

Sub-surface Drainage: Tile Drains

The function of sub-surface tile or tube drains are to control rising water tables. Tile drains consist of buried pipes (open slotted, perforated or open ended) which intercept and remove excess water from water logged areas or where groundwater level are high. Drainage water collected by the tile drains is disposed to either land, waterways or evaporation basins.

How effective is tile drainage?

The effectiveness of tile drainage is determined by:

- soil drainage characteristics to allow water to pass through the soil fabric and be collected by the tile drains, eg., hydraulic conductivity
- the extent and type of soil layers – the presence of multiple impervious layers can restrict the drainage rates of soil profiles

Tile drainage has been constructed and used effectively throughout Australia. Although it has been used predominantly for drainage in irrigated areas with high intensity horticulture, its broader application is both an economic and environmentally sensitive option to address specific dryland salinity processes. Typically examples illustrating application for dryland groundwater salinisation processes are shown in Figure 1.

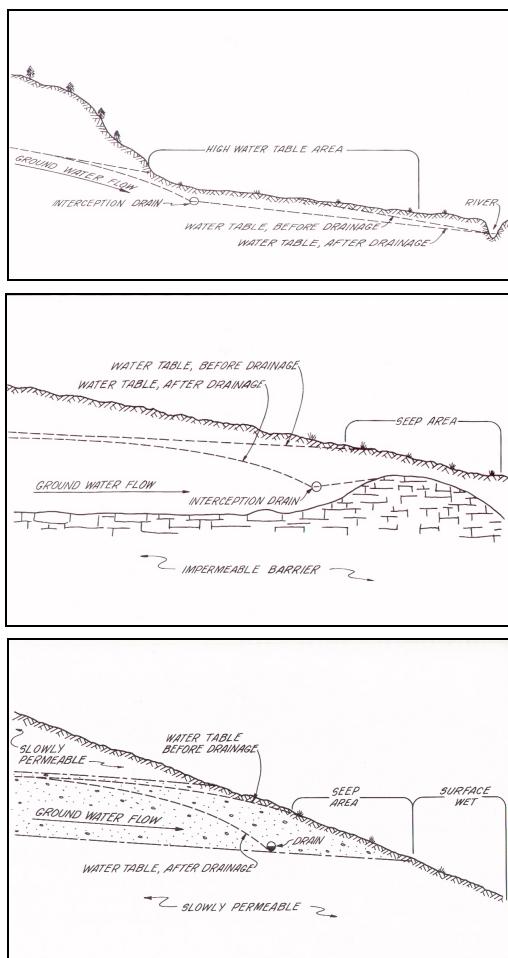


Figure 1: Examples of Tile Drainage Applications

Under what conditions is the option most effective?

Sub-surface tile drainage is most effective in:

- Topographically flat areas
- Break of slope areas
- Areas with aquifers of low transmissivity
- Heavy textured soils
- High groundwater salinity levels

What conditions may make it unsuitable / what are the risk factors?

- In low soil permeability areas, drains need to be spaced closely, which may not be cost effective.
- Tile drain pipes may get blocked easily and may need to be surrounded by a suitable envelope material.
- Limited drainage disposal options.

How do I go about construction?

Tile drains are usually perforated plastic pipe or clay pipes layed open ended, which discharge into natural waterways or open collector drains. The drainage system is commonly designed by an experienced contractor with the help of an expert consultant. Detailed knowledge of soil and ground surface conditions is needed. Desired water table levels are set to determine drain depths required. Drainage rates are calculated to determine the tile drain pipe size, spacing and layout configurations using standard formulae.

The preparation of a detailed plan, consisting of the drainage layout, contour information and disposal arrangements is essential for a sub-surface drainage systems. This information will also be generally required by the local or regional planning authorities to gain approval for the drainage development.

A typical layout of a tile drainage system is shown in Figure 2. Examples of the most common construction techniques used for the installation of tile drainage are shown in Figures 3 and 4.

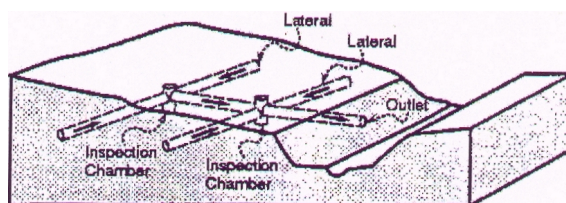


Figure 2: A tile drainage system layout

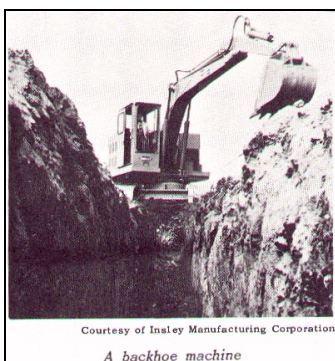


Figure 3: Backhoe tile drain construction



Figure 4: Bucket – wheel type trencher

How can I use or dispose of the water?

Groundwater intercepted by tile drainage can be disposed of in a number of ways and is largely dependant on the quality of the water. When the salinity of the groundwater is less than 4000 mg/L, many options are available for its use, either directly, or through mixing with better quality water. These options include irrigation and stock and domestic water supply. Many options are available for the productive use of more saline groundwater and these should be assessed and used where possible. Where productive uses of the water cannot be developed, the impacts of disposal of the groundwater need to be considered carefully.

Specific disposal methods include:

- on-farm evaporation basins or reuse on woodlots
- community drainage schemes
- disposal to waterways and wetlands
- aquifer injection or recharge
- Serial biological concentration

In all cases, the impacts of use or disposal of the groundwater need to consider the impacts on adjacent landowners, the local community and the environment.

Environmental considerations

In choosing a sub-surface tile drainage and disposal option the impact on the environment, both on to your property and elsewhere needs to

be evaluated. The following checklist summarises the issues that you need to consider.

Possible impact	Y	N
Will disposal of the water cause waterlogging or salinisation elsewhere?		
Will the option or disposal option create unpleasant odours or unsightly visual impacts?		
Will the control option or disposal option have a detrimental affect the water quality in creeks, rivers, wetlands or lakes?		
Will construction affect the movement of native animals within the area?		
Will the implementation of the control option introduce nutrients or other contaminants (eg. Pesticides) into the waterways?		
Will the control option create additional erosion through excess waterway flow or by other means?		
Do I have any pest plants that may colonise the waterways, wetlands and swamps due to the salinity control option?		
Do I have acid sulphate soils? If so, consult a soil scientist prior to undertaking the works!		

How much is it likely to cost?

The cost of constructing sub-surface tile drainage will vary considerably based on the drainage spacing and disposal options available. Some indicative installation and operating costs per hectare derived from irrigated areas around Australia are provide below. Note, these costs would probably be an upper estimate considering that the intensely irrigated areas would generally require a greater density of tile drains to groundwater level control.

Irrigation Region	Installation Cost	Operating Cost
Kerang (60m spacing)	\$4,230/ha	NA
(120m spacing)	\$2,280/ha	NA
Murrumbidgee	\$2,800/ha	NA
Riverland	\$5,000/ha	NA
Sunraysia	\$4,500/ha	\$36/ha/yr

Note: for operating and maintenance costs not determined assume these cists to be about 5% of capital per annum.

Key contacts list

- Local natural resource management staff
- Appropriately qualified consultant
- Local Water Authority staff
- Local drainage contractors