Sunraysia Drainage Strategy

Volume 1 - The Strategy

June 2002

Department of Natural Resources and Environment

GOULBURN-MURRAY WATER

SunRISE INC. Sunraysia Regional Initiative for a Sustainable Economy - 21st Century

First Mildura Irrigation Trust

Lower Murray Water

Mildura Rural City Council

EPA Victoria

Murray-Darling Basin Commission

mallee catchment management authority

Sunraysia Rural Water Authority

Executive Summary

E.1 Background

In response to community concerns about rapid expansion of urban areas into adjacent irrigated lands and the need for a coordinated approach to drainage, Mildura Rural City Council has identified a need to prepare a Sunraysia Drainage Strategy.

The principal output of the Strategy is a master plan outlining how urban development and the existing irrigation development will be serviced with surface and sub-surface drainage to the year 2050.

E.2 The Study Area

The Study Area is shown on Figure E-1 and includes:

- The urban centres of Mildura, Merbein, Irymple and Red Cliffs;
- First Mildura Irrigation Trust, Red Cliffs and Merbein Irrigation Districts, and other abutting irrigation areas.

The Study Area is characterised by undulating topography. Many parts of the area are landlocked with no natural gravity drainage outfalls. With existing drainage systems, around 40% of the area drains to the River or floodplain, and the remainder to inland water bodies.

E.3 Existing Drainage Systems

E.3.1 Urban Drainage

Approximately 40% of the Mildura/Irymple urban area currently drains to the River or floodplain.

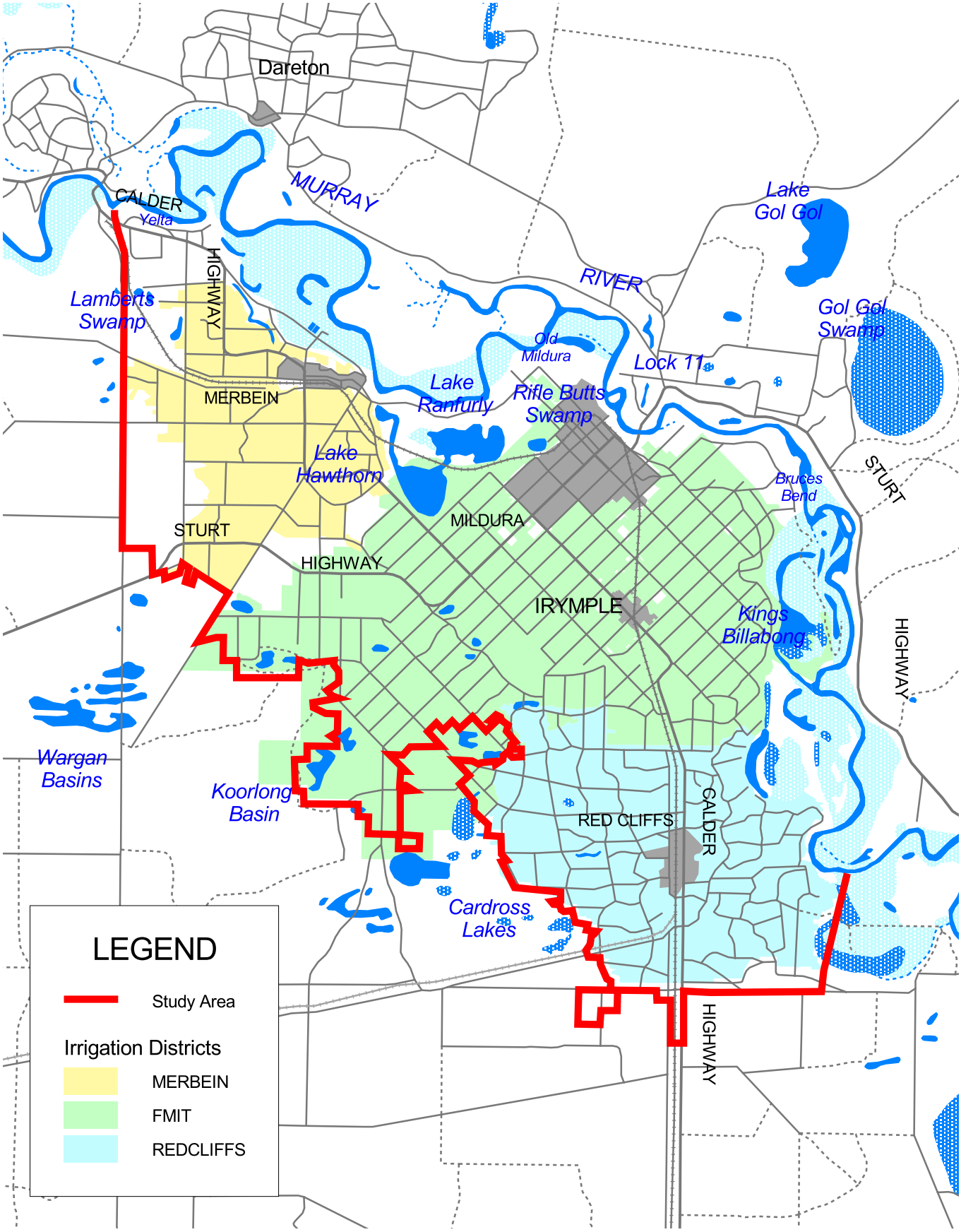
The remainder drains to Lake Hawthorn, Lake Ranfurly East and Rifle Butts Swamp. The drainage system serving the large landlocked area around Irymple relies on retardation basins and pumping systems to discharge to these water bodies. Council works, over the past 15 years, have augmented the stormwater drainage system on an ad hoc basis, with design solutions being developed with respect to catchments. The lack of augmentation of the main drainage system within the urban areas over the past 15 years has often required the development of retention/retardation basins to store stormwater. Stormwater is discharged by pumping from these basins into pipes which generally discharge into the above lakes and swamps.

E.3.2 Irrigation Drainage

The majority of the irrigation area is serviced by subsurface drainage that interconnects into a comprehensive drainage network. Most of the irrigation drainage is discharged either directly or indirectly to the River Murray, or to the multitude of inland evaporation basins. However, there are some irrigated areas that still dispose to drainage shafts (or disposal bores).

The Lake Hawthorn Drainage Diversion Scheme operates to pump irrigation (and urban) drainage from Lake Hawthorn to Wargan Basins.

FIGURE E1 - STUDY AREA



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E.3.3 Rural Surface Drainage

There is very limited surface stormwater drainage infrastructure in rural areas within the Sunraysia Region, due at least partly to the scarcity of defined rural watercourses and surface drains. Water draining from roads and properties tends to pool in localised areas and infiltrate through the soil profile. Due to this lack of infrastructure, flooding has been highlighted as an issue at a number of locations.

E.3.4 Groundwater

Prior to European settlement, the regional watertables were generally 15 to 20 metres below the ground surface. Irrigation within the Mildura area has resulted in the formation of a regional groundwater mound beneath the irrigated and urban areas, and the development of perched water tables, which subsequently recharge the regional groundwater mound.

To offset the impact of this growing regional mound on the River Murray, the Mildura-Merbein Groundwater Interception Scheme was constructed in 1981. The scheme operates along a 15 km reach on the Victorian side of the river between the townships of Mildura and Merbein. Groundwater intercepted by the scheme is pumped to Lake Ranfurly East and West before being transferred further inland to the Wargan Evaporation Basins.

E.4 Values of Receiving Environments

A number of key water bodies receiving drainage discharges have high ecological, cultural and heritage, amenity and recreational, economic and drainage values. These values are summarised in Table E1.

■ **Table E1 Summary of current values of environments receiving urban stormwater and irrigation drainage**

Receiving Environment	Environmental		Cultural		Amenity			Eco-nomic	Drainage	
	Instream	Riparian	Indigenous	Non-indigenous	Recreational	Amenity	Tourism	Water Supply	Flood reductions	Salt & nutrient reductions to Murray River
Environments receiving urban stormwater runoff (& irrigation drainage)										
Murray River	V high	V high	V high	V high	V high	V high	V high	V high	High	Low
Kings Billabong	V high	V high	V high	V high	V high	V high	V high	High	Low	Mod.
Basin 12	High	High	Mod.	Low	Mod.	Mod.	Low	Low	High	V high
Rifle Butts Swamp	Mod.	Mod.	Mod.	Low	Low	Mod.	Low	Low	High	Mod.
Lake Ranfurly East	V high	V high	High	Low	Low	High	Low	Low	High	V high
Lake Hawthorn	V high	V high	Mod.	Low	High	High	Mod.	Low	V high	V high
Environments receiving irrigation drainage										
Cardross Lakes	V high	V high	Low	Low	Low	Low	Low	Low	Mod.	Mod.
Koorlong Basins	Low	Mod.	Mod.	Low	Low	Low	Low	Low	Mod.	V high
Lamberts Swamp	Low	Low	Low	Low	Low	Low	Low	Low	Low	V high
Lake Ranfurly West	V high	V high	High	Low	Low	Low	Low	Low	Low	V high
Wargan Basins	V high	V high	Mod.	Low	Mod.	High	Low	Low	V high	V high
Psyche Bend Lagoon	Low	Low	Mod.	Low	Low	Low	Low	Low	Mod.	V high

E.5 Standards of Service

It is recommended that the following drainage design standards be adopted for future urban development:

- minor drainage system standard: peak flows should be contained within the piped drainage system as follows:
  - residential development – 5 year average recurrence interval (ARI) storm event; and
  - industrial and commercial development – 10 year ARI storm event;
- major drainage system standard: the floor levels of all habitable buildings should be at least 300 mm above peak flood levels resulting from the 100 year ARI storm event.

Current irrigation drainage design standards are considered adequate, and are recommended for future irrigation development.

Cross drainage of major highways and railways should be designed to cater for peak flows from either then 50 or 100 year average recurrence interval storm event. Cross drainage for other rural roads should be deigned to cater for peak flows from either the 5 or 10 year average recurrence interval storm event, depending on the importance of the road.

E.6 Drainage Management

E.6.1 Disposal Measures

Key issues that have been addressed in developing future drainage disposal measures included:

- Conversion of land use from irrigation to urban use may significantly reduce future inflows to Lake Hawthorn. This is likely to result in significantly higher salinities and nutrient levels, and lower operating levels.
- Reduced drainage flows resulting from improved irrigation practices may have significant implications for the quantity and quality of water in inland basins, particularly Cardross Basins and Lake Hawthorn.
- Both urban and irrigation drainage waters may be contributing significantly to algal blooms in the Murray River.
- Significant salt loads and poor quality drainage waters discharge to the River from the Merbein Irrigation District drainage shafts, Lamberts Swamp and the West and North West Drains. Disposal of drainage waters to the shafts is estimated to result in an annual salt load to the River of more than 5,000 t.

Recommended disposal measures are as follows:

- The majority of runoff from the Irymple Basin should be pumped to Lake Hawthorn (Measure 1 in Table E2).
- Urban runoff discharging to Lakes Hawthorn (Measure 1) and Ranfurly East (Measure 2) should be treated in wetlands prior to discharging to these two water bodies. The existing disused sewerage lagoons on the shores of Lake Ranfurly East should be retrofitted to form the wetland required to treat runoff to this water body.
- Runoff from the urban drains servicing the Etiwanda and San Mateo catchments of urban Mildura, should be treated in a wetland prior to discharging to the Murray River (Measure 3).
- Flows from Lamberts Swamp, Merbein West and North West Drains, and the drainage shafts, should be pumped back to Wargan Basins (Measure 4).
- Irrigation drainage from part of existing Red Cliffs catchment 1 should be pumped back to Cardross Lakes (Measure 5).
- Irrigation drainage from the remainder of FMIT catchment 7 should be redirected to a wetland at the northern end of Kings Billabong. Subject to detailed studies on the watering requirements of flora and fauna in around this wetland, it may also be necessary to include provision for discharge directly to the Billabong (Measure 6).
- Outfall from the Merbein town drainage system should be connected directly to the River, via an ephemeral wetland (Measure 7).

These measures are shown on Figures E-2 and E-3.

Further, more detailed, investigations will be required prior to implementation of any of these measures. These should take account of economic, social and environmental issues, and include development of detailed business cases. The detailed investigations will also need to consider the need for economic, social and environmental tradeoffs between competing needs for a number of the inland water bodies.

FIGURE E2 - PROPOSED WORKS - IRRIGATION AREAS

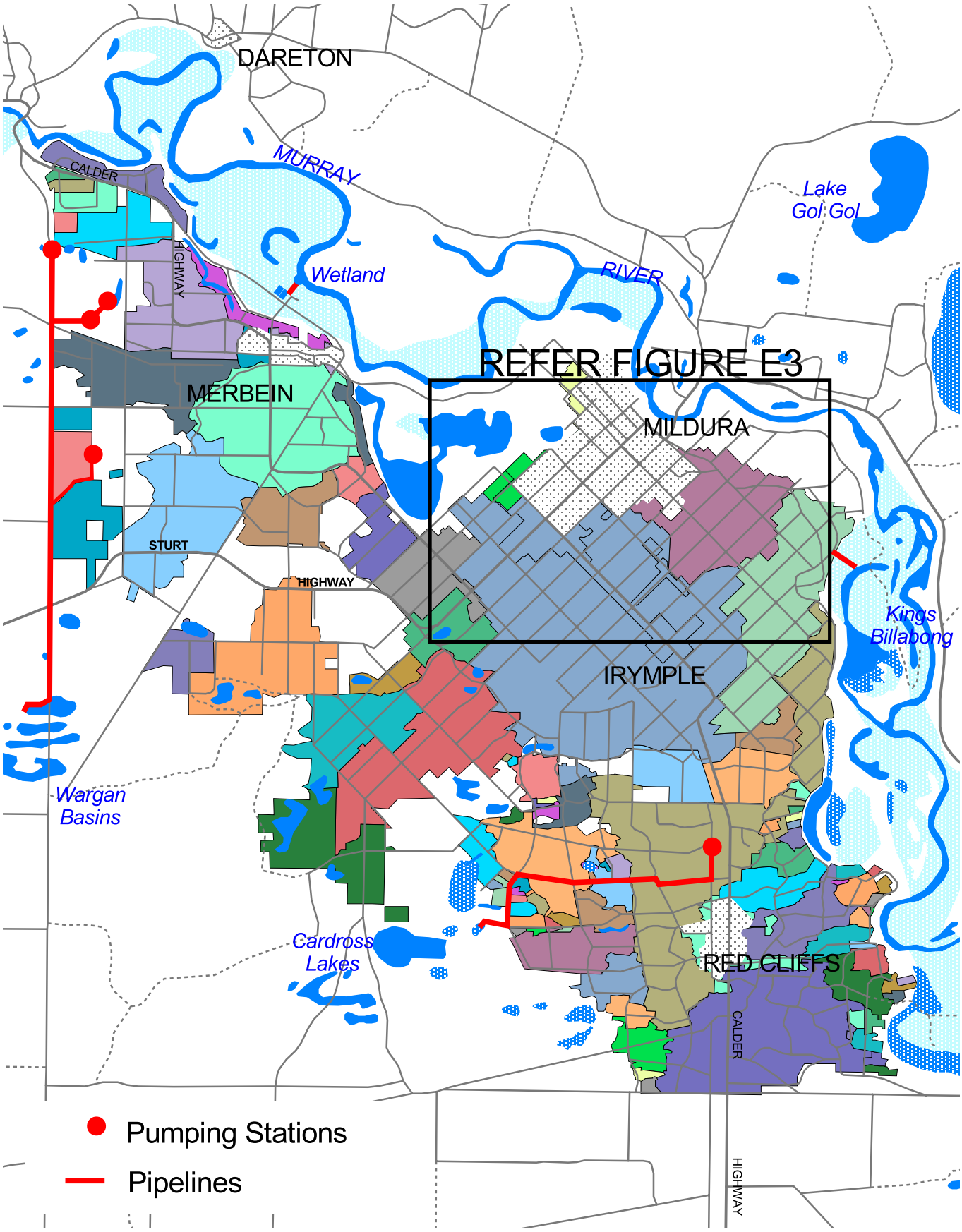

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FIGURE E.3
PROPOSED WORKS - MILDURA/IRYMPLE

Lake Ranfurly

Lake Hawthorn

Rifle Butts Swamp

MURRAY RIVER

MILDURA

IRYMPLE

WETLAND

A
B
D
E
F
G
H
I
J
K
L
M
N
O
P
R
S
T
U
V
W
X
Y
Z1
Z2
(Y)
AA
AB
Q1
Q2
Q3
Q4

Gravity Drains

Pumped Drains

Basins (indicative of location only)
Areas based on volumes with depths between 2 -3 metres

Surface Catchments

Potential Development 2000 - 2050

Cadastre
(reproduced with permission of DNRE)

N

500 0 500 1000 Metres

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Where drainage is disposed to the River, existing and new pipes should generally extend completely to the waterline, in accordance with the recommendations of the Draft Nyah to the South Australian Border Salinity Management Plan.

E.6.2 Rural Surface Drainage

Runoff from local storms results in flooding of rural land at a number of locations. In many such instances, particularly where the affected properties are at the low points of landlocked catchments, pumped disposal to remote sites, and other similar solutions that might be considered in urban areas, will not be cost effective.

Because the circumstances differ between sites, it is strongly recommended that each case be considered on its merits. Measures that should be considered either alone or in combination will include:

- installation of culverts;
- small, property scale, on-site detention facilities in the catchment upstream of the obstruction, to reduce peak flows;
- construction of evaporative disposal basins at the low points of landlocked catchments;
- allowing landholders to dispose of stormwater to the subsurface drainage system. This would need to be carefully controlled and monitored to ensure that discharge is only allowed when capacity is available, and that any adverse downstream water quality impacts are minimised;
- construction of low levees or floodwalls around individual houses. Small pumps would also be required to discharge stormwater from inside the floodwall/levee;
- raising of buildings to above flood levels;
- building relocation; and
- property acquisition.

Known and expected flood levels and extents should be clearly identified and documented by Council. Council should then ensure that new buildings are either:

- not located in areas of known or expected rural surface flooding; or
- have their habitable floor levels constructed at least 300 mm above known or expected flood levels.

In cases where rural surface drainage discharges to the floodplain, the need to connect this directly to the River will need to be assessed on a case by case basis.

E.6.3 Urban Subsurface Drainage

It is recommended that some sub-surface drainage to be allowed for in urban areas. In areas of new development, it is recommended that developers be required to commission a risk assessment to determine the need for subsurface drainage. This should be undertaken by a suitably qualified and experienced hydrogeologist or irrigation engineer. In areas of existing development, subsurface drainage will generally only be required in known problem areas. The cost of this should be met as a project under this strategy and be funded by the relevant stakeholders.

It is expected that no more than about a third of the urban area will require subsurface drainage. This cost should be included as part of the developers' costs.

E.6.4 Major Drainage System to Service Existing and Future Development in the vicinity of Irymple and South Mildura

There is virtually no urban drainage infrastructure in place in any of the undeveloped parts of Mildura Irymple currently zoned for urban development. This may ultimately impede development. The rate of urban development in the Mildura Irymple area has been 40 ha per year over the past 14 years, and is not expected to decrease in the foreseeable future. This is double the rate assumed in preparation of the Mildura Planning Scheme.

Lack of masterplanning and coordination of urban drainage has often resulted in standalone subdivisional drainage systems discharging to outfalls of inadequate capacity.

Recommended major trunk drainage works required to provide the recommended standard of drainage service for areas of proposed development in Mildura/Irymple are also shown on Figure E-3. The most significant of these is an integrated system designed to cater for existing and proposed development in the Irymple Basin and South Mildura. This comprises a series of retention basins, wetlands, gravity drains, pump stations and rising mains, discharging to Lake Hawthorn. Consideration should be given to incorporating playing fields into some or all of the basins. This would require appropriate safety provisions, eg prominent signage and safe egress paths, in recognition of the storm hazard.

Development to the south and west of Mildura will not be able to proceed without these or other similar major trunk drainage works.

E.6.4 Reuse

Relatively little drainage water is currently reused in the Study Area. Consideration should be given to incorporating additional storage within basins, for localised reuse on parks, gardens and playing fields.

Subject to detailed investigations of impacts on inland water bodies, consideration should be given to maximising reuse opportunities by incorporating water sensitive urban design principles into areas of new urban development.

E.7 Costs of Proposed Works

The costs of the major proposed works are summarised in Table E2. It should be noted that the table presents estimated costs for the listed major works only, and does not include any allowances for renewals, or for any other works.

■ **Table E2 : Summary of Costs**

System	Estimated Costs		
		Annual ($/yr)	
	Capital ($)	Existing Development	2050 Development
1. 16th Street Drain (including Lake Hawthorn wetland)	$ 47,750,000	$ 450,000	$ 450,000
2. Lake Ranfurly East Wetland	$ 60,000	$ 10,000	$ 10,000
3. Etiwanda and San Mateo wetland	$ 1,200,000	$ 10,000	$ 10,000
4. Major system to service Merbein Irrigation District	$ 5,290,000	$ 130,000	$ 110,000
5. Part Red Cliffs catchment 1 to Cardross	$ 1,890,000	$ 60,000	$ 60,000
6. FMIT catchment 7 to wetland near Kings Billabong	$ 400,000	$ 10,000	$ 10,000
7. Merbein town drainage	$ 680,000	$ 20,000	$ 20,000
TOTAL	**$ 57,270,000**	**$ 690,000**	**$ 670,000**

Construction of works should be staged to allow for progressive development, or to allow for development not proceeding as envisaged. However it is vital to reserve basin sites and drain easements immediately based on ultimate development requirements.

E.8 Impacts on Key Water Bodies

Conversion of irrigation to urban land use, and future reduction in irrigation drainage rates, will result in a nett decrease of flows to Lake Hawthorn, and an increase in salinity. The average salinity of Lake Hawthorn under existing inflow conditions, and assuming revised Lake Hawthorn Drainage Diversion Scheme operating rules will be around 5,000 EC. Under future inflow conditions, revised Scheme operating rules, and proposed disposal measures described above, the future average salinity of Lake Hawthorn is estimated to be around 8,000 EC without urban subsurface drainage, and 6,000 EC with urban subsurface drainage. These salinities would be significantly higher, and operating levels much lower than existing, without the proposed diversion of drainage from areas of new development to Lake Hawthorn. To assist amenity and conservation values, it may be prudent to regularly monitor the salinity of the Lake, and top up with irrigation water if necessary.

Reduction in drainage rates will result in lower water levels and higher salinities in Cardross Lakes. It will be necessary to import additional freshwater to Cardross Lakes in the future to maintain the health of fish species listed under the Flora and Fauna Guarantee Act.

Implementation of the proposed measures is estimated to result in River Murray salinity reductions as follows:

- Immediately following implementation 6.5 EC
- Year 2050 8 EC

The majority of the immediate impact is associated with removing the existing salt loads contributed by the Merbein Drainage Shafts, Lamberts Swamp, and Merbein West and North West Drains, by diversion to inland water bodies. A significant proportion of the 2050 impact is associated with the assumed reduction in irrigation drainage rates from 1.4 ML/ha/yr to 0.7 ML/ha/yr.

E.9 Institutional Arrangements

A clear management arrangement must be sought for assets where more than one body discharges drainage water to the same system or a system owned by another authority. This issue will arise, for example, if Council discharges urban runoff to FMIT irrigation drains that have spare capacity due to conversion of land use from irrigation to urban.

Wholesale institutional change is not considered necessary, and the following institutional changes/assignments are recommended:

- responsibility for subdivision scale urban subsurface drainage should be assumed by Council. Responsibility for larger scale works should be rationalised between Council and FMIT using the principles outlined below;
- ownership and management of irrigation drains in urban areas should be rationalised between FMIT and Council;
- in cases where irrigation drainage discharges to a subsurface drain for which ownership has been transferred to Council, or where urban drainage (generally subsurface) discharges to a drain owned by FMIT, existing drainage standards should be maintained for current users, and infrastructure use fees should be payable by the discharging authority to the owning authority;
- responsibility for outfalls and other off farm components of private irrigation drainage systems outside the Irrigation Districts should be investigated further. This responsibility could, if necessary, be assumed by the adjacent irrigation authority.

Management arrangements and obligations for many of the key water bodies are unclear. There is also a lack of clarity and detail in agreements and arrangements between authorities discharging to water bodies, and the water body owners/ managers/operators.

Ownership of land assets associated with water bodies on private land should remain with individual authorities.

More detail should be included in the agreement between NRE and SRWA / FMIT regarding uses of Kings Billabong and Basin 12 as water supply and drainage basins.

Ownership of land assets associated with water bodies on Crown Land should remain with the individual authorities, with access managed by way of agreements**.** The obligations of the managers of each water body should be clearly defined and formalised, on a case by case basis.

The current arrangements for operation and management of the Lake Hawthorn Drainage Diversion Scheme and Mildura Merbein Groundwater Interception Scheme and associated water bodies and other assets, should be clarified. The Schemes should continue to be operated by G-MW. It is recommended that G-MW recover the proportion of scheme operating costs that can be assigned to urban and irrigation drainage, from Council, FMIT and SRWA. The obligations of the managers of Lake Hawthorn, Lake Ranfurly and Wargan Basins should be clearly defined and formalised, on a case by case basis. Storage management plans should be prepared for each of these water bodies.

There is no overall drainage strategy for the Study Area, and a lack of co-ordination between the various authorities with drainage related functions.

It is recommended that an agreed coordinating group be appointed to provide the lead role in implementation, management and monitoring of the Strategy. The Drainage Task Force could continue to play a lead role in implementing the Strategy in the short term, with a view to transferring this responsibility to the new coordinating group as soon as practicable. It is recommended that the Mallee CMA assists the Task Force/new coordinating group in sourcing appropriate funding for coordination of the Strategy.

E.10 Cost Sharing

Cost sharing arrangements should be based on the 'beneficiary-pays' principle. It is recommended that benefiting landholders should bear the cost of a basic drainage service, in both irrigation and urban areas, via the relevant drainage authorities.

E.11 Tariffs

Developers' contributions are currently inadequate to fund required offsite urban drainage works.

It is strongly recommended that Development Contribution Plans be prepared as soon as possible to ensure a flow of funds for construction of future major urban drainage works. The plans should set contribution rates on a catchment basis, to provide an equitable means of differentiating drainage costs between areas, particularly where pumping is required. Rates should ensure adequate capital funding for off-site drainage works.

If there is a move to charge a specific drainage rate for operation and maintenance and renewal of the urban drainage system, it is recommended that this be based on property area.

The most equitable means of rating for drainage would involve a two-part tariff system, subdivided into service and operational components, and it is recommended that this be considered by SRWA and FMIT for implementation.