Environmental Management Workbook

for Roadside Maintenance Activities

Government of South Australia
Department for Transport,
Energy and Infrastructure

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Introduction

This Workbook has been designed by the Department for Transport, Energy and Infrastructure (DTEI) for participants of the Environmental Training Course for Road Maintenance Activities.

The purpose of this book is to provide participants with resource material for future reference and a list of advisory bodies to contact with regard to environmental matters.

Education of all employees and contractors involved in road maintenance activities is the key to achieving Best Practice Environmental Management. By adopting a philosophy of continuous improvement the department endeavours to lead the way in environmental management.

These environmental management strategies are considered to be vital in the protection and management of natural resources for the community and state of South Australia.

Aim of the course

To provide participants with skills and knowledge to ensure protection of the environment when undertaking maintenance of road and transport assets, and understanding of their legal obligations.

Session 01
Legal Obligations

The following legislation is relevant to road maintenance activities:

- *Aboriginal Heritage Act, 1988*
- *Agricultural and Veterinary Products (Control of Use) Act, 2002*
- *Controlled Substances Act, 1984*
- *Dangerous Substances Act, 1979*
- *Environment Protection Act, 1993*
- *Fire and Emergency Services Act, 2005*
- *Heritage Places Act, 1993*
- *Mining Act, 1971*
- *National Parks and Wildlife Act, 1972*
- *Native Vegetation Act, 1991*
- *Natural Resources Management Board Act, 2004*
- *Pastoral Land Management and Conservation Act, 1989*
- *Petroleum Products Regulation Act, 1995*
- *Environment Protection and Biodiversity Conservation Act, 1999 (Commonwealth)*

Environmental obligations and legislative controls are a joint responsibility between the department's employees and contractors involved in road maintenance activities.

The *Environment Protection Act, 1993* requires organisations and individuals to have a "duty of care" to protect the environment from pollution. It is an offence under the Act to intentionally or recklessly cause any form of environmental harm and it is also an offence to cause serious or material environmental harm.

Penalties for some of these offences are as high as $1,000,000.

Session 02
Environmental Management Workbook
for Roadside Maintenance Activities

The Department for Transport, Energy and Infrastructure is committed to:

Providing a road system in harmony with the environment and operating in accordance with the principles of 'Ecologically Sustainable Development' through:

- **compliance with relevant legislation**
- **adopting best practice environmental management.**

The Environmental Management Workbook for Roadside Maintenance Activities is designed to be used by road maintenance staff working directly for, or under contract to, the department.

The purpose of the Environmental Management Workbook is to ensure that road maintenance work is conducted in a manner that minimises impact on the environment and protects the State's natural environment and cultural heritage.

It is the responsibility of all employees and contractors to adopt environmentally responsible work practices. The Environmental Management Workbook provides guidelines for the minimum acceptable standards of practice. By adopting and, where possible, improving on these guidelines workers will contribute to the department's aim of achieving best practice environmental management.

Session 03
Environmental Definitions

The following are some key environment terms used in discussing environmental management.

Environment: all living things including biological, physical and social surroundings and the interactions between these.

Biological: includes plants, animals and humans.

Physical: includes soil, water, air, climate and landforms.

Social: includes Aboriginal and non-Aboriginal, population, economics, health, values, technology, buildings, transport, organisation, culture etc.

Environmental Management: the management of human activity that has the potential to impact on the environment.

These environmental terms will assist you in understanding the major issues regarding environmental management.

To achieve best practice environmental management of road maintenance activities there must be a consistent and uniform approach by departmental employees and contractors.

A glossary of environmental terms is provided at the end of this workbook.

Session 04
Roadside Vegetation

1 Importance of roadside vegetation

Native vegetation includes all naturally occurring local native plants, including: trees, small ground covers and native grasses; wetland plants such as reeds and rushes; and marine vegetation including mangroves and seagrasses. These plants may be located in natural scrub or may be isolated plants in a modified setting, such as trees over pasture or low shrubs amongst introduced grasses.

Roadside vegetation contains valuable remnants of native vegetation and may represent the only remaining example of the original vegetation. Native vegetation on the roadside is valuable because it:

- provides habitat for native wildlife
- contains rare and endangered plants and animals
- provides corridors of vegetation which allow the movement of wildlife
- is easier to maintain than introduced vegetation
- provides a local seed bank for replanting
- maintains the depth of the water table to prevent salinity
- provides shade and shelter
- enhances aesthetic value of the landscape.

Roadside vegetation contains valuable remnants of native vegetation.

Protecting roadside vegetation is more than just planting and protecting trees. The smaller plants (shrubs, grasses and herbs) are often crucial in suppressing weeds, stabilising the soil and providing fauna habitat.

All vegetation plays an important role within the ecosystem. Dead and very mature trees are particularly valuable as they provide hollows and nest sites for native animals. Dead and decaying vegetation releases nutrients back into the soil and enables them to be recycled by the growing vegetation.

2 Legal requirements

In South Australia, native vegetation is protected by the *Native Vegetation Act, 1991*, the *Development Act, 1993*, the *Aboriginal Heritage Act, 1988* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*. Approval is required for the removal of vegetation for road works and road maintenance. Approval for the removal of native vegetation is required under the *Native Vegetation Act, 1991*. Approval is required under the *Development Act, 1993* to remove "significant trees" and "heritage trees". Through your supervisor you should ensure that any necessary approvals have been obtained prior to removal of vegetation.

3 Minimising disturbance to vegetation

The preservation of native roadside vegetation is the simplest and most cost effective method of managing roadside land. It is important to ensure the survival of all levels of vegetation, from trees through to ground covers. Different levels of vegetation provide habitat for different birds and animals, contributing to species survival and a healthy balance between predators and prey.

Roadside vegetation is highly vulnerable to disturbance. The disturbance of soil and vegetation opens the door for invasion by weed species. The management of roadside vegetation is therefore based on a principle of minimum disturbance of native vegetation in conjunction with weed control programmes. Native vegetation will require little maintenance if undisturbed.

Small native shrubs and groundcovers, and the animals which depend on them for survival, have been severely threatened since European settlement. The grazing by stock and wide spread clearance of land has been responsible for many plants becoming rare or endangered and in some areas these plants only survive on roadsides.

Bush Corridors
Most animals need to move amongst vegetation to enable them to find food, shelter, breeding sites or mates. Roadside vegetation forms vital corridors for the movement of birds and other native fauna. These bushland corridors are sensitive to disturbance and hence road maintenance activities need to be minimised and undertaken accordingly.

Weed Suppression
Native vegetation, particularly ground covers, will suppress the spread of weeds. Established native plant species can out compete the introduced species and prevent their growth.

Wind Break
The corridors of roadside vegetation also provide shelter for adjoining farmland, livestock and crops.

Fire Suppression
Introduced weeds and grasses, such as Phalaris, can increase the risk of fire.

Care should be taken not to knock trees with machinery as this provides opportunity for infection and can result in death of the tree.

4 Avoid working under the canopy of trees

Healthy vegetation is an asset. It is more cost effective and easier to protect existing trees, shrubs and groundcovers than it is to replant them.

Vehicle and machinery movement within the drip line of a tree increases the risk of damage to the roots, trunk and limbs. Most trees utilise the top 30cm of soil to 'feed', whilst the deeper penetrating roots stabilise the tree.

Stockpiling of material, parking or storing of vehicles and machinery, and the movement of vehicles and machinery can cause soil compaction and destroy native herbs and grasses.

Fill material placed under the tree canopy inhibits the movement of air and water through the soil. This can cause root death and/or trunk rot.

Whilst the placing of fill within the drip line can damage the tree, so too can excavation within the drip line.

Don't park vehicles under trees.

5 Soil compaction and its impact on vegetation

Soil compaction can be caused by the weight of vehicles or machinery. This can cause the pores held within the soil to become compacted. These pores contain the air, water and minerals that are essential for vegetation growth. Once these pores are compacted, the water and air can no longer travel effectively through the soil and the roots within the soil virtually starve.

How to prevent soil compaction:

- **avoid storing vehicles and machinery underneath trees or on vegetation**
- **minimise vehicle movement in vegetation and under trees**
- **avoid moving vehicles and machinery on undisturbed soil wherever possible**
- **do not stockpile material on vegetation or underneath trees**
- **rip and loosen compacted soil prior to rehabilitation.**

6 Weeds

Weeds are plants which have an adverse impact on agriculture or native vegetation. Weeds pose a significant long term threat to native roadside vegetation.

Road maintenance activities can lead to the spread of weeds. One of the most common methods of weed spread is on road maintenance equipment. Most equipment is used at more than one site and, if not cleaned, can carry soil or vegetative matter that contains weed seeds or roots. The transportation of these seeds to a 'new' site can lead to the establishment of a new weed population.

It is an offence to bring (or permit to be brought) plants defined as pests into control areas. It is also an offence to transport a pest plant, or any soil or vehicle carrying a pest plant, on a public road in a control area. If shown that a noxious weed has been introduced in a control area as a direct result of road maintenance activities then it is possible for litigation to occur. A list of declared plants (weeds) can be obtained from your regional Natural Resources Management Board or your local council.

Weed Management

Road maintenance vehicles should be inspected and cleaned before they are moved into or out of control areas to make sure no pest plants or seeds are transported. Care should also be taken when obtaining materials from borrow pits to ensure the material is not weed infested.

Key guidelines include:

- **minimise soil and vegetation disturbance**
- **ensure that all equipment is free of soil and vegetation prior to moving onto and off site**
- **check the site for pest plants before grading, mowing or clearing**
- **ensure that equipment is washed down well away from watercourses**
- **ensure road maintenance material is collected from areas free of pest plants**
- **if material is affected, please contact your supervisor**
- **check with your regional Natural Resources Management Board for declared weeds.**

Disturbance can lead to weed invasion.

7 Herbicide use

Herbicides are used to control grass growth around road furniture, weed control during landscaping, as an alternative to mowing in inaccessible or special situations, or to control specific pest plants or particular undesirable grasses, eg phalaris.

It is essential that the appropriate herbicide treatment is used for each type of weed. Herbicides are highly toxic and should be handled in accordance with Material Safety Data Sheets.

Herbicide equipment and application techniques:

- **herbicide shall only be used by trained licensed operators**
- **herbicide shall be used in strict accordance with manufacturer's guidelines**
- **herbicide use should be limited to control of vegetation where mechanical methods are inappropriate**
- **strict records of herbicide use must be kept up to date**
- **do not spray herbicides in windy conditions**
- **do not spray herbicides if it is raining**
- **do not spray herbicides in waterways**
- **empty herbicide containers should be disposed of to a licensed waste disposal site.**

Ensure equipment is weed free.

Ensure equipment is washed down well to avoid the spread of weeds and disease.

8 Branched broomrape

Branched broomrape is a parasitic weed, which has been found growing in the Murray Mallee region near Murray Bridge. As a parasite, branched broomrape attaches itself to a host plant and draws nutrients from the plant. Crop yields are reduced as a result. Properties that are infested with branched broomrape are place under quarantine within a Containment Area. A Code of Practice has been developed to allow farmers and others in the district to operate without spreading the branched broomrape seed.

Contaminated soil poses the biggest risk for spreading branched broomrape. Branched broomrape seed is very small and can easily contaminate soil. Machinery, vehicles and any other equipment that carries soil, pose the biggest risk. The movement of soil from the Containment Area is heavily restricted, so there is a need to make provisions for this when working in the area. There is a risk that some infestations of branched broomrape have not yet been identified. For further information please contact the Branched Broomrape Operational Centre on 1800 245 704.

To prevent the spread of branched broomrape:

- **minimise soil disturbance**
- **decontaminate all equipment before leaving the greater Containment Area. This applies even if equipment has only been used on un-infested land**
- **work with the Branched Broomrape Operational Centre to establish a wash down station.**

Branched broomrape

9 Phytophthora (root rot fungus)

Phytophthora (root rot fungus) is a serious plant disease that destroys many of our native plants. Many plant species are susceptible to this disease, whereas others are resistant. The disease is caused by a microscopic fungus, that lives in the soil and in plant roots. The fungus infects and rots the roots of plants. Since plants take up nutrients and water through their roots, any root damage will result in the death of the plants.

Figure 1 (page 18) shows the location of Phytophthora Potential Threat Areas in South Australia.

The fungus spreads via soil and water movement and naturally moves downhill. Human activity has greatly increased the spread of the fungus by moving infected soil, gravel and plant material. Changing drainage patterns can also cause the spread of the disease.

The disease can be transferred in mud or soil on vehicles, machinery and peoples shoes. There is no known method to eradicate Phytophthora once it has been introduced.

To prevent the spread of Phytophthora:

- **minimise soil disturbance**
- **ensure vehicles and equipment are free of soil**
- **establish clean down stations.**

Don't spray in windy conditions.

Phytophthora (root rot) fungus has killed this grass tree.

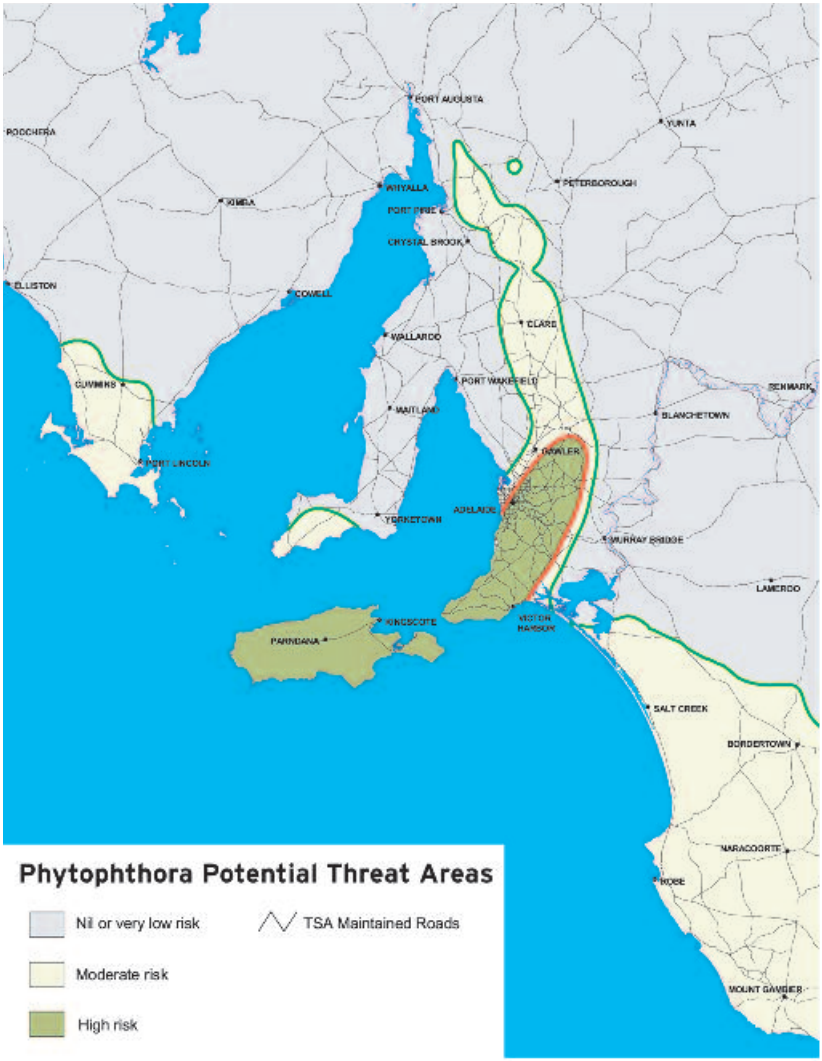


Figure 1. Phytophthora Potential Threat Areas in South Australia.

10 Preventing the spread of maintenance materials

Maintenance materials should be stored on land that is already clear of native vegetation. All vehicle and machinery movement should be confined to this area and not be allow to 'spread' into surrounding vegetation. Stockpiles should be marked to prevent the stockpile area from spreading. These stockpiles should not be pushed into surrounding vegetation.

Disturbance by just one vehicle can cause significant environmental harm in areas of native vegetation.

When grading shoulders or clearing open drains, soil should not be pushed or windrowed into roadside vegetation but should be removed. Avoid excessive clean up of an area, ie grading road shoulders or verges to the base of trees. This removes the valuable topsoil and groundcover vegetation.

When grading unsealed roads and shoulders ensure that the formation is not widened.

AVOID WINDROWING SPOIL INTO ROADSIDE VEGETATION

11 Prevention of fire

Fire is historically a natural part of the Australian landscape. However the natural landscape has been changed with the introduction of agriculture, rural and urban development. Many of our roadsides are now dominated by weeds and introduced trees and shrubs.

These introduced plants generally burn more readily than native vegetation and so increase the risk of a bushfire occurring, eg. tall grasses such as phalaris which dry off in the summer months.

Extreme care should be taken during summer months to ensure that road maintenance activities do not increase the risk of fire. Hot vehicles should not be parked or driven over any vegetation.

Session 05
Fauna

1 Potential impact on native animals

Roadside vegetation provides habitats for native fauna and links areas of remnant vegetation which form corridors for the movement of animals across extensively cleared landscapes. Given the significant loss of species and habitats, there is an additional responsibility to conserve the natural environment.

The loss of habitat is threatening the survival of many of our native animals. These animals rely on native vegetation for shelter, food, protection from prey and for breeding grounds.

The majority of animal species are found at ground level. For every species that lives in the canopy, 30 species live at ground level. Therefore it is crucial that this habitat is protected.

Fauna likely to be affected include soil organisms, ground dwelling insects, small mammals, birds, reptiles and larger native mammals.

Placing hollows in trees for fauna.

2 Minimising impacts on native animals

Disturbance of vegetation can destroy wildlife habitats. To limit this disturbance and potential impact on native vegetation:

- **keep machinery movement in vegetation to a minimum**
- **be aware of native fauna movements**
- **retain tree hollows, where practical, when pruning**
- **retain dead trees in areas of native vegetation.**

3 Legal requirements

Under the *National Parks and Wildlife Act, 1972* it is an offence to intentionally or negligently take protected animals unless a permit has been acquired. "Take" includes injuring an animal (which may include damaging its nest or burrow). "Protected" animals include all native animals, all migratory birds and animals, and other animals that are defined by the Act or regulations under the Act to be protected.

It is important to make sure that no protected animals are injured or killed as a result of careless or negligent actions during road maintenance operations.

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* some threatened (e.g. endangered or vulnerable) species and the Ramsar Wetlands such as the Coorong and Lakes Alexandrina and Albert; Bool and Hacks Lagoons; Coongie Lake; the Riverland and Banrock Station Wetland Complex are protected. Check with your supervisor in relation to any work affecting vegetation or fauna habitat in these areas.

4 Pest animals

Pest animals on departmental managed land should be controlled. The *Natural Resources Management Act, 2004* regulates the control of pests such as rabbits.

Session 06
Vegetation Removal and Disposal

Vegetation clearance includes burning, poisoning, slashing and lopping of branches, draining or damming of wetlands, smothering or burying (eg stockpiling, windrowing), compaction (by vehicles) and introduction of plant disease (eg infected topsoil).

Vegetation removal and disposal is governed by the *Native Vegetation Act, 1986*, the *Development Act, 1993*, the *Local Government Act,1999* and the Commonwealth *Environment Protection* and *Biodiversity Conservation Act, 1999*. It should be ensured that any necessary approvals have been obtained prior to the removal of vegetation.

1 Guidelines for pruning

Careful pruning can often alleviate the need for tree removal, though incorrect or poor pruning may render a tree unstable or unsightly.

Pruning can be done using either mechanical or hand tools. The choice should be governed by the type and significance of vegetation. Hand pruning is more appropriate in the case of trees.

Pruning using the 3 cut method

Pruning within road reserves should take into account visual, physical, ecological and social factors. The safety of staff, adjoining property owners and road users should also be considered.

Pruning is undertaken for road safety reasons and includes:

- maintenance of the "clearance envelope (5m)" above all roads
- removal of vegetation which interferes with infrastructure, such as bridges and drainage lines
- removal of dead, insect infested and diseased limbs which are a hazard
- to improve the form, shape or structural integrity of the tree
- to improve sight distance.

What to consider

- **apply pruning techniques which aim to minimise harm to the tree and aid the natural healing processes, this will reduce the chance of rot and disease.**
- **take into consideration the tree species, its environment, physical dimensions and the required result.**
- **pruning should be undertaken at the appropriate time. This occurs in winter for both deciduous and native species, i.e. when the plants are dormant or have a retarded growth rate respectively. Some species, however, are best pruned immediately after flowering.**
- **avoid excessive pruning or lopping.**
- **ensure the safety of staff, road users and adjoining property holders and their assets.**
- **in vegetation of significant value, or if any problems are encountered, seek advice.**

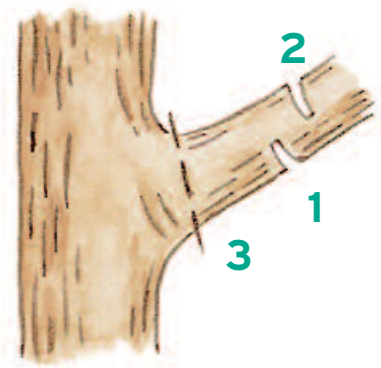
THINK BEFORE YOU CUT, IF IN DOUBT CONSULT AN EXPERT

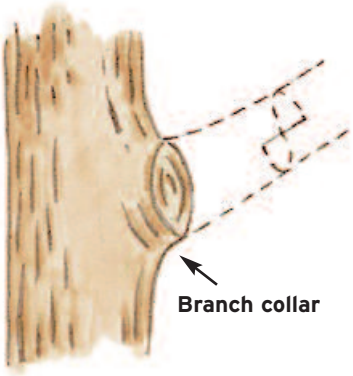
To avoid injury below the cut, use the three-cut method on all but the smallest branches.

1 The under cut.

2 The upper cut (to remove the branch).

3 The final trim cut. Cut close to, but not flush with the main trunk or limb. Always cut on the outside of the branch collar. This assists the tree in wound healing (callusing) and provides a protective barrier against decay.





Type of equipment

Appropriately sized equipment should be used for the task. The equipment should be in good working order, blades should be sharp and all equipment should be clean prior to commencement and after completion of the contract.

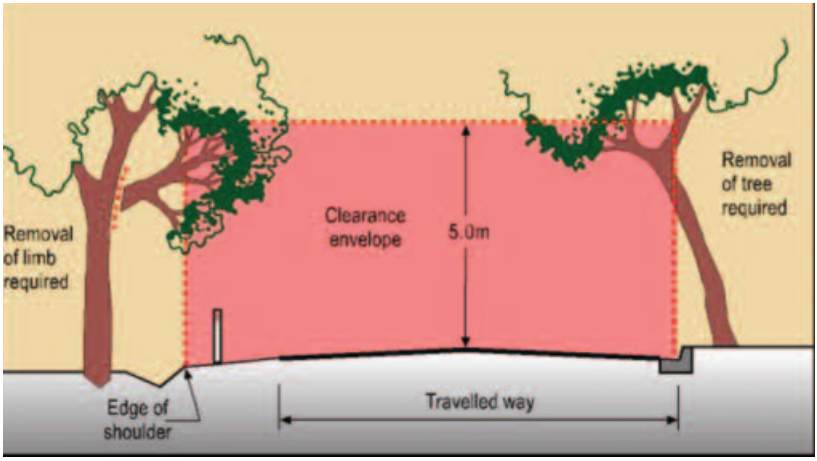
Height clearance

Consult the relevant contract documentation for dimensions to be maintained for vegetation removal and or pruning.

The Department for Transport, Energy and Infrastructure has a legal requirement for the safe travel of vehicles (of legal dimension) on all roads. The canopy branches, limbs and trunks must allow for the passage of legal height vehicles (4.6m). To allow for regrowth between pruning and sagging of branches when wet or windy, a clearance height of 5.0m is adopted.

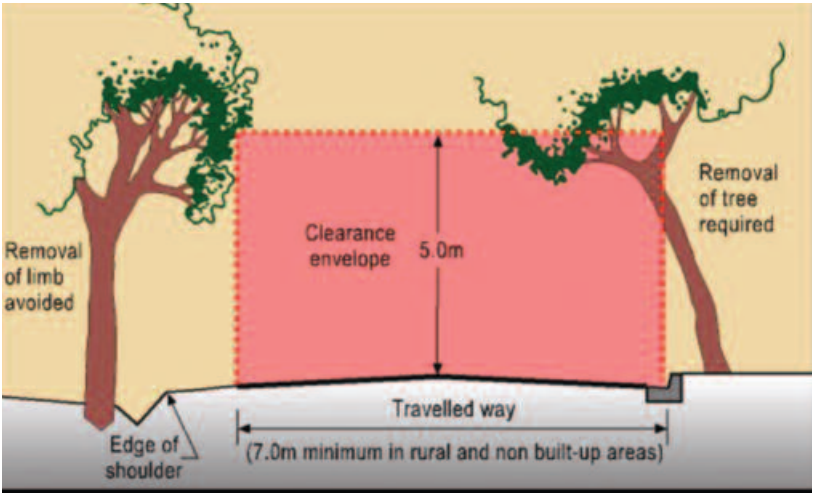
Standard Clearance Envelope (kerbed and unkerbed)

The Commissioner will maintain a vertical clearance of 5m to the kerbline or the edge of shoulders, as appropriate.



Restricted Clearance Envelope

At Council's request, or where existing vegetation makes it impracticable to achieve a standard vegetation clearance (as is often the case in the Adelaide hills), the Commissioner will maintain, as a minimum, a vertical clearance of 5.0m high extending the width of the travelled way or 7.0m in rural and non built-up areas, whichever is the greater. For areas where a Restricted Clearance condition applies please discuss with the Superintendent.



2 Clearance for sight distance

Where clearing for sight distance (eg curves, intersections, guideposts), use methods that minimise soil disturbance and avoid grading or bulldozing. Remove only tall growing species (using cut or cut and swab) and retain low growing species and ground covers.

3 Disposal of waste vegetation

Chipping

Waste vegetation should be chipped for mulch. Weed species such as olives should be disposed of at a licensed waste disposal site.

Chipping of light material for mulch is a desirable method of vegetation disposal, provided it is not infested with weeds. Chipped vegetation can be added to road verges thinly as a mulch, or stockpiled at depots for use in landscaping projects. If used as a mulch it should not cover or destroy native vegetation.

Mulches reduce loss of soil moisture through evaporation, inhibit the germination of weeds and protect the soil from erosion.

Use a 'chipper' to dispose of vegetation and add to roadsides as mulch or stockpile for re-use.

Firewood

Logs should be reused for firewood or chipped for mulch where possible. They may be suitable for salvage for furniture or wood turning. Hollow logs provide habitat for native fauna and contribute to the recycling of nutrients and can be retained on site. Alternatively, logs should be disposed of at a licensed waste disposal site. This should be discussed with the Superintendent prior to proceeding with this option.

It is less preferable, but permitted, to burn the timber in circumstances acceptable to and in written agreement with the local council and the Country Fire Service.

If the vegetation is diseased, e.g. Phytophthora, consider burning on site.

Light Vegetation

Vegetation (ie. grasses) mixed with bituminous materials should be disposed of at a licensed waste disposal site.

Chip and reuse mulch where possible

Session 07
Drainage and Soil Erosion

Soil erosion can cause the pollution of waterways, loss of vegetation, adverse impact on aquatic species, a decrease in the aesthetic value of a site, a safety hazard or damage to the road asset.

The primary factor which controls the rate of soil erosion is speed. Wind and water have the potential to cause soil erosion. If either of these elements travel at a speed greater than that which the native or introduced surface cover can withstand then erosion will occur.

Water erosion is dependent on both the speed and the volume of the water. The greater these factors, the greater the risk of erosion.

Wind erosion can occur anywhere on exposed soils but most commonly in arid and coastal regions, particularly on sandy soils. Wind speed and soil erosion can be decreased by vegetation, mulch and wind breaks.

Maintaining vegetative cover on all areas of the roadside greatly assists with erosion control.

To prevent soil erosion:

- **incorporate regular inspection programs and prompt repairs to erosion control works**
- **instigate a revegetation program, where appropriate, to maintain a vegetative cover.**

Fibre matting is a useful option to consider for stabilising steep slopes.

1 Legal requirements

The *Environment Protection Act, 1993* requires all individuals and organisations to have a "duty of care" to protect the environment from pollution.

Care should be taken to avoid pollution of waterways when carrying out drainage works, road repair or any maintenance activity. Where erosion is likely, sediment controls such as straw bales, sand bags or silt fences should be used.

Sediment detention basins should be cleaned out periodically to ensure their ongoing effectiveness.

The *Natural Resources Management Act, 2004* covers water affecting activities and work to be undertaken may require a permit. Check with your supervisor.

2 Reasons for re-establishing drainage

Inadequate roadside drainage systems can result in damage to the structure of the road. This damage can result in soil erosion, environmental harm and expensive repair operations.

Both wind and water erosion remove valuable topsoil. The topsoil contains a high proportion of minerals, organic material and a valuable seed bank. The eroded material is transported along the waterways, drains, creeks, and rivers, and can cause silting problems.

Once the topsoil and associated vegetation has been eroded, the exposed soil is vulnerable to weed invasion. The siltation of waterways can also produce an ideal environment for weed establishment, and harm fish and other aquatic fauna.

Use of riprap bags to control soil erosion.

Drainage guidelines to minimise soil erosion:

- **turn-out windrows at regular intervals to maintain drainage (ensure turn out is not directly down the slope)**
- **establish and maintain grassed open drains**
- **riprap bags can be used to control soil erosion on roadsides where appropriate**
- **when operating pumps to remove excess water during repair operations, ensure the pump disperses water evenly across ground**
- **retain vegetation wherever possible.**

3 Good practice in grading and drain clearance

A key to maintaining good drainage systems is regular inspection and maintenance. Maintenance activities, eg. grading of table–drains, must take into account how likely it is for batters and slopes to erode. Drains that are wide and vegetated with low grades are preferred to deep, narrow drains with steep grades.

The following guidelines for drainage maintenance will minimise the risk of roadside soil erosion:

- **retain vegetation wherever possible, the vegetation stabilises the soil**
- **minimise soil disturbance by confining vehicles and machinery to maintenance area**
- **avoid grading drain and turn-out material into vegetation**
- **ensure that drainage does not adversely affect vegetation**
- **always remove all debris and excess materials at the end of a job.**

4 Erosion control - soil stabilisation

It is important that work sites are protected from erosion. Vegetation protects the ground surface from erosion by slowing down the rate of water runoff and is the best method of soil stabilisation. Vegetation chippings can be spread to help prevent erosion, eg on unstable batter slopes or exposed soil.

Fibre matting can also be used to protect newly constructed batters and drains until vegetation is established.

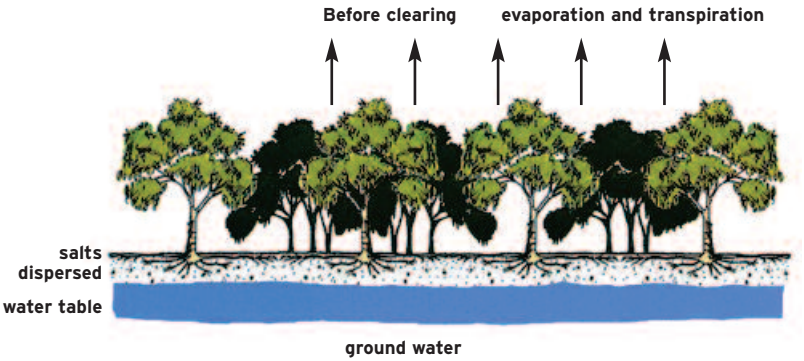
5 Salinity

Salinity problems affect roadsides as well as rural land. Saline soils interfere with the growth of most agricultural crops and native vegetation. Soils may accumulate salt over time from a number of sources, however the greatest controllable factor which increases the salinity of the soil is vegetation clearance. Retaining deep rooted perennial vegetation helps to maintain lower local water tables.

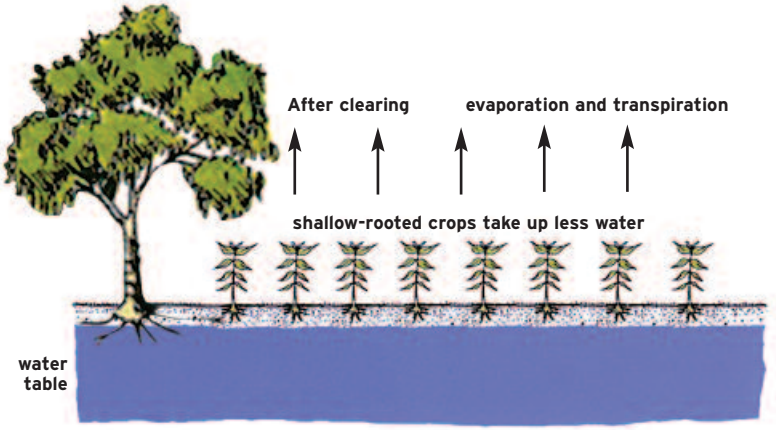
When the vegetation is cleared the water table rises up through the soil and brings with it dissolved salts. These salts then interfere with the plant roots and can cause vegetation to die. This may result in a further rise in the water table bringing the salts to the soil surface. The resultant environment is one where it is extremely difficult for vegetation to grow and is highly susceptible to erosion. The salt may also have an adverse impact on road infrastructure.

Clearing vegetation can cause salinisation.

Ground water table before vegetation clearance.



Ground water table after vegetation clearance.



More water soaks through to the water table because these plants take up less water than trees. Rising water table brings salts to the surface.

Session 08
Stockpiles

1 Selecting a site

Prior to selecting a stockpile location, check relevant contract documentation or contact your supervisor to see if there is a roadside management plan listing stockpile sites. All existing stockpile sites are listed in the Maintenance Contract documentation and may be pegged on site. For additional stockpile sites all environmental approvals will need to be obtained prior to creating the site.

The stockpiling of road maintenance material and spoil should always be on previously established stockpile sites, cleared land or on unused road pavement. **Stockpiles should not be located on vegetation or underneath trees.**

Stockpile sites should also be kept weed free. Locating stockpiles in areas of weed infestations can lead to the spread of weeds.

Access to surrounding vegetation should be prevented by marking or fencing the stockpile area.

Keep stockpiles away from surrounding vegetation.

2 Topsoil

The topsoil is the most significant zone of the soil for vegetation growth. Held within this layer are native seeds for revegetation, essential minerals for plant growth and the soil micro-organisms that break down the decaying organic matter to simple mineral form which can then be absorbed by the vegetation.

To stockpile the topsoil only the top 100-200mm needs to be removed. It is important to ensure that the topsoil is not mixed with poorer quality subsoil. The soil should be stockpiled in cleared areas, away from existing drainage lines, trees, shrubs and native grasses.

Weeds should be removed before stockpiling by spraying or scalping, to ensure that weeds are not spread.

Most seeds will remain viable in the soil for approximately 12 months, therefore, ideally the soil should be respread or reused within that time.

3 Contamination

Stockpile sites should be kept weed free and be treated prior to using the material. Vehicles should also be weed free to ensure that they are not a source of weeds for either the stockpile or the maintenance site. Stockpile material that contains weeds should not be located on or adjacent to land which has native vegetation, eg. drain spoil containing pasture grasses, weeds removed from shoulder etc.

4 Containing the spread

Reuse stockpile sites, do not continually create new ones. Damage will occur to surrounding vegetation if stockpiles are gradually pushed outwards by machinery.

Stockpiling of material, parking or storing of vehicles and machinery, and the movement of vehicles and machinery can cause soil compaction and destroy native vegetation.

5 Rehabilitation

The rehabilitation of disturbed areas such as plant storage, depots, camps and stockpile areas should be carried out in the following manner:

a) Remove excess material

b) Remove or treat weeds, if required

c) Restore contours consistent with the surrounding land

d) Rip parallel to the contours to alleviate soil compaction

e) Revegetate the area with native species, where appropriate

f) Spread mulch to protect the soil from erosion and retard evaporation of moisture

g) Install erosion control measures, where necessary.

Session 09
Contamination of Soil and Water

1 Sources of contamination

Groundwater

The contamination of soil and water can have a long term impact on the environment and may lead to contamination of groundwater and surface water. Groundwater is the water located below the surface of the soil. The depth at which this water is found is called the water table. Groundwater can become polluted with salts, hydrocarbons, accidental spillages and chemicals such as weed sprays and fertilisers. Contamination of groundwater can cause serious environmental harm. Trees and deep rooted shrubs may depend on groundwater for their water supply. Hence any pollution of this water has the potential to harm this vegetation and can contaminate drinking water.

Surface Water

Surface water is contained within creeks, streams, rivers and lakes, and also includes runoff. This water is easily contaminated by oil spills, wastes and the use of excessive chemicals. The water then moves into the waterways and travels rapidly to new areas and the marine environment.

Rain that is not absorbed into the soil but flows into the gutters is called stormwater. Pollutants that are contained in the stormwater include litter, animal faeces, oil, heavy metals, pesticides, fertilisers and silt. These pollutants can cause environmental damage and affect the quality of water.

Road maintenance activities which can contribute to contamination include:

- pest plant and weed spraying
- maintenance of machinery, refuelling and oil changes
- washdown of spraybars and equipment
- storage of materials and wastes at depot sites.

2 Management measures

To prevent contamination adopt the following:

- **dispose of waste oil appropriately**
- **flush spray equipment into containers and re-use or dispose of at a licensed waste depot**
- **maintain equipment to prevent oil leaks**
- **wash down vehicles in a manner that prevents contamination of soil and water**
- **prevent siltation of waterways eg. by using straw bales or geotextiles**
- **do not sweep debris into or towards stormwater drains**
- **prevent the entry of chemical sprays into local waterways**
- **avoid the over use of chemical sprays for weed and vegetation control**
- **dispose of unused chemical sprays at a licensed waste depot**
- **store chemicals at an approved site in the manner recommended in the Safety Data Sheets.**

This should not happen - Contamination of soil resulting from flushing of spray bars onto the ground. This contamination also killed the tree!

Session 10
Waste Management

1 What is 'waste'?

Waste is defined as any solid, liquid or gas (or a combination of these) that is left over, surplus or an unwanted by-product from any business or domestic activity, whether the substance is of value or not.

It is an offence under the *Environment Protection Act, 1993* to pollute. The disposal of road maintenance wastes should follow these principles:

- minimise the production of wastes
- maximise the reuse and recycling of wastes
- dispose of wastes in an environmentally responsible manner.

2 Minimising waste production

Road maintenance activities should aim to eliminate or minimise the production of wastes. Waste should be separated for recycling, or disposed of at a licensed waste disposal site. Where possible do not take material wrappings and packaging into the field and always aim to create the minimum amount of waste material necessary to complete a task.

Hazardous Wastes

The most common hazardous waste handled during road maintenance activities is bituminous waste. Spray bars should be flushed out into containers at the depot rather than on the road verge. Other hazardous wastes include paint, sprays and other chemicals.

Paint containing lead poses a serious environmental problem with significant health risks to people and animals. Stripping of lead paint from bridges or other structures should follow the Department for Transport, Energy and Infrastructure procedures. A license under the *Environment Protection Act, 1993* is required.

3 Identifying clean fill materials

Clean fill is material consisting of clay, soil, crushed rock, rubble and other inert mineral matter, up to 200mm in size. Clean fill should not contain organic matter such as timber or vegetation, or any other waste material such as papers, plastics and containers.

4 Reuse and recycling

All excess materials including soil waste should be recycled where possible.

This includes materials such as:

- waste oil
- car batteries
- ferrous and non-ferrous materials
- bollards
- fire Extinguishers
- flashing lanterns
- paper
- 200 litre (44 gallon) drums
- street lighting poles
- traffic signal poles
- cable drums (wooden drums from electrical cable)
- recyclable guide posts
- vegetation.

Waste to be disposed of should be well labelled.

5 Disposal

- **ensure wastes are disposed of at a licensed waste disposal depot that is licensed to take the particular type of waste**
- **consult your supervisor or the Environment Protection Authority for the appropriately licensed waste disposal site**
- **hazardous waste should be carried by a licensed carrier**
- **dispose of clean fill:**
  - **within road works such as shoulders, median strips etc**
  - **on departmental land or private land with landholder approval, or**
  - **at a licensed waste depot**
- **do not place fill material over native vegetation**
- **flush spray bars into containers and dispose of at a licensed waste depot**
- **see 'Vegetation removal section' for guidelines on the disposal of waste vegetation**
- **permapine posts (CCA treated posts) are not to be burnt, but are to be disposed of at a licensed waste depot**
- **excess chemicals are to be disposed of at a licensed depot.**

Session 11
Cultural Heritage

Heritage includes 'those places and events which define and sustain the Australian character and provide a living and accessible record of the nation's history' (Australian Heritage Commission, 1997). Our cultural heritage, both indigeneous and non-indigeneous, contributes significantly to the quality of life we value. It is a living heritage and will be continually added to.

Heritage sites can include:

- Aboriginal heritage
- Non-Aboriginal heritage
- vegetation
- unique natural features.

Aboriginal rock engravings, Copley to Balcanoona.

1 Aboriginal heritage

Aboriginal people have been living in Australia for at least 40,000 years. Their culture is complex and links closely with the land. Sites which show evidence of Aboriginal use of the land, their history, culture and traditions are protected by legislation.

Examples of Aboriginal heritage sites include; sacred sites, Aboriginal scar trees, burial sites, camp sites and artefacts.

Aboriginal sites and objects are protected by the *Aboriginal Heritage Act, 1988*. It imposes an obligation on all South Australians not to damage or disturb such sites or objects.

It is an offence to damage, disturb or interfere with Aboriginal sites.

Maintenance activities, the grading of shoulders and clearing of drains can uncover evidence of Aboriginal sites.

If burial sites or artefacts are uncovered stop work immediately and report to your supervisor, who will contact the Superintendent's representative.

Aboriginal canoe tree.

2 Non-Aboriginal heritage

South Australia's non-Aboriginal heritage sites help maintain our cultural identity and document the state's development from exploration and early industries, to the present day.

Examples of non-Aboriginal heritage sites include stone walls, heritage bridges, trees and historic buildings. Heritage sites are recorded on heritage registers at a national, state and local level. Heritage registers include the natural as well as the built environment.

A tree may be of historic significance, for example, the Burke and Wills Dig Tree, and the Herbig Family Tree.

Roadside reserves contain sites of significant cultural and natural heritage value. The Department for Transport, Energy and Infrastructure maintains a database of such sites in the Roadside Significant Sites Database (RSSD). A roadside significant site is an area identified as environmentally significant which requires specific care and protection when activities are undertaken along roadsides. These sites are distinguished with roadside markers. Consult your contract documentation for sites in your area.

Marker post for roadside significant sites.

The *Heritage Places Act, 1993* establishes a register of heritage places which is maintained by the Department for Environment and Heritage.

It is offence to intentionally damage a registered heritage place.

Under the *Development Act, 1993* approval is required for any work on a state heritage place, or that would affect the context of the State Heritage Place. Development in relation to a State Heritage Place includes demolition, removal, conversion, alteration or painting. This also includes the installation of signs and roadside furniture within a State Heritage area.

Protect heritage items in the road corridor such as stone fences

Repair heritage structures with appropriate materials

Preservation of Heritage Sites:

- **check for the presence of sites in your work area (Refer to the Roadsides Significant Sites Database - RSSD)**
- **verify the location of sites and any protect actions for that site**
- **avoid disturbance or damage to sites**
- **ensure approval has been obtained for work on heritage sites**
- **If an Aboriginal burial site or artefacts are uncovered, stop work and report to the superintendent. Liaison will be undertaken with the relevant Aboriginal community and the Department of the Premier and Cabinet, Aboriginal Affairs and Reconciliation Division**
- **ask your supervisor if uncertain.**

Stone Wall at Cut Hill on the Victor Harbor Road.

Session 12
Emergency Procedures

Emergency procedures should be documented in your approved safety plan.

- If a polluting incident occurs, it is a requirement for the supervisor to notify the Environment Protection Authority (EPA) as soon as practicable. Be aware of the location of any clean up materials and follow procedures if a polluting incident occurs.

- If an Aboriginal heritage site is uncovered, stop work and contact your supervisor, who will contact the Superintendent's representative.

Contacts
for Environmental Advice

Your first point of contact for Environmental Management issues should be your supervisor who may then contact the Superintendent. Other sources of information are as follows:

Department for Transport, Energy and Infrastructure (DTEI)
Environmental Systems Unit
Phone (08) 8343 2686 (advice on environmental issues, the department's policies and procedures, vegetation removal)

Aboriginal Affairs and Reconciliation Division, Department of the Premier and Cabinet
Phone (08) 8226 8900 Fax (08) 8226 8999 (Aboriginal heritage)

Country Fire Service (CFS)
Phone 1300 362 361 (bushfire protection)

Department for Environment and Heritage
Phone (08) 8204 1910 (state heritage, reserves)

Environment Protection Authority (EPA)
Phone (08) 8204 2000 (waste, pollutants, erosion control)

Local Government offices
Website http://www.lga.sa.gov.au (local heritage, general enquiries)

Natural Resources Management Boards
Website http://www.nrm.sa.gov.au (declared plants, pest animal and plant control, water affecting activities)

SA Water
Phone (08) 7424 1000

State Emergency Service
Phone (08) 8463 4171 (emergencies)

Zero Waste
Phone (08) 8204 2051 (recycling)

Glossary

Aboriginal sites and objects
Land or objects which are of significance to Aboriginal tradition or history, or have been declared under the *Aboriginal Heritage Act, 1988* to be a site or object.

Agricultural chemicals
Substances used for the prevention or promotion of growth of any vegetation, or protecting vegetation against attack from insects, animals, fungi and destroying rodents or pests.

Amenity planting
Planting of trees, shrubs and groundcover to visually improve the appearance of an area, this may include natives and introduced species.

Clean fill
Excavated material; consisting of clay, soil, crushed rock, and rubble up to a maximum size of 200mm. Clean fill shall not contain organic material such as timber and / or vegetation, or any other waste material such as asphaltic concrete, papers, plastics and containers, etc.

Clearance of Native Vegetation
Includes the killing, removing or burning of native vegetation, or the severing of branches, limbs, stems, or trunks, or any other substantial damage to native vegetation.

Declared Plants
Plants declared a pest under the *Natural Resources Management Act, 2004.*

Environment
All living things, their biological, physical and social surroundings, and the interactions between all these.

Environmental Management
The management of human activity that has the potential to impact on the environment.

Land Degredation
A decline in the quality of soil, vegetation, water and other natural resources as a result of road maintenance activities or any other human activity on the land.

Native Vegetation
Vegetation that is natural to the area (indigenous) and has not been introduced.

Open Drains (grassed)
Non-paved roadside drains on which grassy vegetation has been allowed to establish to protect the drain from scouring or erosion.

Polluting
Polluting includes discharging, emitting, depositing or disturbing pollutants and failing to prevent the discharging, emitting, depositing, disturbing or escaping of pollutants.

Turnout
Break in windrow formed at regular intervals, generally by grading, to take water off the road.

Waste
Any matter discharged or left over in the course of industrial, commercial, domestic or other activities, and includes excavated material not classified as clean fill. Any solid, liquid or gas, or combination of these that is left over, surplus or unwanted by-product from any business or domestic activity, whether the substance is of value or not.

Windrow
Ridge formed along edge of road work when grading.

Weed
Weeds are an introduced plant from some other part of Australia or another country. Weeds include agricultural pest plants and environmental weeds (weeds which threaten native plant communities).

Further Reading

Department for Transport, Energy and Infrastructure documents

DTEI, *Cultural Heritage Guidelines - A Handbook for Staff and Contractors*

DTEI, *Phytophthora (Dieback) Control Operational Instruction 21.3*

DTEI, *Northern and Western Region Weed Management Plan*

DTEI, *Outback Unsealed Roads - Environmental Best Practice Guidelines*

DTEI, *Residual Herbicide Use Operational Instruction 21.4*

DTEI, *Roadside Significant Sites Operational Instruction 21.5*

DTEI, *Vegetation Removal Policy*

DTEI, *Weeds of the Northern and Western Region - A Field Guide to the Identification and Management of DTEI Priority Weeds*

DTEI, *Weeds of the Metropolitan Region – Field Guide*

DTEI, *Weeds of the Eastern Region – Field Guide*

DTEI, *Water Affecting Activities Permits Standard Operating Procedure*

Environment Protection Authority document

Environment Protection Authority, 1997, *Stormwater Pollution Prevention - Code of Practice for Local, State and Federal Government*