‘revenue recycling’, where polluters are paying the public for a privilege to pollute the environment. Grandparenting, on the other hand, allows the dischargers to retain the revenue, rather than the Government or the community.

Combination approach

A combination of grandparenting and auction can overcome the weaknesses of both systems. The US Acid Rain Program provides an example of a combined approach. Under that scheme, credit allocation is based principally on historical emissions. However, the scheme also requires 3% of new credits to be auctioned each year, thereby providing for new entrants into the credit market and providing price information. Proceeds from the auctions are returned to the original holders of the auctioned credits and so the financial burden is no greater than that of a purely grandparented system (Tietenberg, 1998). However, this approach means that there has been a significant transfer of wealth from the community to the initial credit holders.

Auctioning after the initial allocation of credits helps to establish a market price, removing uncertainty about the value of freely allocated credits, and facilitating credit exchange and decisions about discharge control costs.

Abatement costs are usually more significant in the initial period after an emissions trading scheme is implemented than in later periods. Requiring that a certain proportion of credits be bought at auction in later periods therefore has a lower cost impact on firms because purchase falls outside the initial period of highest cost (Hinchy et al., 1998).

Finally, increasing the proportion of credits auctioned will weaken any cost advantage of established firms over potential entrants that can occur with free allocation of credits to existing firms (Hinchy et al., 1998).

Assessment

In the case of the Hunter catchment, there is a relatively stable population of existing dischargers and credit holders who have adapted to the pilot Scheme, but also a significant need to provide for new dischargers owing to the growth of mining within the catchment. Mining is inherently dynamic, and in the Hunter catchment growth is also strong.

Given this and the issues described above, the EPA believes that a combination approach would be preferable for the allocation of credits in order to:

- provide certainty over a reasonable timeframe for existing developments
- allow access to credits for new developments
- ensure that there is a fair return to the community in exchange for allowing the use of the credits.

The application of a combination approach is described further in the next sections on initial allocation and reallocation of credits.

Initial allocation

The existing participants in the pilot Scheme have adapted their water management practices according to the pilot Scheme’s rules and their pilot credit allocations. Initial allocation by grandparenting would avoid creating significant uncertainty for those participants.

Auctioning would ensure that credits went to their most efficient end-use and would avoid the issue of wealth transfer from the community to the discharging industries. However, some

weight should be given to the research findings that suggest that auctioning the credits may increase private compliance costs by a greater amount than imposition of direct regulatory controls.

As such, the EPA proposes an initial allocation of credits by grandparenting. Credits will be issued without charge to Scheme participants who wish to remain in the Scheme according to their pilot Scheme credit allocation, adjusted to take account of any 'permanent' trades¹⁰ and rounded to the nearest multiple of 5. Credits issued by grandparenting will be divided into 5 equal-sized parcels of credits having lifespans of 2, 4, 6, 8 and 10 years respectively. (Credits will be allocated in multiples of 5 to facilitate this process.) Upon expiry, credits will be reallocated as described in the next section.

Reallocation

Under the pilot Scheme, credits were administratively allocated by the EPA. Provision was made for new entrants through the EPA holding 20% of the credits as a reserve for new developments. To date, 4 new developments have been granted a total of 113 credits from the reserve. The administrative allocation system is, however, now proving increasingly burdensome for proponents and the EPA. This is because some aspects of the formula are based on 1994 data (e.g. mine water make, output and jobs as at 1994), while others are less relevant than when the Scheme was established. For example, the formula was established to reward licensees who had voluntarily implemented good environmental practices. Practices such as monitoring are now mandatory for Scheme participants so a reward is no longer appropriate. In addition, the formula is not readily adapted to developments other than coal mines (e.g. power stations). Ongoing administrative allocations would not be flexible and in any case it is expected that the EPA credit reserve will be fully allocated within 2 years of the Scheme's start.

Current pilot Scheme rules mean that, once the EPA reserve is exhausted, new entrants wishing to carry out controlled salt discharge could obtain credits only from existing credit holders. Because the credit market is small, this could potentially represent an entry barrier to new developments or require new developments to implement less efficient salt management systems. This represents a potential restriction on competition, and would be inequitable to new developments.

To prevent this but still maintain an administrative allocation system, the EPA would need to introduce a system that would provide for new developments. This could take one of the following forms:

- A 'clawback' approach, where credits are removed pro rata from existing participants (based on existing holdings) and allocated to new developments, or
- A dilution approach, where new credits are created as per the needs of new developments, and the total number of credits is allowed to progressively increase. The total allowable salt discharge would be calculated in the same way, with each credit worth a progressively smaller proportion of that total allowable discharge.

Both approaches would have the effect of undermining certainty for credit holders who manage salt discharge via credit holdings. If the value of these credit holdings is constantly subject to change (via clawback or dilution), they cannot form the basis of cost-effective wastewater management planning. As such, these approaches would undermine the potential for the Scheme to facilitate cost-effective pollution reduction over time.

¹⁰ A 'permanent trade' is one in which credits are traded by one Scheme participant to another and no 'return date' is marked on the trading record. That is, the entitlement to discharge conferred by the credits is passed to the transferee and is not intended that it return to the transferor. There have been few permanent trades under the pilot Scheme.

To avoid this problem, the EPA instead proposes periodic reallocation of credits by auctioning credits to replace those credits that have expired. Each parcel of 200 grandparented 'first issue' credits will expire at 2-yearly intervals. (First issue credits can be held and traded only by licensees who were in the pilot Scheme and by any new discharging licensees who are allocated credits following the commencement of the proposed Regulation but before the first auction.)

Upon expiry of each group of 200 credits, it is proposed to auction 200 new credits with lives of 10 years each. Once auctioned, these 'new' credits will be able to be purchased and held by any person, not just existing Scheme participants. This process will provide for new entrants into the credit market while also providing existing participants with certainty during the transitional period about their initial credit holdings and the drawdown in those holdings if credits are not repurchased at auction.

This approach progressively unwinds the pilot Scheme's potential for uncompensated wealth transfer, and should also result in lower credit prices because the discharge privilege accorded by the credits is limited in its duration. It is expected that the first auction would be held 1 year after the proposed Regulation commences, with the auctioned credits to take effect when the first group of 200 credits expires.

Costs

Two auctions will be conducted during the 5-year period under consideration in this RIS. Potential credit purchasers will incur a cost associated with researching and preparing auction bids. It is uncertain how much time this will take, or whether all existing credit holders will lodge bids, given that only 9 of them currently have EPA authorisation to discharge saline water. However, assuming that around 20 credit holders wish to bid, the bid preparation may take up to 2 days per credit holder. Assuming average annual costs of \$100 000 per person involved and 212 working days per year, the cost is \$470 per day. The cost of bid preparation is therefore \$18 800 per auction. This amount is likely to be less than industry costs if an ongoing administrative allocation system were operated instead.

The Government will also incur auction costs. These will vary depending on the type of auction used. However, a basic estimate of the economic cost of a standard ascending-bid auction at an auctioneer's rooms can be made from examining administration, auctioneers' and promotion costs.

It is expected that administration costs will include arranging an auction and auctioneer, arranging documentation and giving effect to auction results. These tasks are estimated to take about 10 staff-days of time in years 2 and 4 for the EPA at a cost of \$4 200 each time. Notification and promotion are expected to cost approximately \$2 000 per auction, including the cost of public advertising. Each auction is estimated to cost \$10 000, and in year 2 there will be an extra cost of around 15 days of EPA staff time, valued at \$6 300, to research the auction mechanisms to be used. The estimated total cost to Government for both auctions is therefore \$36 000 in present value terms.

Given that 2 auctions will occur during the first 5 years of the proposed Regulation, the estimated present cost of auctions is \$70 000. The proposed Regulation allows the EPA to charge a fee to recover the costs incurred in connection with an auction.

National Competition Policy

In terms of the Competition Principles Agreement, the proposed approach does not amount to a significant restriction of competition in terms of access to salinity credits. In the period following initial allocation of credits but before the first auction, new entrants who hold an environment protection licence authorising the discharge of salt to the Hunter River may obtain credits by requesting an allocation from the EPA reserve. Should the EPA decide to issue the

credits, the new entrant will be allocated credits on a basis that, as far as possible, is equitable and consistent with that used for allocating credits to pilot Scheme participants.

After that initial period, the auction system will provide open competition for salinity credits. The requirements of the Competition Principles Agreement are therefore met.

Assessment

The proposed Scheme has the following advantages:

- Holders of credits under the pilot Scheme will not face sudden changes in compliance costs. Credit holders may choose not to purchase credits at auction and instead allow their credit holdings to run down gradually over a period of 10 years, allowing a transition period for investment in alternative salt management systems if desired.
- Any person to whom first issue credits have been allocated and who fails to obtain their desired number of credits at one auction does not face the loss of their entire existing credit holding and can compensate by obtaining more credits at the succeeding auction. In addition, private trading (which has increased since the pilot Scheme began) can still take place to meet short-term needs.
- Auctions will mean that market price information is available to inform private trading and to assist with water management planning.
- Staggered credit auctions mean that the market will be better able to identify realistic price levels in a shorter period of time, rather than risk a wide range of bids at the first auction followed by a 10-year wait for new price information at another auction.
- New entrants will have an opportunity to obtain credits by auction without having to attempt to negotiate with potential competitors.
- The NSW community receives a return for the use of the credits by industry.
- The process for allocating credits will be more efficient than the administrative system under the base case, and avoids the significant difficulties that would arise once the EPA reserve is exhausted.

It is concluded that the proposed Scheme will provide a transparent and efficient outcome at reasonable cost, and is superior to its alternatives.

6.4 Administrative provisions

New administrative arrangements are required to improve systems for the provision of the following services:

- real-time salinity monitoring in the river and some tributaries
- prediction of the river's flow level in each sector
- calculation of total allowable salt discharge
- communication of discharge opportunities and total allowable discharge to credit holders, in sufficient time to allow credit trading and discharge planning
- an efficient credit trading system
- a mechanism for funding the provision of the above requirements.

To overcome administration difficulties that have been experienced under the pilot Scheme, it is proposed to establish a 'Services Coordinator' to undertake river monitoring and modelling and to provide the River Register. The Credit Register and credit trading system will continue to be

provided by the EPA, although the proposed Regulation empowers the EPA to contract out this role in future.

It is also proposed to formalise the current steering committee through the creation of an 'Operations Committee'. This body will have an advisory role, as well as the capacity to take on the role of Services Coordinator at some point in the future.

6.4.1 Services Coordinator

The EPA considered 3 possibilities for the role of Services Coordinator:

- the EPA
- the Hunter Catchment Management Trust
- an Operations Committee made up of stakeholder representatives.

EPA

The EPA has the statutory powers and skills necessary to ensure that the functions outlined above are carried out effectively. While conferring the role of Services Coordinator exclusively on the EPA would have the advantage of giving responsibility for the tasks to a single organisation, this approach may not adequately address the concern raised by some participants that they are not receiving monitoring and modelling services at a level that justifies their investment (or not having input to decisions about the level of service provided). In practice, it is the Scheme participants who are best placed to identify any deficiencies in provision of some of the services and who are motivated to scrutinise performance and minimise service provision costs. In the longer term, the Scheme has the potential to be run by stakeholders, with EPA involvement in Scheme administration limited to enforcing rules where necessary and ensuring that Scheme objectives are met.

Hunter Catchment Management Trust

The Hunter Catchment Management Trust as Services Coordinator has several advantages. The role would be consistent with the Trust's strong links with the community and its success in improving the Hunter catchment over many years. The Trust is a statutory body established under the *Catchment Management Act 1989* and therefore has the power to enter into contracts for the provision of required services. It has the existing legislative power to set up separate trust funds and special deposit accounts to enable Scheme funds to be kept separate from other Trust revenue. Apart from its legal structure, it has the appropriate expertise, infrastructure and administrative systems to ensure the provision of the River Register (the Trust currently has an annual budget of approximately \$8 million and 35 full-time employees).

However, this approach has disadvantages. Membership of the Trust is restricted by the *Catchment Management Act* to a majority of land users or holders, persons with an interest in environmental matters, persons nominated by Local Government authorities, and persons who are officers of relevant Government departments. Existing participants in the Scheme (i.e. mines and power stations) could be excluded from the process of selecting service providers and determining appropriate costs and contributions. This option would not provide the desired level of accountability, transparency and stakeholder participation.

Stakeholder committee

A stakeholder-based Operations Committee would:

- build on and harness the existing spirit of cooperation and goodwill among participants
- provide a mechanism for stakeholders to ensure they are getting value for money and adequate service delivery in the provision of the Scheme's infrastructure

- provide greater accountability regarding the operation of the Scheme, and the achievement of the Scheme's environmental outcomes.

Assessment

In the short term it is expected that the EPA will have greater expertise in establishing the initial contractual arrangements and could do so more efficiently than an Operations Committee. Such a committee would take time to establish and develop the appropriate structures and expertise.

It is therefore proposed that a hybrid of Options 1 and 3 be used, with the EPA initially responsible for Scheme administration but with the potential for the Operations Committee to take on the role of Services Coordinator once that Committee is established and functioning effectively. Although such a transfer of the role could not occur immediately, the Operations Committee would still be established in the first year of the Scheme's operation to provide advice on the operation of the Scheme. It is proposed that the Committee be chaired by a representative of the Hunter Catchment Management Trust, with members representing Scheme participants and other stakeholders.

To enhance the level of transparency and accountability in respect of service delivery, the EPA would initially formalise the current arrangements for provision of services by the Department of Land and Water Conservation (DLWC) through a legal contract. As a transitional arrangement, and to ensure continuity in the provision of the River Register, the proposed Regulation provides that the Water Administration Ministerial Council (the corporate body which contracts on behalf of DLWC) is taken to be appointed as Services Coordinator—although this does not prevent the EPA from varying or terminating that appointment.

Costs

EPA administration costs

For this analysis, it is assumed that the Services Coordinator role is fulfilled by the EPA for 3 years, and by the stakeholder Operations Committee after that time.

EPA administration costs associated with the Services Coordinator role are expected to include 25 staff-days of EPA time to establish the role and arrange the contracts for which the Coordinator is responsible. There will also be costs of contract drafting, tendering and selecting service providers in year 1. The total year 1 cost for the EPA Service Coordination role is estimated at around \$27 000.

In years 2 and 3, it is expected that 15 days of staff time will be required for reviewing reports, clarifying matters and authorising payments at a cost of \$13 300. This is expected to drop in years 4 and 5 to \$2 300.

The present cost of EPA consultation with the Operations Committee (by attending Committee meetings as described below) is estimated at \$6 500 during the first 3 years of the Scheme. The total present cost to the EPA of services coordination is therefore around \$49 000.

Operations Committee administration costs

The Operations Committee is expected to have 8 members who meet 4 times per year normally, and 10 times in year 3 of the Scheme to facilitate the take-over of the Services Coordinator role from the beginning of year 4.

The economic cost of the Committee is estimated at \$236 per member per meeting day, giving a total cost of \$18 900 in year 3 and \$7 500 in other years. In present value terms, the cost of Operations Committee meetings is around \$40 200 over 5 years.

Administrative support is estimated at 30% of the Committee's costs, plus \$4 000 for contract redrafting in year 3, and 5 days' staff time per year in years 4 and 5 for Services Coordination

functions taken over from the EPA. The cost of Operations Committee administrative support and service coordination is estimated at \$16 000 over 5 years.

The total present cost for the Operations Committee over 5 years is estimated at \$55 500.

Cost of monitoring, modelling and River Register

The cost of monitoring, modelling and provision of the River Register under the pilot Scheme has been estimated by the Department of Land and Water Conservation at \$290 000 per year. If participants in the Scheme wish to maintain the current level of functionality (i.e. wish the Services Coordinator to purchase the same monitoring and modelling without any enhancements), then the cost to the Department of Land and Water Conservation of monitoring, modelling and River Register provision will not change under the proposed Regulation.

Participants have, however, expressed a desire to obtain a 24-hour river modelling and advice service provided on-line through the Internet. If this level of functionality is purchased it is anticipated that annual costs associated with monitoring, modelling and River Register provision will be approximately \$165 000 per year more than the cost of the existing services, or \$681 000 in present value terms over 5 years. It should be noted that this is not a requirement of the Regulatory Proposal. It is instead a possible outcome of the framework that would be set up under the Proposal, whereby Scheme participants would have greater choice over the levels of service provided. It is therefore included as a discretionary cost of the Regulatory Proposal.

The incremental cost of monitoring, modelling and River Register provision is therefore zero. (In terms of the cost borne by participants, however, the proposed Regulation will move to full cost recovery as discussed in Section 6.4.2.)

Total costs of Services Coordinator

The total present cost of Services Coordinator administration is expected to be \$105 500 over 5 years, representing the additional work that will be necessary to introduce formal service provision and funding arrangements, and to introduce an appropriate level of formal stakeholder involvement in the Scheme.

This cost is partially offset by the costs of the existing informal committee. This committee, made up of 5 coal mine representatives, 1 power station representative and 3 Government representatives, meets quarterly for half a day at a time to monitor the Scheme. Assuming an economic cost of \$236 per day of time, the cost of the informal committee is \$4 245 per year, or \$17 400 over 5 years in present value terms. This committee would be replaced by the proposed Operations Committee, and the savings from this would partially offset the additional costs of services coordination. The incremental cost is therefore \$88 500 over 5 years.

6.4.2 Options for funding the Services Coordinator's functions

The Services Coordinator will determine the total annual costs of monitoring and modelling services through its contracts with the providers of those services. However, for the Services Coordinator to provide the functions required of it, a mechanism for funding the Coordinator's work and contractual obligations is needed.

The Services Coordinator will need to provide for the costs of river monitoring and modelling services and maintenance of the River Register, along with administrative costs and any sitting fees that may arise if the Operations Committee takes on the role of Services Coordinator.

Under the pilot Scheme, river monitoring and modelling services are around 60% funded by Scheme participants according to their credit holdings, with the remaining 40% effectively funded by the Government (DLWC). Scheme participants currently provide funding on an informal basis according to the number of credits they hold.

The informal nature of these arrangements has been identified as a potential risk to continued funding, and this needs to be addressed if there is to be certainty about the Scheme's continuation. In addition, the 40% subsidy currently provided by the Department of Land and Water Conservation is unlikely to be sustainable from that agency's budget, and is contrary to NSW Government policy, which requires that identifiable users of services pay the full cost of those services.

As such, the subsidy is unlikely to continue and the full cost of the Services Coordinator's functions must be met by participants. However the establishment of the Operations Committee discussed above will help ensure that future services can be obtained efficiently and transparently through contractual arrangements.

There are 3 possible bases for recovering Scheme costs from participants:

- Payment by all participants according to credit holdings.
- Payment by licensees who are authorised to discharge salt into the Hunter River.
- A combination of the above.

Payment by all participants according to credit holdings

Under this option, credit holders would pay the total cost of the Service Coordinator's functions according to the number of credits they hold as a proportion of the total. The cost is currently estimated at \$290 000 per annum, meaning that each credit would cost \$290 per year if current service levels are maintained and efficiency gains cannot be obtained.

Payment by discharging licensees

Those licensees who are authorised to discharge salt are the principal beneficiaries of the monitoring and modelling services and so could share the total cost of these services. At present there are 12 such licensees, who would pay around \$24 200 per year each at current cost levels. Under the estimates used for the base case, it is predicted that there will be 15 licensees by year 5 of the Scheme, which would reduce individual licensees' costs to \$19 300 per year in present value terms.

Combination approach

Payment could be based on a mix of credit holdings and licence status. Under this proposal:

- All licensees holding an environment protection licence to discharge salt to the Hunter River would jointly contribute 50% of Scheme administration costs.
- Salinity credit holders (licensed and non-licensed) would jointly contribute 50% of Scheme administration costs, according to their average credit holdings during the Scheme year.

This would mean a cost to discharging licensees of \$12 000 each per year, plus the cost of credit holdings. At the fifth year, with 15 licensees, the cost would drop to \$9 700 each per year in present value terms.

For credit holders, the cost would be \$145 per credit per year based on full recovery of current Scheme costs.

Assessment

If liability to contribute to Scheme administration costs was restricted to credit holders only, some licensees may be tempted to give up their credits (and hence access to controlled discharges) and rely on having sufficient storage for the less frequent events when flood flow discharge is allowed. As a result, the cost burden would fall more heavily (and inequitably) on the remaining credit holders.

If payment is restricted to licensed dischargers only, then credit holding is costless. This could promote speculation beyond that which is useful for market liquidity. It would also mean that payment for the services would not correlate to the benefit received. For example, some licensed dischargers benefit considerably more than others from the ability to discharge during high flows and flood flows. There is an equity argument that those licensed dischargers should also make a contribution in proportion to their credit holdings.

Given the level of benefits received under the Scheme by credit holders and licensed dischargers, the preferred option is the combination option, with licensees paying 50% and credit holders 50% of Scheme administration costs.

6.4.3 Credit Register

The proposed Regulation establishes the role of Registrar, charged with establishing and maintaining the Credit Register. The Registrar is proposed to be the EPA or its appointee (which would be engaged in accordance with the usual Government tendering guidelines).

The Credit Register will be provided as an on-line service that will also provide for on-line credit exchange. As the EPA has already developed the on-line Credit Register (presently in its training phase at the time of writing), the only new cost is the ongoing cost of hosting the system and maintaining the software. Assuming a cost of \$5 000 per year for these, the present cost of the credit register would be \$15 800 over 5 years. However, this cost would be incurred under both the base case and the proposed Regulation. The incremental cost is therefore zero.

6.4.4 Other EPA administration costs

The EPA will incur some administration costs other than those of Services Coordination and auctions. These are expected to be one-off costs in most instances as the Scheme comes into effect. These costs would include such matters as appointing and arranging administrative support for the Operations Committee, and determining credit allocations for new or expanded developments before the first auction. It is estimated that these administrative functions will take around 55 staff-days and cost around \$22 500 over 5 years, although these are likely to be offset by cost reductions arising from the ending of the pilot Scheme. A neutral impact is assumed for this analysis as the most realistic case.

7. SUMMARY AND CONCLUSION

This chapter summarises the impacts of the proposed Regulation and compares its costs against those of the base case, which is to retain the pilot Scheme.

7.1 Economic costs

The economic costs of the proposed Regulation are summarised in Table 7.1.

Table 7.1: Quantified costs— present value over 5 years (\$m).

Cost component	Proposed Regulation	Existing scheme	Incremental cost
Flood flow threshold	\$1.0m–\$3.6m	0	\$1.0m–\$3.6m
Services Coordinator administration	\$0.1m	\$0.02m	\$0.09m
Current River Register and monitoring service	\$1.19m	\$1.19m	0
Credit Register	\$0.02m	\$0.02m	0
Auctions	\$0.07m	0	\$0.07m
Total for Regulation	\$2.4m–\$5.0m	\$1.2m	\$1.2m–\$3.8m
Optional cost for enhanced river monitoring and modelling service	\$0.68m	\$0.68m	0
Total with options	\$3.1m–\$5.7m	\$1.9m	\$1.2m–\$3.8m

Table 7.1 shows that the estimated additional cost of the proposed Regulation above that of the pilot Scheme is between \$1.2 and \$3.8 million in present value terms over 5 years. Almost all of this is attributable to the cost of increased flood flow thresholds in the Upper and Middle Sectors. A cost range is given because the cost impact can be offset to some extent by credit trading, but there is also significant uncertainty about the precision of the cost estimates because of the number of assumptions required to model the responses to the proposal. The EPA will seek more detailed data on these costs from the licensees involved during the consultation program.

7.2 Benefits

The most significant benefits of the proposal are those that come directly from the maintenance of salinity levels within the specified targets, and thus the capacity for new development to proceed with the general acceptance of the community. The direct benefits of fresher water accrue to the environment and to agricultural and urban users of water from the Hunter River and its tributaries. The potential effects of elevated river salt levels are to render water undrinkable for people and stock, reduce agricultural yields, accelerate corrosion of domestic and industrial pipework and appliances, and to affect aquatic ecosystems.

The indirect benefits of the avoided cost of foregone development accrue to the region and the State. These are large. For example, new mines typically employ over 300 people with annual production worth over \$300 million (which is greater than the value of all agricultural output in the Hunter catchment above Singleton). At present at least 6 new mines are under consideration in the Valley. Under pre-Scheme conditions, it is likely that community opposition to new salt discharges would have stalled most of these projects.

Three other benefits of the proposed Regulation are operational in nature and are additional to the overall benefits of achieving the salinity targets and facilitating ongoing economic development:

- Increased transparency and accountability in the areas of river monitoring, modelling and River Register provision, particularly with respect to funding and service quality.
- Increased certainty that market imperfections will not occur through inefficient credit allocation or distribution methods, non-availability of credits to new market entrants or unnecessary restrictions on eligibility to hold credits.
- Increased certainty that the Salinity Trading Scheme will function on a firm regulatory basis into the future, hence reducing the risk associated with investing in credits as an alternative to increased water storage or treatment capacity.

7.3 Distributional impacts

The proposed Regulation gives effect to the NSW Government policy of full cost recovery from identified users of Government services.

7.3.1 Costs to salt-discharging licensees and credit holders:

Under the proposed Regulation, dischargers will face three principal additional costs:

- Costs associated with the need to either increase water storage and/or treatment capacity as a result of the increased flood flow thresholds in the Upper and Middle Sectors, or the costs of credits required to avoid that need. Those costs are set out in Table 7.1.
- A greater share of the cost of Scheme administration which is currently subsidised by the NSW Government, i.e. provision of monitoring services, River Register, legal contract provision and Committee administration.
- The costs of obtaining and holding credits through auction or trading. The actual costs of credit trading and of purchasing credits at auction are not yet known.

7.3.2 Cost to Government

The Regulatory Proposal is designed so that it operates according to principles of full cost recovery. While the EPA will incur its normal costs associated with licensing functions and the Scheme (for example, enforcing Scheme rules where necessary), there will be no net cost to Government for any of the additional functions conferred on the EPA under the proposed Regulation.

The Government is expected to receive revenue from credit auctions which is the return to the community for allowing the use of the Hunter River for the disposal of salt. There is insufficient information at present to be able to accurately determine what the likely auction price for a credit will be, and hence the likely revenue from the auctions. However, revenues will be net of auction costs.

7.4 Conclusion

The pilot Hunter River Salinity Trading Scheme has provided an effective and efficient framework for the management of salt discharges into the Hunter River. Since the Scheme's commencement, salinity targets have not been exceeded except as a result of non-licensed diffuse discharges or natural conditions. This has been achieved without major conflict among river users and has allowed for new salt-discharging industries to set up within the catchment, which may not have been possible under the previous management system.

An examination of a wide range of alternatives to the pilot Scheme shows that all would deliver either poorer environmental outcomes or similar outcomes at much greater cost. It is therefore concluded that a Salinity Trading Scheme should continue as the basis for managing salt discharges into the Hunter River.

The proposed *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation* will permanently implement the existing pilot Scheme and place the Scheme into a firm legislative framework.

The principal purpose of the Regulation is to ensure the cost-effective achievement of the water quality objectives for the Hunter River catchment that were set through the original stakeholder consultation process on the pilot Scheme and, more recently, incorporated in the Interim Water Quality Objectives (EPA, 1999b). Specifically, those objectives are to keep river salinity below 600 EC at Denman and 900 EC at Singleton.

To achieve these targets, the proposed Regulation will retain the same structure as the pilot Scheme, but will introduce a substantive change by increasing flood flow thresholds to 20 000 ML/day in the Upper Sector and 10 000 ML/day in the Middle Sector of the Scheme.

The incremental cost (that is, the cost above that of the existing pilot Scheme) of the proposed Regulation is expected to lie in the range of \$0.27 to \$0.90 million per year. Over 5 years, this is equivalent to an economic cost of \$1.2 to \$3.8 million in present value terms.

Almost all of this cost is the estimated economic cost that Scheme participants will incur in adjusting to the increased flood flow thresholds that are necessary to meet the water quality objectives. These costs will be mitigated by the capacity to acquire credits from the current large pool of underused entitlements.

The proposed Regulation will also introduce the following operational and administrative changes to the Scheme:

- The creation of 1 000 tradeable salinity credits, each having a lifespan of 2 to 10 years, and their allocation to existing pilot Scheme participants in accordance with pilot Scheme credit holdings.
- The expiry of 20% of the credits every 2 years and the reallocation of those credits by public auction.
- The creation of a new administrative role of Services Coordinator, which will be responsible for providing the river monitoring, modelling and River Register services necessary to run the Scheme. The Services Coordinator will be able to contract out its functions and its costs will be recouped from Scheme participants.
- The creation of a new stakeholder committee called the Hunter Valley Salinity Trading Scheme Operations Committee, which the EPA may appoint as the Services Coordinator.

These administrative changes under the proposed Regulation will bring about the following benefits, which are additional to those of ensuring that the salinity targets for the catchment are not exceeded and of facilitating ongoing economic development in the Region:

- Increased transparency and accountability with respect to funding and service quality of river monitoring, modelling and River Register provision.
- Increased certainty that market imperfections will not occur through inefficient credit allocation or distribution methods, non-availability of credits to new market entrants or unnecessary restrictions on eligibility to hold credits.
- Increased certainty that the Salinity Trading Scheme will function on a firm regulatory basis into the future, hence reducing the risk associated with investing in credits as an alternative to increased water storage or treatment capacity.

While these latter benefits cannot be quantified, the EPA believes them to be significant. Increased certainty about the continuation of the Scheme and its placement on a firm regulatory basis provides investors with a longer planning horizon and reduces the risk associated with investment in salt water management infrastructure. The introduction of competitive processes into credit allocation is expected to contribute to the wider economic efficiency gains achievable under the National Competition Policy.

The benefits of avoiding the cost of foregone development are also significant, with each new mine likely to employ over 300 people and to generate output worth over \$300 million per year.

The changes introduced to the Scheme will allow the Scheme to be adaptable and robust and to continue to succeed in a dynamic operating environment with expanding industries that have the potential to adversely affect water quality. This adaptability will be particularly valuable in the Upper Sector where mining development is growing rapidly but where the river (and its salt dilution capacity) is smaller.

These benefits, combined with the achievement of the water quality objectives for the catchment, are sufficient to conclude that the proposed Regulation is superior to the existing pilot Scheme arrangements.

It is therefore recommended that the proposed Regulation be made.

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APPENDIX ONE: ALTERNATIVE SALT MANAGEMENT OPTIONS NOT CONSIDERED VIABLE

Nil discharge and shutdown of facilities that cannot avoid discharge

Smith (1995) described this option as requiring the closure of 10 existing mines that at the time employed nearly 3 300 people and produced coal worth \$1.8 billion. If applied to Macquarie Generation, with sufficient desalination plant capacity the power generator could comply, but every megalitre of water that is currently discharged would require treatment at an operating cost of \$200 or more per ML. Capital costs of expanding desalination capacity would be additional to this.

Smith (1995) concluded that in practice it was unlikely that this option would ever be contemplated while any other feasible option existed.

Pipeline to the sea

A pipeline could be connected by branch lines to each potential discharger and carry saline water directly to the sea, running alongside coal haulage railway lines. The cost of such a pipeline was estimated by Croft in 1983 at \$15–\$25 million, excluding the cost of obtaining land easements (Croft 1983, cited in Smith 1995). In 1998 dollars, that is equivalent to \$30–\$50 million, excluding the cost of easements. Additional problems exist with identifying unauthorised discharges to the pipeline, and with potential environmental impacts at the pipeline discharge point if located in the Hunter River estuary.

Deep well injection

Croft (1983) concluded that the geology of the Hunter catchment made deep well injection of saline water neither physically practical nor financially feasible. Deep well injection into Permian coal seams would require in excess of 7 000 bores owing to the low permeability of the seams. Deep well injection into alluvial aquifers would result in the saline water either reaching the Hunter River or contaminating stock and irrigation bores (Croft 1983, pp. 44–45).

Storage and evaporation

Smith (1995) concluded that for many mines, the space required for evaporation ponds would exceed the area of their mining leases. In addition, evaporation disposes of water but leaves behind large quantities of salt which cannot be easily disposed of without creating future salinity hazards (Smith 1995, p. 53).

Desalination

Desalination is a technique already used by Macquarie Generation as a partial solution to saline water problems. The technique used by Macquarie Generation still leaves a concentrated brine for which disposal remains an issue. In addition, if capacity had existed to desalinate all saline water that was discharged via the Salinity Trading Scheme from 1995 to 1998, the operating cost would have exceeded \$1.5 million per year on average.

Croft & Associates (1983) undertook a detailed study of the possibility of mines using desalination as a salt management technique. They concluded that the capital cost would have ranged from \$20 to \$32 million (\$30 to \$50 million in 1998) and annual operation would have cost \$2.5 million (\$3.7million in 1998).

Licensing system prior to the Salinity Trading Scheme

Up until 1 January 1995, the pollution control licensing system that the EPA used to regulate salt discharges to the Hunter River involved neither a monitoring and river modelling system nor a salinity credit trading scheme. A number of licensing systems were used:

1. A volume limit— discharges were limited to a maximum volume on any given day.
2. A combined volume and concentration limit— discharges to the Hunter River were limited by volume and were also subject to a maximum salinity limit, having the effect of requiring licensees to direct their saltiest water to reuse wherever possible.
3. A combination volume, ambient and increment limit— discharges to the Hunter River were volume-limited and were not allowed if the river salinity exceeded 700 EC or if the discharge would cause the river salinity to increase by more than 40 EC. The increment limit was set to prevent upstream dischargers from using up the available discharge opportunities (Smith 1995).

Systems 1 and 3 were in effect immediately before the pilot Scheme came into effect. They provided some equity between dischargers, as no discharger could have a more significant salinity impact on the river than any other. However:

- System 3 favoured upstream dischargers over downstream dischargers
- the volume and incremental limits meant that only small discharges were allowed even at times of very high river flow when salinity effects would have been low
- System 1 meant that small discharges could still take place even during very low river flows, with significant salinity impacts.

These licensing systems had further practical difficulties, including the inability to accurately time discharges so that saline water did not cause large increases in river salinity.

These licensing systems were not able to keep river salinities within acceptable limits when salt discharge was occurring, and it is unlikely that they would be able to maintain river salinity beneath the current 600 EC and 900 EC limits set for Denman and Singleton.

Because of the river salinities that occurred under these licensing systems, the EPA moved in 1992 to a position of allowing no further salt discharges to the Hunter River. Had that licensing system remained in place and the nil development policy been retained, the effect would have been to prevent or significantly alter the development of Bengalla Mine and Redbank Power Station.

Preventing the development of Bengalla mine, which is the newest mine, would have prevented the employment of 300 staff and the production of \$300 million worth of coal per year. This output is greater than the total value of agricultural production in the catchment.

APPENDIX TWO: MINE PARAMETERS FOR MODELLING EXERCISE

These values were used to represent a hypothetical new mine in modelling the need for and impacts of revised flood flow thresholds in the Upper and Middle Sectors. See Section 6.2 for further explanation and discussion.

Adopted base case operational conditions.

Variable	Assigned value	Comment
Production	8 Mt p.a.	Washery water use 120–160 L/t
Dust suppression	1.0 ML/day	Haul roads etc.
Stockpile	0.07 ML/day	Dust suppression
Truck wash	0.03 ML/day	
Catchments		
Hardstand	10 ha	
Strip & bench	160 ha	
Pit floor	30 ha	
Unshaped spoils	100 ha	
Shaped spoils	80 ha	
Rehabilitated land	60 ha	
Undisturbed land	40 ha	
Dam storage		
Mine storage/transfer	150 ML	1.5 ha surface area in total
Raw water storage	250 ML	3.5 ha surface area
High flow discharge	10 ML/day	Discharge if above 50% capacity
Flood flow discharge	100 ML/day	Discharge if above 50% capacity

APPENDIX THREE: SENSITIVITY TESTING OF FLOOD FLOW THRESHOLD ASSUMPTIONS

The key parameters from which flood flow thresholds were set for the Upper and Middle Sectors are identified here. Following identification of the base case used to determine thresholds, the sensitivity of the required river flow to changes in the parameter values is tested.

Upper Sector

Base conditions

- 3 mines discharging at once
- average discharge of 100 ML/day each during flood flows
- river salinity 350 EC
- discharge water salinity 4 500 EC.

Impacts on flow needed to meet 600 EC salinity target.

Flow needed to meet target (ML/day)	
No. of mines discharging	
2	3 120
3	4 700
4	6 250
5	7 800
Size of discharge per mine (ML)	
50	2 340
100	4 700
150	7 000
Capacity (~850 ML in total)	13 250
River salinity (EC)	
300	3 900
350	4 700
400	5 850
450	7 800
500	11 700
Discharge salinity (EC)	
3500	3 500
4000	4 080
4500	4 700
5000	5 280
6000	6 480

Middle Sector

Base conditions

- 5 mines discharging 100 ML each at 4 500 EC
- Macquarie Generation discharging 700 ML at 1 800 EC
- Redbank Power Station discharging 15 ML at 33 000 EC
- river salinity 400 EC.

Impacts on flow needed to meet 900 EC salinity target.

Flow needed to meet target (ML/day)	
No. of mines discharging	
3	4 400
4	5 100
5	5 830
6	6 550
Size of discharge per mine (ML)	
50	4 000
100	5 830
150	7 600
Capacity (~1215 ML in total)	8 350
River salinity (EC)	
300	4 850
400	5 830
500	7 280
600	9 700
Mine discharge salinity (EC)	
3500	4 830
4000	5 330
4500	5 830
5000	6 330
6000	7 330

Assessment

In both sectors the flood flow threshold required to meet salinity targets is most sensitive to the ambient (pre-discharge) river salinity level.

The base case for the Upper Sector reflects expected conditions under current flow thresholds and levels of catchment development, and indicates that the current flood flow level of 2 000 ML/day is too low. Initially a flood flow level of 5 000 ML/day appears reasonable. However, the low number of discharging mines with large individual discharge capacities suggests that the sensitivity to total discharge capacity is also very important, thus indicating that a flood flow threshold of at least 13 000 ML/day is required. The proposed Regulation sets the flood

flow threshold for the Upper Sector at 20 000 ML/day as this should be sufficient to provide for expected mining expansion in the Sector.

The base case for the Middle Sector is conservative, i.e. tending towards a 'reasonable' worst case. While the base case assumes average conditions with regard to pre-discharge river salinity, and there is significant scope for that to vary upward, the base case is very conservative with respect to discharge. The base case assumes that 5 mines, Macquarie Generation and Redbank Power Station discharge at near their volume limits (with expected salinities). This is unusual in the Scheme's history to date. Under these conservative conditions, the current flood flow threshold is still adequate to meet the salinity targets.

However, the key sensitivities in the Middle Sector are river salinity and the possibility of 1 or 2 mines with large individual capacities discharging. As noted, river salinity has significant scope to vary upward and is also likely to increase to the Upper Sector limit of 600 EC as discharge capacity expands in the Upper Sector. It is also possible for 1 or 2 mines with large discharge capacities to release up to 400 ML/day rather than 100 ML/day as modelled. These factors, particularly if combined, suggest that a higher flood flow threshold than the current level may be required.

**APPENDIX FOUR: DRAFT PROTECTION OF THE ENVIRONMENT
OPERATIONS (HUNTER RIVER SALINITY TRADING SCHEME)
REGULATION 2001**

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