Lake Muir – Unicup Lake Recovery Catchment

Hydrology Field Day
Summary of Presentations

16 November 1999

Department CALM, Manjimup

Outline of the Presentations

Stream monitoring	Peter Taylor, Agriculture WA
Wetlands Management	Dave Gardiner, CALM
Legalities of drainage & drainage construction	Peter Tipping, Agriculture WA
Environmental impacts in reserves	Roger Hearn, CALM
Farmers' forum, open discussion	Ben Rose, Agriculture WA

Stream monitoring

Peter Taylor
Research Hydrologist
Agriculture WA
9771 1299

STREAM MONITORING PROGRAM 1999

Introduction

Increases in stream flows can have dramatic impacts on regional hydrology and catchment health. These include greater and longer inundation of wetlands and farmland, the transportation and accumulation of salt into fresh wetlands and the dilution of water in naturally saline wetlands, which favours the development of salt sensitive communities at the expense of salt tolerant communities. Other physical and chemical impacts include erosion, sedimentation, and eutrophication due to nutrient export as well as reduced access. Concern at these possible impacts in the Muir Unicup catchments prompted the Recovery Catchment Team to initiate a surface water monitoring program.

The aim of this project was to investigate the movement of water and salt through the catchment, specifically to determine major flow paths, flow rates, timing of flows and quantities of salt being transported.

Methods used

Two methods were employed to achieve these aims. Firstly, an automatic stream monitoring station was installed at the end of May 1999 by the Water & Rivers Commission on Noobijup Creek, approximately 500m upstream from the Muir Highway. This station logged flow and salinity data hourly. Due to the expense of purchasing and installing automatic monitoring stations, a number of other sites were selected for spot monitoring (see map). These were generally culverts and pipes under roadways where accurate dimensions of flow could be obtained (see diag.). Sites were visited up to 16 times during the year. On each occasion, depth of flow was measured either manually or from a gauge board, the time taken for water to flow through each culvert (a known length) was recorded and the electrical conductivity of the water was measured using a portable WTW LF318 EC meter. Volumetric flow rates were calculated from depth and velocity data and conductivity values were converted to concentrations of salt (mg/L). This enabled mass flow rates of salt to be calculated for each site at each visit (g/s). An average value was determined for the year and converted to an annual tonnage by assuming flows over 150 days.

Results

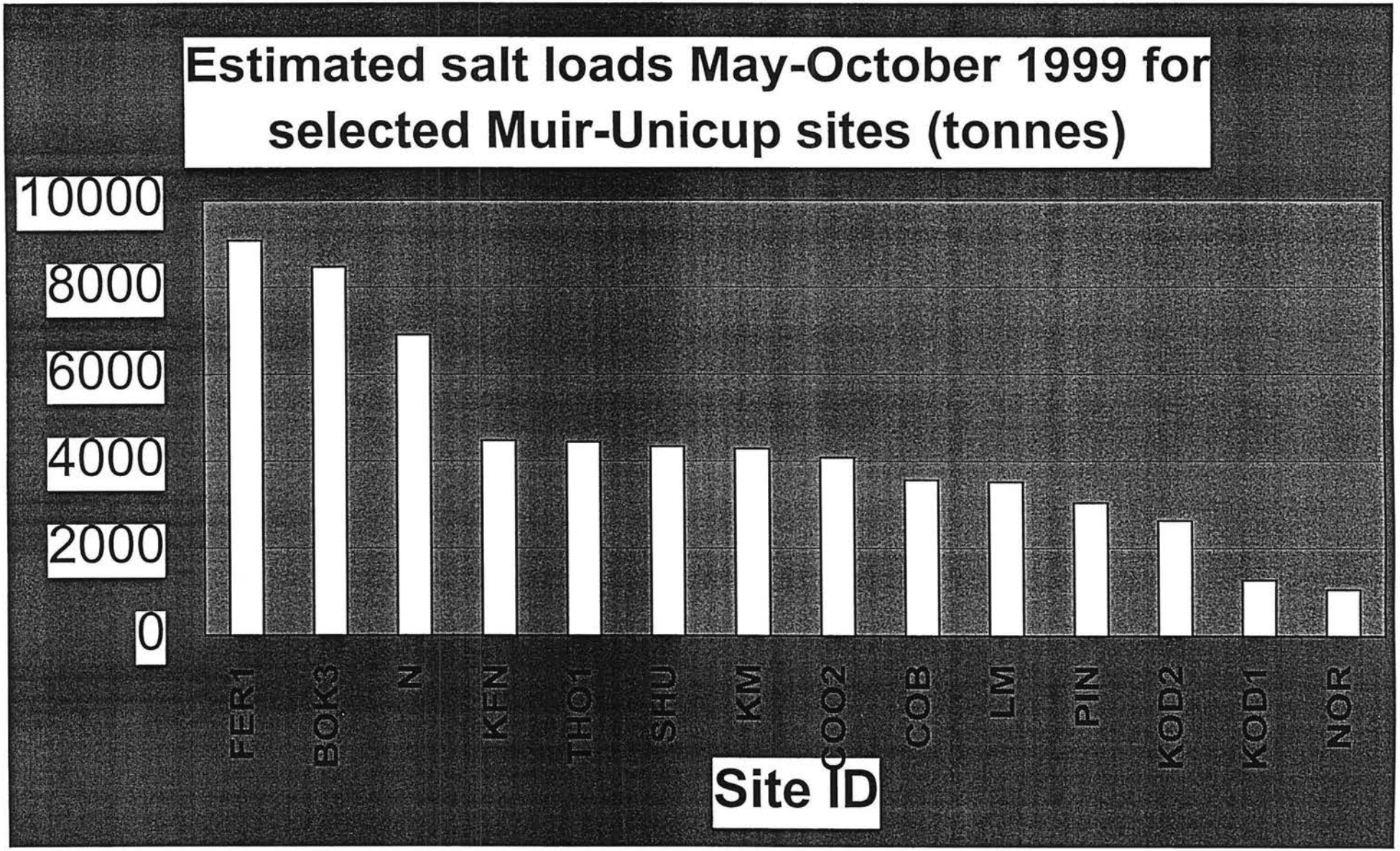
Estimated salt loads over the period May to October 1999 are shown for all the sites with loads greater than 1000 tonnes (see graph). Highest of these was recorded at site FER1, a culvert under Wingebellup Road that takes water to the Tone River via a constructed drain. No threat to wetlands exists from this load. This also accounts for sites THO1 and KFN, one of the two outlets from Kulunilup Nature Reserve. Second highest was site BOK3 which takes water across Wingebellup Road into Kulunilup

Reserve from farmland to the north and includes the component from site COO2. This inflow (~ 8000t) to Kulunilup is matched by the two outflows, KM and KFN (~ 4000t each), hence the salt load appears to be transferred through the reserve. The component that travels through site KM on Unicup Road ends up in Unicup Lake which is naturally brackish to saline. Of concern is the salt load in Noobijup Creek (Site N). This creek flows via a constructed drain into Byenup Lagoon but it is possible that the bulk of the lagoon is bypassed by the salt load since the inlet and outlet are situated close together at the northern end of the lagoon. Further studies may determine this. Flows from Byenup Lagoon ultimately end up in Lake Muir after moving through Mulgarnup Swamp and a constructed drain through to Mulgarnup Bridge on Nabagup Road.

High loads in Pindicup Creek are also of concern as shown by sites SHU and PIN. The load at SHU is likely to be an under-estimate since the creek was noted on several visits to be bypassing the semi-circular flume when levels were high. Outflows from the Cobertup Swamp area (site COB) have a high salt load but eventually flow into a naturally saline wetland. Flows into Lake Muir under the Muir Highway at site LM will be under-estimated because Red Lake fills first and delays the flows into Lake Muir. Salt loads through Kodjinup Reserve (KOD1 to KOD2) are of little concern since these are directed straight into the Tone River.

Further Work

Monitoring will continue in 2000 after a more thorough review of the data. Particular areas of interest include Byenup Lagoon, where a detailed study of surface and groundwater interactions will be undertaken and Mulgarnup Bridge where a staff gauge will be installed to allow more accurate estimates of flows to be determined.


Estimated salt loads May-October 1999 for selected Muir-Unicup sites (tonnes)
10000
8000
6000
4000
2000
0
FER1
BOK3
N
KFN
THO1
SHU
KM
COO2
COB
LM
PIN
KOD2
KOD1
NOR
Site ID

STREAM MONITORING PROJECT

MUIR-UNICUP RECOVERY CATCHMENT

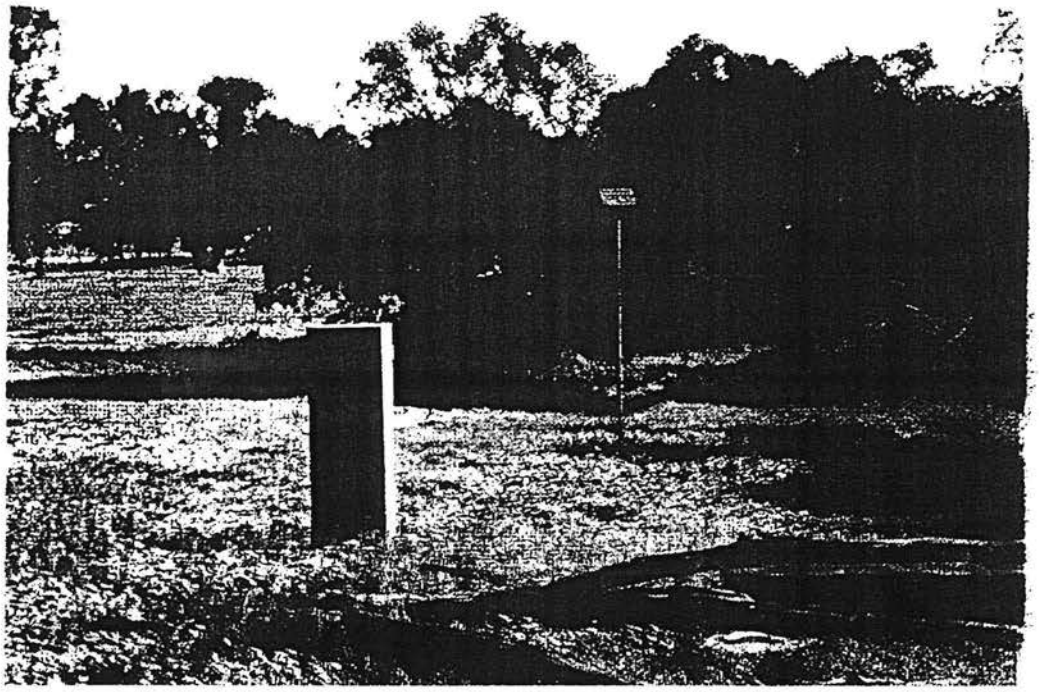
Aim: *To assess the movement of water and salt at selected sites over time and to identify possible salinity "hotspots"*

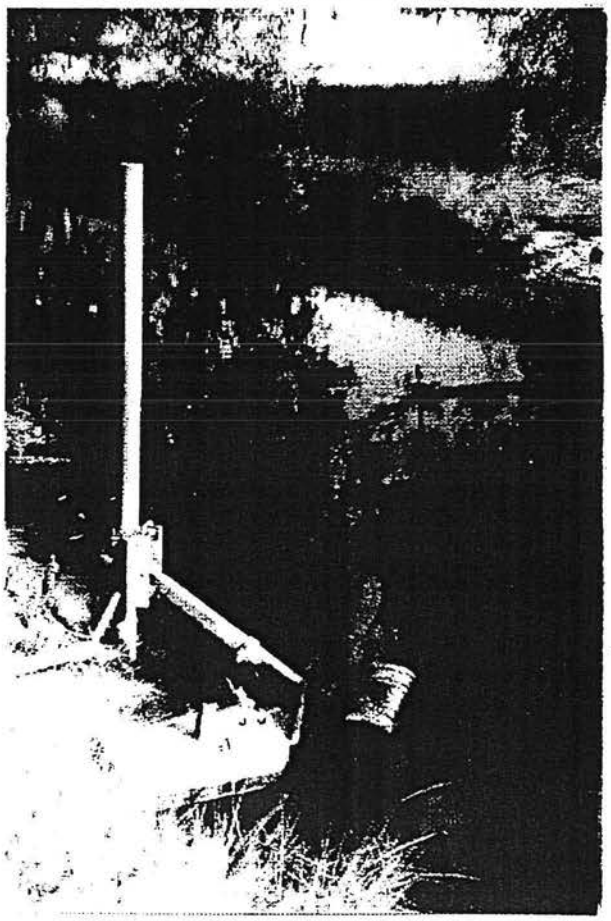
Implications of increased stream flows;

- Greater and longer inundation of wetlands and farmland
- Transport and accumulation of salt in fresh wetlands
- Dilution effect in naturally saline wetlands
- Erosion, sedimentation, access etc

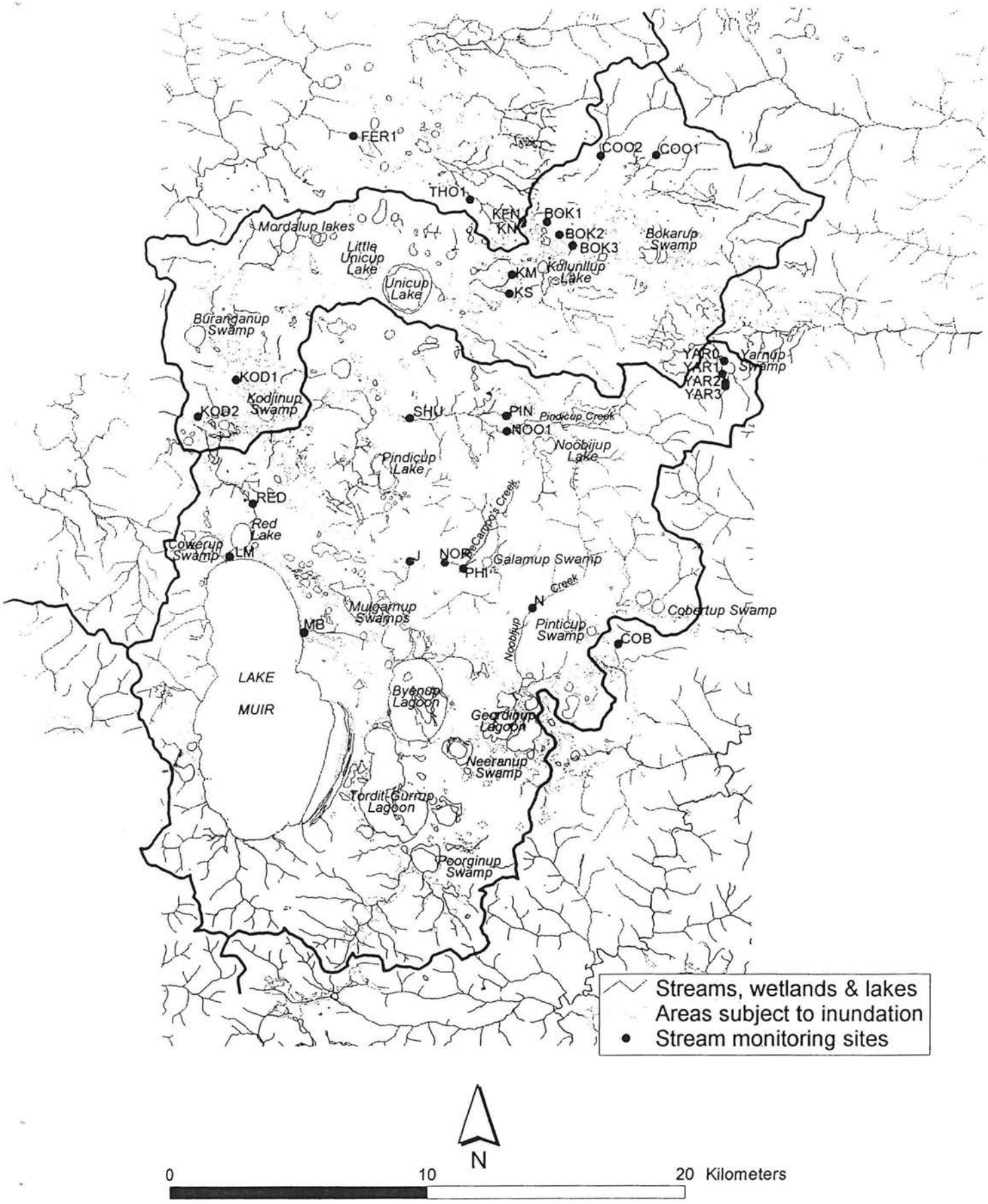
AUTOMATIC STREAM MONITORING STATION

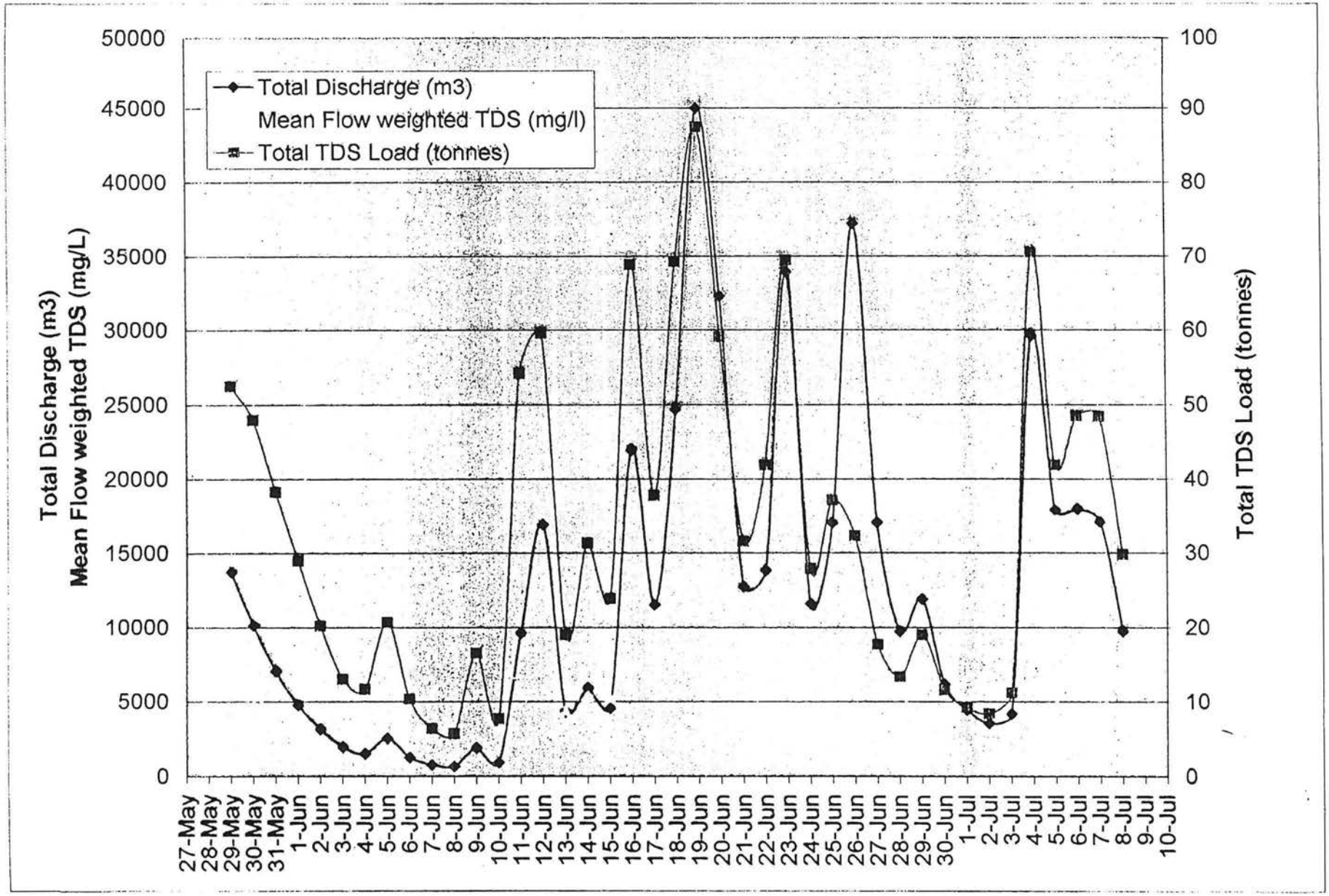
- CHOWERUP CREEK





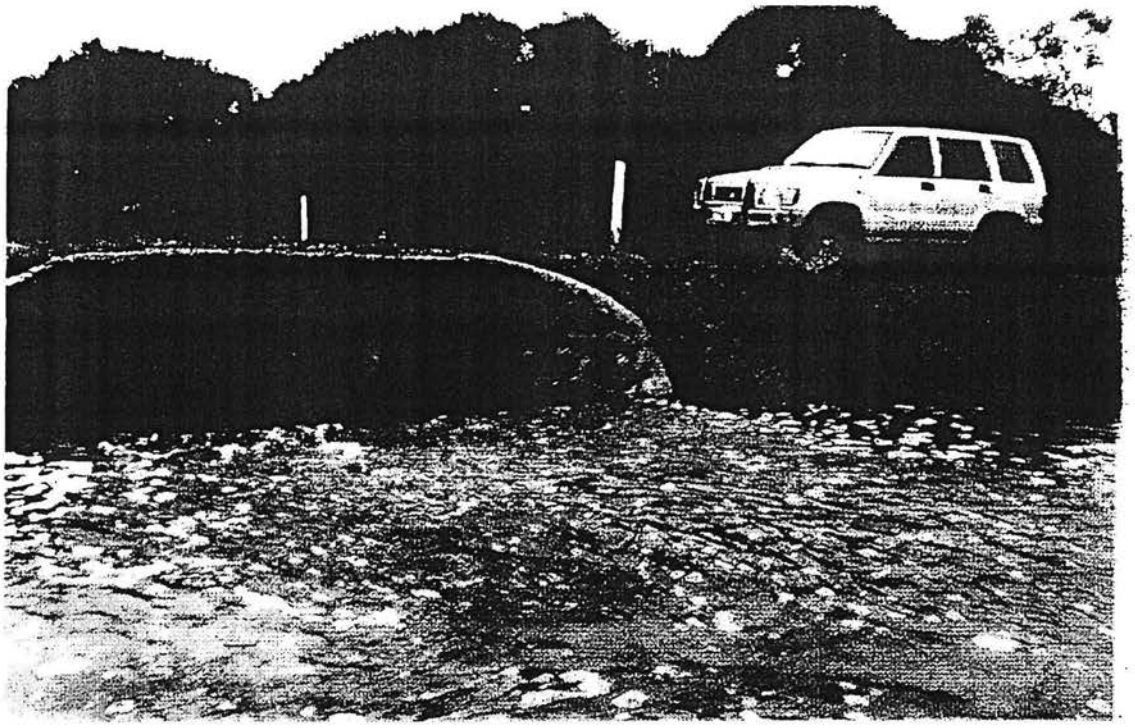
Natural hydrology and stream monitoring sites

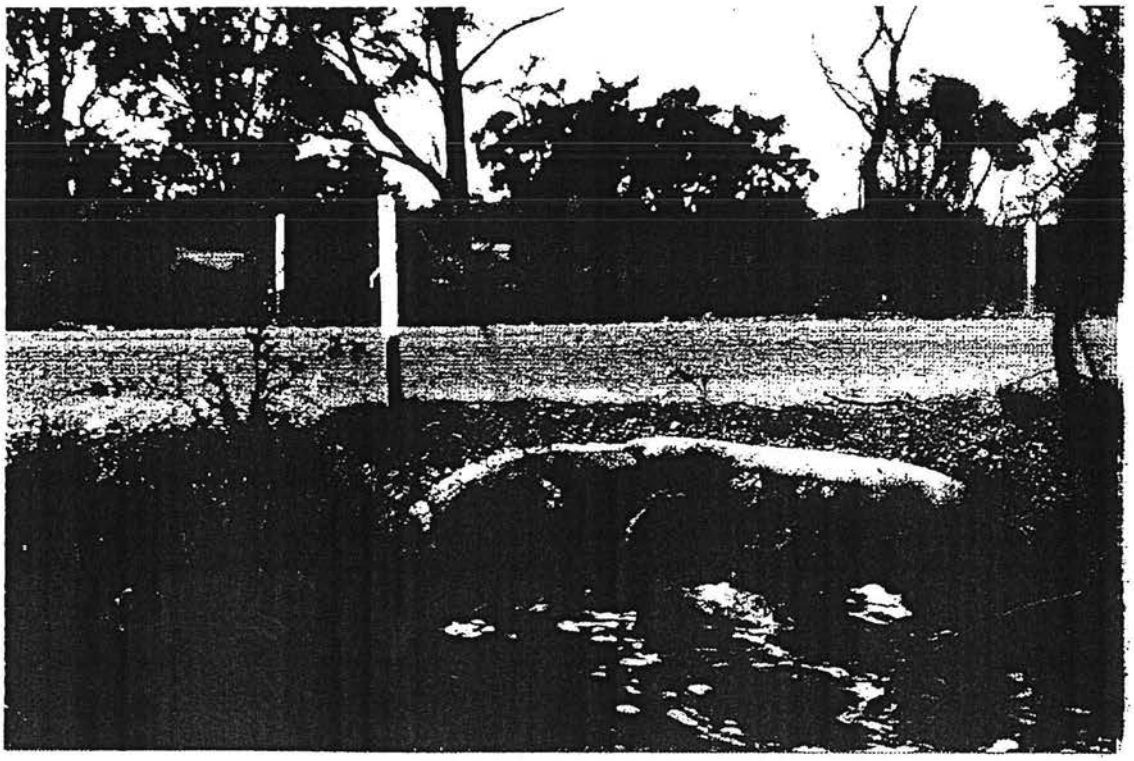




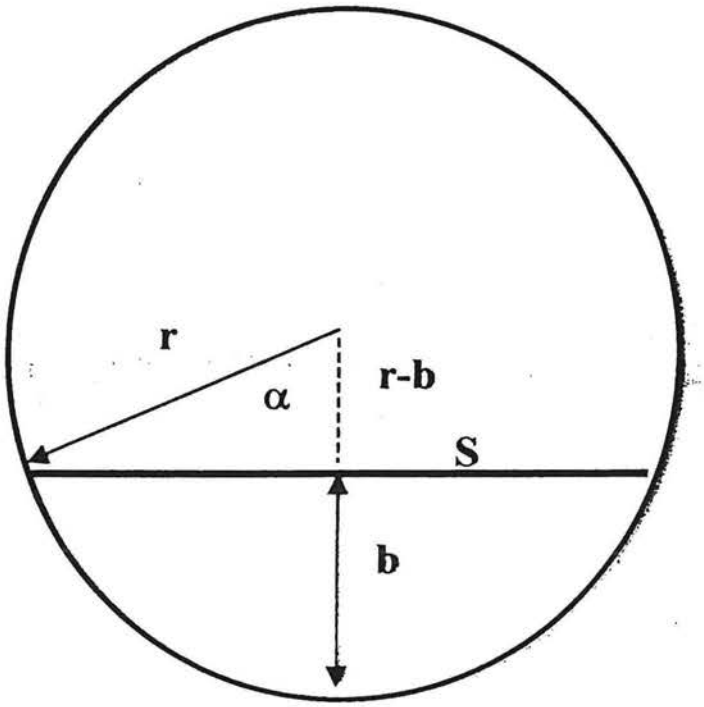
NOOBIJUP CREEK
GAUGING STATION

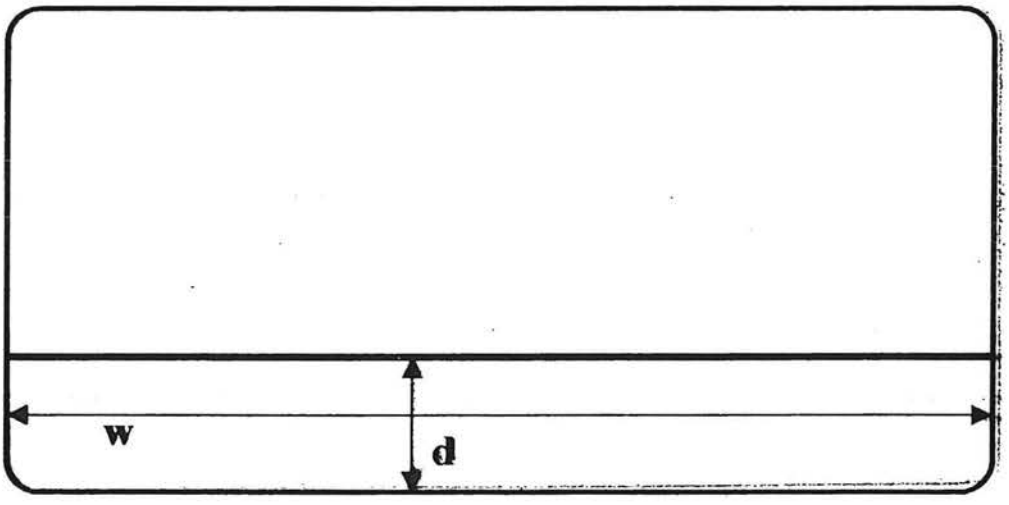
STREAM MONITORING SITES





To calculate the X-sectional area of water in a culvert:





Wetlands Management

Dave Gardiner
Recovery Catchment Officer
CALM
9771 7919

• Since the previous community meeting in February 1999, several research reports have been completed, which assess the nature conservation values of the catchment:

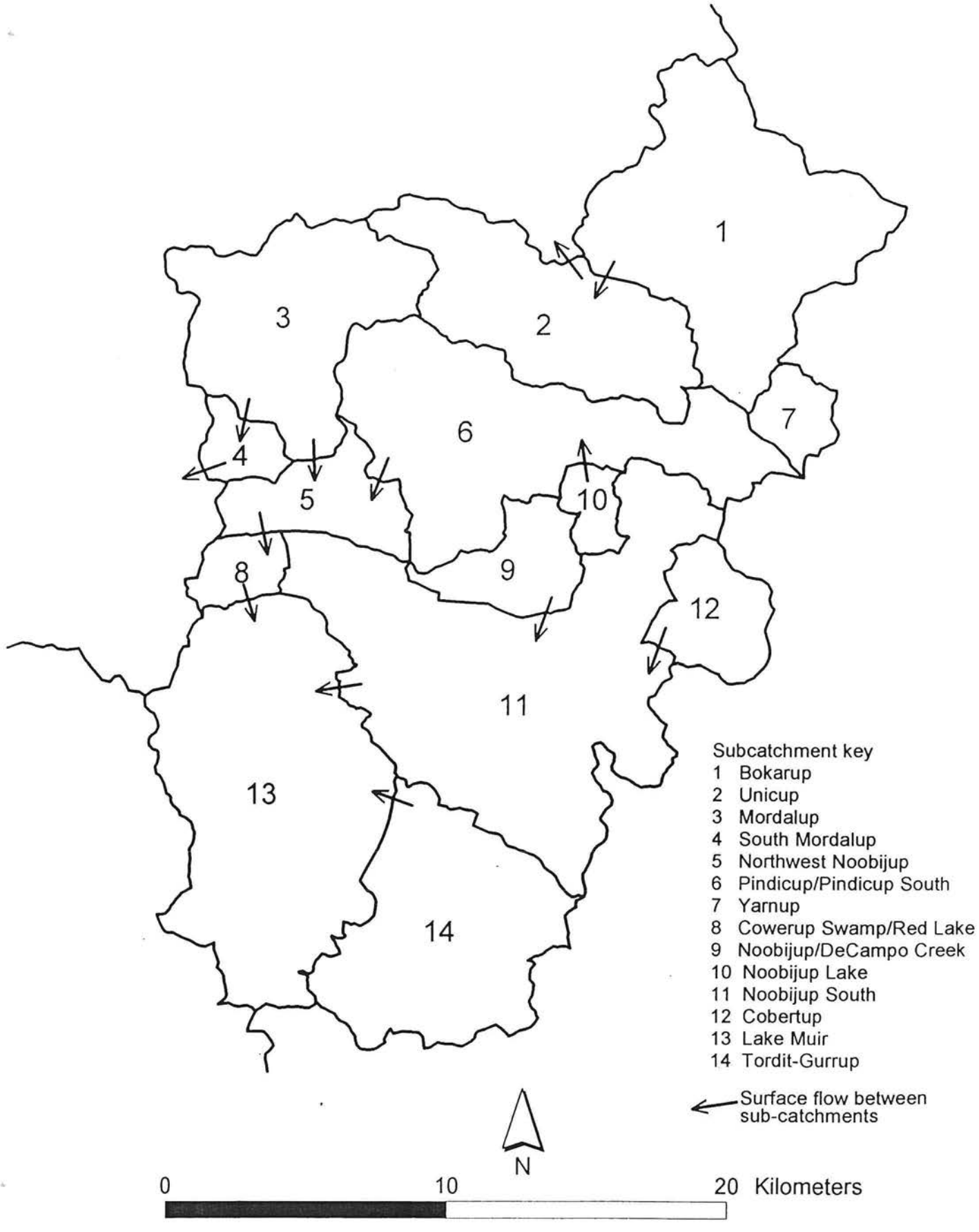
- Flora species and vegetation
- Aquatic macroinvertebrates
- Geophysics & hydrogeology

Additionally, the abundance of waterbirds in particular areas is a consideration. This has allowed CALM to prioritise sub-catchments of the region, in terms of biodiversity values and threat of salinity upon wetlands.

• The current target areas in order of priority are:

High salinity risk/ High biodiversity	Yarnup
	Noobijup South
	Noobijup Lake
	Northwest Noobijup
	Cobertup
	Pindicup/Pindicup South
	Bokarup
	Unicup
	Cowerup Swamp/Red Lake
	Tordit-Gurrup
	Mordalup
Low salinity risk/ Low biodiversity	South Mordalup
	Lake Muir

Sub-catchments



Yarnup Swamp

• Yarnup Swamp has been the main target area this year. Monitoring records which commenced in 1980 show a definite long-term increase in salinity of Yarnup Swamp. A saline creek on private property to the southwest was recognised to be the main cause of the increase, and CALM negotiated purchase of the 116-hectare block in May 1999.

• Soil and water sampling studies were carried out in June on this block, and revealed salinity as high as 5000mS/m at one point along the eastern boundary next to Yarnup Road, which is as salty as sea water.

• There are hills on both sides of the creek on this block, which carries saline flows directly into Yarnup Nature Reserve. The southern hill is suspected to contribute most of the groundwater recharge to the saline seeps alongside of the creek. However, piezometer bore drilling will be carried out next January, and will reveal the hydrogeology of the area. This will determine whether the northern hill is also contributing to recharge, and where the shallow and deep aquifers may be located.

• The block is now CALM property, and a revegetation plan has been prepared. The southern hill will be revegetated to alternating sections of bluegums and a mix of jarrah/marri. The bluegums will aim to quickly reduce recharge, and after 10 years they will be harvested and replaced with jarrah/marri for longer term management. The clay flats, where most of the salinity is apparent, will be planted to native paperbark species, as well as yate and other eucalypts. Seed collection will be undertaken shortly.

Noobijup Lake

• Noobijup Lake is directly threatened by saline flows. Two areas of salinity dieback occur in the reserve; on the southern boundary and the western boundary. The southern site is highly saline (up to 190mS/m) and scalded, and is located along creek inflows. This southern creek coincides with a major north-south faultline, so it is possible that the saline groundwater is being carried to the surface along the fracture.

• It was recognised that revegetation would be the best option for the area. The recharge sites around the reserve have since been established to commercial bluegum plantation, which will help reduce recharge to the saline/scalded sites. The area is now considered secure for the medium-term, so no rehabilitation works are planned at this stage.

Byenup Lagoon

• The Noobijup South sub-catchment includes the area where Noobijup Creek rises on Patmore's block, and its flows into Byenup Lagoon and Mulgarnup swamps.

• Byenup Lagoon contains *Baumea* reeds, and from 1995 aerial photography showed signs of considerable stress, presumably from increasing salinity. The area of reeds under stress has become less since then, although it is still present in the western part of the lagoon. It is known that Noobijup Creek is one of the most saline in the

catchment, but it is not known how much salt enters Byenup Lagoon from surface flows, or how much is from naturally saline groundwater.

• It is proposed to undertake piezometer bore drilling at several sites around Byenup, at various depths up to 50 metres, to determine the source of saline water in the lagoon. Water sampling done during winter this year showed higher salinity in the southern part of Byenup (which has no inflow) than in the northern part, where constant inflows tend to mix with fresher water.

Yarnup Swamp showing saline creek to southwest
and saline clay flat (outlined)

Noobijup Lake showing scalded saline sites (outlined)
and surrounding plantation areas

View northeast of Byenup Lagoon
Orange colour in lagoon indicates stress in reeds

Drainage construction

Peter Tipping
Land Conservation Officer
Agriculture WA
9771 1299

- Drainage regulations – Statutory Declarations from neighbouring landholders are required.

- Culverts – permission from Main Roads Department required for culvert works.

- These legal regulations are in place to preplan drains on a catchment basis for the benefit of the community and to avoid conflict with neighbours, and where these conditions can be met, then suitable drainage can proceed.

Farmnote
No. 47/93
replaces 15/91

Western Australian Department of Agricultu

Agdex 558
Legal aspects of drainage

Notification of draining or pumping saline land

Regulation 5 of the Soil and Land Conservation Amendment Regulations 1992 requires owners or occupiers of land to notify the Commissioner of Soil and Land Conservation at least 90 days before a new drainage or pumping scheme (set up because of the salinity of the water) discharges water on to other land or into water or a watercourse.

Drainage is being used increasingly to treat land salinisation. Deep tube, or open drainage, and aquifer pumping can be used to lower saline water tables. Lowering the water table below a critical level will stop salt accumulation near the soil surface. However, drainage of land can also have significant negative off-site effects. When considering drainage, land users must be aware of their obligations and responsibilities to neighbours and the general community.

Pumping or draining saline water and then discharging it on to other areas or into waterways may degrade water quality, surrounding land and utilities. The discharged water may also significantly salinise land or waterways further away, or make them unnaturally waterlogged. Other damage by the saline water may be the loss of private or public amenities, such as the degradation of natural vegetation, damage to roads or culverts, or an increase in soil erosion.

If pumped or drained saline water causes a nuisance downstream, it can be considered a noxious effluent and may present a case for common law action.

New Regulations

The new Regulations only apply to new schemes of pumping or draining ground water and do not apply to the seasonal start-up of existing schemes. The Regulations apply even if water is discharged on to the same property.

Landholders who plan to pump or drain water to control salinity should complete a Notice of Intent (Form 2 in Schedule 2 of the Regulations; a copy is printed overleaf), obtain written consent from affected neighbours and prepare a plan of the proposal. An aerial photograph of 1:10,000 scale is ideal. The Notice of Intent and plan should be submitted to the nearest Department of Agriculture office at least 90 days before the pumping or drainage starts. Failure to notify the Commissioner is an offence carrying a $2,000 penalty.

Public notification

The District Office notifies the relevant public authorities (such as CALM, Main Roads Department, Water Authority, Environmental Protection Authority and Shire Councils) and relevant land conservation district committees of the proposal. The District Office then invites them to lodge objections with the Commissioner within 30 days.

Assessment

If objections are received or if the Commissioner, through the District Officers of the Department, considers that the proposal is likely to accelerate land degradation, then the proposal is assessed. If no objections are received, the Commissioner through the local Officer-in-Charge advises the proponent that the proposal may proceed.

The assessment is made using established guidelines and considers both on-site and off-site land degradation hazards arising from the proposal. The Commissioner considers the assessment report and decides whether the proposal may proceed. If the Commissioner considers the proposal will lead to land degradation, the proponent will be advised that the proposal should not proceed. If this advice is ignored a Soil Conservation Notice will be issued to stop the proponent continuing with the proposal.

Other legislation relevant to land drainage and aquifer pumping

- **Soil and Land Conservation Act** – controls practices that cause land degradation.
- **Land Drainage Act** – applies to declared drainage districts.
- **Rights in Water and Irrigation Act** – regulates the discharge of pollutants into streams.
- **Country Areas Water Supply Act** – applies to surface catchments and ground water systems used for public water supplies, where effluent disposal is controlled by the Water Authority.
- **Environment Protection Act** – controls effluent disposal that may have a detrimental environmental impact. It is administered by the EPA.

1566/2/94 — 7500
PP 665002/00031

ISSN 0726-934X

FORM 2

[Reg. 5]

SOIL AND LAND CONSERVATION ACT 1945

SOIL AND LAND CONSERVATION REGULATIONS 1992

NOTICE OF INTENTION TO DRAIN OR PUMP WATER FROM LAND UNDER REGULATION 5

To: The Commissioner of Soil and Land Conservation
Department of Agriculture
Baron-Hay Court
South Perth WA 6151

I .....
(full name, block letters)
of .....
(postal address)
propose to drain/pump * water from about ..... hectares
of land in the municipality of .....
being .....
(the land's title description)
and being ..... km ..... of .....
(north, south, east, west) (siding or townsite)
and to discharge the water .....
.....
(describe land, water, watercourse or lake onto or into which the water is to be discharged)
as indicated on the plan below.

The draining/pumping * will commence on or about .....
and will continue for .....
(period)

I am the ..... of this land.
(owner *, occupier *, owner and occupier *)

Signed ..... Date .....

* Delete as appropriate.

Plan

(Show the direction of north, the land to be drained, the title description of the land and adjoining locations, any adjacent public roads and where the water is to be discharged.)

Agriculture
WESTERN AUSTRALIA

GUIDELINES UPDATE '95

REMINDERS TO PERSONS NOTIFYING THE COMMISSIONER OF THEIR INTENT TO DRAIN LAND.

The **Notice of Intent (NOI)** to drain land [required under Regulation 5 of the Soil And Land Conservation Act 1945] can be processed promptly if the proponent provides the Commissioner with an **accurate plan** which can be photocopied.

The plan needs to identify:

a) the area to be drained,

b) the proposed layout of the drains and

c) specifications of the drains.

Notices of Intent without an accurate plan will delay the process and may not be accepted by the Commissioner.

1. It is suggested that your plan is developed from the most recent aerial photograph covering your property, at a scale of **1 : 10,000.** An aerial photograph can be purchased from:

   The Central Map Agency
   Department of Land Administration
   "Midland Square"
   PO Box 2222
   MIDLAND WA 6056

2. All Notices of Intent for drainage are sent by the Commissioner to the relevant Shire, Land Conservation District Committee and other Government Agencies for comment. This means the landholder can expect that it will take up to the required 90 days if there are any delays in providing the Commissioner with the required information. It is recommended that landholders plan their drainage well ahead of actual construction.

J S Duff
DEPUTY COMMISSIONER
OF SOIL AND LAND CONSERVATION

DRAINAGE

Some of the RULES under COMMON LAW.

A natural watercourse must not be obstructed or diverted.
Surface water must not be collected ie. in a dam, and then diverted to land that would not naturally receive it.
The entry point of surface water on land lower down the catchment must not be changed
Water must not be brought in from another watershed.
A landholder or contractor cannot accelerate the flow of water, or carry out actions that increase the salinity or nutrient levels of that watercourse.
The Upslope landholder is not liable for water that flows naturally from his land to a lower property. A lower landholder must accept natural flow, even if it naturally floods portion of his land.
Drainage, Esp deep drainage, causing higher levels of salinity , eutrophication or erosion would not be regarded as natural.
The lower landholder lower in the landscape can use reasonable care and skill to hold back the water from earthworks on a higher property that have caused a change in flow. He cannot discharge that extra flow onto a third property.
Legal action and damages can be recovered from an upslope landholder because of any alteration or concentration of the natural flow from that property.
Drainage water may not be diverted from its natural course, or the waterflow onto adjacent land changed, without the consent of all landholders. preferably in writing.
Landholders cannot interfere with Public drains , but Local Government may require land to be drained to improve a public utility.
The discharge of effluent, pollutants or waste into either surface or underground water bodies is prohibited.

Some ACTS and STATUTES. Other than Common Law affecting drainage works.

Soil and Land Conservation Act.
Land Drainage Act.
Rights in Water and Irrigation Act.
Country Areas Water Supply Acts.
Local Government Acts
Environmental Protection Acts

Peter Tipping
LAND CONSERVATION OFFICER

*Booklet with colour photos available through Dave Gardiner.

Resource Management Technical Report 185
October 1998

COMMON CONSERVATION WORKS USED IN WESTERN AUSTRALIA

Prepared by
Martyn G Keen
Agriculture Western Australia
Northern Agricultural Region
Geraldton

October 1998

Natural Heritage Trust

Agriculture
WESTERN AUSTRALIA

Table of Contents

Environmental impacts

Roger Hearn
Program Leader Nature Conservation
Department CALM
9771 7948

Muir-Unicup Hydrology Field Day – Conservation Issues

Drainage can have major impacts on conservation values both through downstream impacts as well as locally at the site of drainage works. These include:

- creation of permanent water bodies;
- reduction or increases in periods of inundation and saturation; and
- changes to the natural salinity regime.

Each of these can impact on regenerative processes of species, or the capacity of species to continue competing and hence persist on affected sites. Changes in species compositions result in direct impacts on biological communities.

As well as these impacts, earthworks such as drainage can introduce disease (eg. *Phytophthora*) to a site or change the site so disease vectors present (but having little impact) take hold.

While there has been debate on dieback expression and the impact of drainage in Kodjinup Nature Reserve (either causing or exacerbating it), of more significance here is the lesson learned in relation to the process of assessment of possible impacts of draining versus not draining.

At the time drainage proposals for Kodjinup were put, little was known of the conservation values on the reserve and what the likely impacts could be of draining versus not draining.

Now, following recent survey efforts, a set of data in the form of vegetation mapping (major communities) and species lists for each of the reserves (and some level of details for areas within them) have become available. It is now possible to start analysing possible impacts of proposed drainage into, adjacent to or out of reserves, including impacts of the possible introduction *Phytophthora* and possible site changes likely to change dieback disease dynamics.

Any drainage proposals in future will result in a more comprehensive impact analysis than was carried out for Kodjinup.

Farmers' forum

Ben Rose
Agricultural Development Officer
Agriculture WA
9771 1299

An open discussion forum was held on any issues of interest. A summary of comments from landholders is below.

- What are the target salt levels in the streams?
- Implications of salt load of Kodjinup into Tone River
- Is Lake Muir OK as the final sump – what about diverting to Frankland?
- Target salt levels in streams:
    - at 3 parts per thousand, Baumea dies back (500-600mS/m)
    - modelling wetlands data – P. Taylor
    - Baumea needs to dry out (wetting/drying cycle)
    - Periodic drainage possibly needed
- Does water in Lake Muir evaporate and/or have underground flow?
- Lake Muir didn't dry out until 1960
- Ferfila's, Kodjinup drains have been diverting original flows
- In 1970s Unicup Lake was up to 8 ft deep
- Roads are main cause of flow diversions
- Fencing off small drains – is subsidy available?
- Underground streams from L. Parke's property to Byenup – salt streams
- Revegetation works next year – what is available?
- Recovery catchment starting to work well at this time – concern that it will end too soon
- Revegetation/management of Buranganup reserve (Water & Rivers Commission)
- More consideration of alternative farm trees (olives, nuts, etc)
- Too few farmers left in area
- Concern that Water & Rivers Commission reserves are a waste
- CALM and government agencies to assist in a plan for Unicup Hall
- What is W&RC going to do about the reserves?
- What industries can get people into the area?
- What happens to bluegums after harvesting?
- 10 years after plantation establishment > may be possible coercion from govt to keep under trees, after harvest
- Bush fire brigade for Unicup
- Plantation management companies – need their opinion on bushfire control
- Tourist drive through Unicup
- Funding for new ventures
- Invite Tonebridge farmers to next meeting

Note: Responses to these issues will be presented at the next Community Meeting, to be held in February or March 2000.