CONSTRUCTION

It is important to supervise construction – to ensure that the design is followed. Invariably, issues will be encountered during construction, however the design can provide guidance as to how to address the issue, using the contractor's experience. The Department of Agriculture can also assist with advice.

NOTE: It may take some time for the soil profile to be sufficiently leached of salts after the water table is lowered, to enable a crop to grow. This depends on the soil type and rainfall after construction of the drain.

MONITORING

Little information has been documented in the public arena about the performance of drainage across the Wheatbelt. It is important to document both the drain on-farm performance as well as the downstream impacts, so that the planning, design and construction of drains can improve, drain performance can be increased and we can address downstream impact problems better. The following basic measurements can be easily obtained:

- water table levels at different distances away from the drain – you can easily make your own observation well, just by inserting some PVC pipe with slots cut into it, into any hole and backfill with sand followed by clay;
- soil salinity – inspect the vegetation growing on the soil, and the soil surface, at different distances from the drain – less salt tolerant species should become more abundant over time;
- drain flow – observe the depth of flowing water in the drain at various points at different times of the year;
- drain water quality – take water samples from the drain at different times in the season and over the years (take them to your local landcare or Agriculture Department office for testing);
- rainfall – measure daily rainfall near the site.

Mark the points where you take measurements so that you can come back to the same spot every time. Take measurements at roughly the same time of the year (eg. mid winter, mid spring, mid summer and mid autumn). Measurements (preferably more than one set) should be taken before the drain is constructed to obtain a "before" case.

Photos – taken of the same area from the same place, over time, can be a great tool to visually record the changes to the site.

CONTACTS

CALM

District offices: Katanning – 9821 1296 Merredin – 9041 2488
Narrogin – 9881 9200

Regional hydrologist – 9881 9217

Dep. of Agriculture

Land Conservation officers/district offices: Albany – 9892 8444
Esperance – 9083 1111 Geraldton – 9956 8555 Katanning – 9821 3333
Merredin – 9081 3111 Moora – 9651 1302 Narrogin – 9881 0222
Northam – 9690 2000

Commissioner of Soil and Land Conservation – 9368 3282

Conservation Notes
Wheatbelt Region
Government of Western Australia
Department of Conservation and Land Management
Conserving the nature of WA

DRAINAGE:
Getting it Right for You, for the Land, for the Environment

INTRODUCTION

The Department of Conservation and Land Management (CALM) manages a large area of conservation estate land in the region on behalf of the community of Western Australia. In many cases, this land is neighbouring farmers who have constructed, or are thinking of constructing drainage on their properties. The conservation estate is often located on valley floors, and in many cases receives drainage water or has drainage water pass through it.

CALM is currently undertaking a number of programmes to address salinity in CALM managed land and engineering options have been used in some of these. In addition, the Department assesses drainage proposals to ensure that nature conservation values are protected.

CALM encourages and needs to be involved in a **planned approach** to drainage, to ensure that conservation values within the conservation estate are protected at the same time as private land managers' water management objectives are met.

PLANNING

Before drainage is considered, some catchment or farm level planning is needed. The following issues need to be considered when planning for remediation of salinity:

- Other problems may be addressed at the same time (eg. erosion, leaching of nutrients/soil fertility loss).
- It may be more economic or effective to address the causes rather than, or at the same time as, addressing the symptoms through drainage; alternatively there may be suitable and productive options to adapt to the more saline environment.
- A catchment scale approach can often be more effective in addressing problems than a farm or paddock scale approach (ie. economies of scale may be brought in – eg. for salt evaporation or farm forestry, and problem transfer can be addressed, that is you're not just passing "dirty" water to the next downstream neighbour).
- Potential impacts on downstream receiving waters and land.

Generally, a combination of options will have multiple benefits (both productive and for nature conservation values) and will end up being more economical, than employing a single option to address one problem.

Getting some **independent advice** to help identify problems, their causes and possible recovery, containment or adaptation options will also be very valuable. This is available from landcare technicians and some landcare officers may have suitable skills (or know of suitable advisors).

SITE MEASUREMENTS

Mapping

Soils and slopes in the catchment should be mapped to determine runoff rates and where surface runoff goes (taking into account existing surface water management). This will enable appropriate placement of the drain and design of surface water management work to ensure the drain is protected from erosion, thus preventing sedimentation downstream.

Test holes

Digging test holes along the alignment using a post-hole digger or backhoe, and observing the hole and inflow of water can determine the following:

- what depth the water flows greatest in the profile (where water flows into the hole);
- how quickly water flows horizontally through the profile (how quickly the hole fills up);
- where the water table is below the surface (how high the water reaches);
- how saline and acidic the water is (taking 0.5 L samples and getting them tested at your local landcare or Agriculture Department office);
- soil types and how hard it will be to construct (visual inspection of the soil that comes out and how much difficulty the machinery has in excavating the hole).

Survey

It is important to determine longitudinal grade of the site where the drain is to be excavated, to identify if there is sufficient fall to create the depth of drain required, to determine flow velocities in the drain and aid in the design of the drain.

DESIGN

Design is very important to ensure a stable, effective and economic solution to the problem. It also ensures that all stakeholders (land owners, agencies, contractors etc.) have a clear understanding of what is to take place. It is recommended to obtain the services of an **independent engineer/landcare technician** of similar to prepare at least a basic design of the proposal. This person should have the expertise to estimate runoff flows, identify appropriate design factors and determine adequate drain capacity. At minimum the following should be stipulated:

Drain shape – side batters, bed width, depth, grade slope, berm width and slope, levee dimensions to suit the soil and expected flows.

Drain placement – where to put the drain relative to natural waterways to avoid erosion or wash-out problems.

Surface water management – how to manage surface water to protect the drain from higher flows coming off adjacent slopes or moving down the waterway.

Downstream water management – how best to manage the discharge water to minimise impacts (whether by storage and evaporation, or some economic use).

Crossings, fencing and revegetation – these should be considered along the drain to keep it stable, increase the long term effectiveness of the drain, allow machinery and stock access and prevent stock and animal losses in the drain.

Department of Agriculture Bulletin 4617 "Deep Drains to Manage Groundwater" is a useful guide to designing deep drainage. Miscellaneous Publications 28 and 29-02 "Conservation Practices for Agricultural Land: Deep Drains" provide further detail.

Inadequate planning, investigation and design may lead to:

- rapid slumping and/or erosion of the drain itself
- sedimentation of the drain
- poor performance (ie. it won't achieve the dewatering effect desired)
- increased erosion and/or sedimentation on farm land
- increased inundation on farm land
- tension between neighbours
- high cost in repair/reconstruction and annual maintenance
- increased downstream impacts – sediment, salinity, acidity, inundation and modified hydroperiods (height and duration of water levels in wetlands) are the main ones.

BUDGET

It is very important to budget the proposal. The cost of the proposal should be weighed against the potential gain:

Construction cost + present value of maintenance & operational costs + value of land taken out of production < expected area recovered x increased net return

NOTIFICATION

Any proponent of works that will intercept groundwater for its removal is required to lodge a **Notice of Intent to Drain (NoID)** with the Commissioner of Soil and Land Conservation. The Commissioner has 90 days to assess the proposal and provide feedback to the proponent in which time no discharge is to occur. Potential land degradation is assessed by the Department of Agriculture and potential impacts on conservation values (priority and rare flora and fauna etc.) and the conservation estate (nature reserves etc.) are assessed by CALM.

It is advisable to **contact** your local **CALM** office as soon as you start the planning process, well **before the NoID is lodged**. The Department of Agriculture will also be able to provide advice on drain planning, design and construction as well as information and advice on production and measurement. **CALM, as a neighbour and land-manager in the catchment, needs to be included in the planning process** to ensure no net negative impact on conservation values or to benefit conservation values. CALM can also provide information, advice and support on managing impacts on natural ecosystems. It will also provide CALM time to adequately assess the proposal for downstream impact without holding up the process.

DRAINAGE:
DEC Assessment of Notices of Intent to Drain

INTRODUCTION

When you send in a Notice of Intent to Drain (NoID) to the Commissioner of Soil and Land Conservation, the Commissioner will check it to make sure it is complete and that there is sufficient information to assess the proposal, before sending it out to a range of agencies for comment. One of those agencies is the Department of Environment and Conservation (DEC).

DEC will assess notices on the basis of presence and likely impact on nature conservation values and assets, such as:

- Nature Reserves, National Parks and other conservation estate
- Rare or priority flora
- Threatened, endangered or priority fauna
- Threatened or priority ecological communities
- Remnant vegetation under conservation agreement or partnerships

DEC – IMPROVING ASSESSMENT

Three basic steps are undertaken with all proposals:

1. **Desk-top assessment** – identification from standard DEC data sets of biological assets that may be within the area impact through either the construction or discharge of the drain. It is at this stage that the level of assessment and information required is determined.
2. **Site assessment** – if possible, a visit together with the Commissioner's representative (usually the local Land Conservation Officer) to the drainage site, plus a visual inspection of the assets possibly impacted and of the downstream receiving waters; collection of water quality data.
3. **Impact assessment** – hydrological calculations to determine extent of drainage discharge and possible hydrological changes; determination of impacts of hydrological changes.

Conservation values may be affected by a proposal which causes changes in:

- Water quality – salt load/salinity, pH, metals (often associated with acidic water), nutrients, turbidity and sediment;
- Water quantity and velocity – waterlogging, flooding and erosion;
- Timing – change in duration and/or timing of flows.

An internal report is prepared with a recommendation, which is then forwarded to the Commissioner. If there are significant issues with the proposal, the proponent may be contacted for additional information or to discuss alternative options.

DEC is also developing a framework within which assessment of drainage will be made simpler. Over the next 3 years, wetlands in the Wheatbelt will be classified according to their value, health and rarity. This will enable rapid determination of the level of assessment required when a NoID is received. Baseline data and information will also be collected for the higher class assets so that drainage proposals can be much better assessed.

BASIC DATA AND INFORMATION

In order to adequately assess a drainage proposal for possible impacts on conservation values, CALM requires some information and data. As a minimum, the following should be provided with all NoIDs:

- A **map showing general location** (eg. photocopy of a road map or grid map with the site marked).
- A scale **plan of the drainage**, preferably on an aerial photo, showing where it will be in relation to features in the landscape and the waterways, where the discharge point is and other works associated with the drains. If possible, the map should also show existing works (ie. grade banks and drainage) and monitoring points.
- **Details of the drain construction** – depth, bed width, side slopes, longitudinal bed grade, location in relation to the waterway, spoil location etc. Provide drawings if possible (several if the drain shape will vary over its length), marking on the plan where the detailed drawings are.
- Calculations of expected maximum **drain discharge** – this can be easily determined from test pits –
  a. Measure the length (L) and width (W), or diameter (D) of the pit (in metres);
  b. Measure the time (t, minutes) it takes to fill the pit to a measured depth (h, metres) – measure this depth below the level at which water is flowing into the pit (the discharge will slow down as the pit becomes fuller);
  c. Calculate the discharge (q, $m^3/s/m$) from Wxh/(60xt) or 3.1416xDxh/(240xt).

  Provision of the raw data – pit dimensions and time and depth measurement will be sufficient.
- **Water table level** from a nearby observation well, and/or the depth below surface that water in the test pits eventually reach. If providing data from observation wells, provide details (depth, depth of screen, height top is above ground and point from which water level is measured) if available.
- Indication of expected **water quality of discharge** – collect a sample from the pit (as soon after excavation as possible), or from an observation well (after fully purging and allowing to recover), take it to the local landcare or Agriculture Department office and ask for pH and electrical conductivity.
- A **description of soils** in the area of drainage, preferably mapped, using standardised descriptors (available from the Department of Agriculture).

Other Useful Data

The following other information and data, can also be useful in assessing drainage proposals, and should be included with the NoID if available:

Management plans – farm plans, catchment plans, water management plans etc. that may have been done in the past, or of which the drainage is part of, will provide a context for the proposed drainage.

Survey data that has been obtained to determine slopes and grades.

Design details – calculation of surface flow, soil slope stability etc. for the drainage.

Rainfall – long term daily rainfall record and/or your annual average rainfall will be useful for surface flow calculations.

Groundwater observations – water levels and the details of observation wells and/or piezometers in the vicinity of the proposed drainage can aid in determining extent of influence of the proposed drainage.

General observations, like has the salinity occurred gradually over a long time, or in steps after major flooding events

DEC AS A NEIGHBOUR

DEC is a land manager within many catchments where drainage is proposed, especially in larger drainage schemes. Where drainage is proposed near or into conservation estate like a nature reserve, CALM should be consulted, as a land manager, at an early stage. This is important to ensure that adequate and appropriate information can be provided with the NoID and so that the best possible solution for receiving waters as well as private land may be achieved in a timely way.