

NILLUMBIK SHIRE COUNCIL ROADSIDE MANAGEMENT PLAN

PART 2: OPERATIONAL GUIDELINES FOR CONSTRUCTION AND MAINTENANCE WORKS ON ROAD RESERVES



*Managing the Functional Values of
Roads and Roadsides*

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1. INTRODUCTION

Nillumbik Shire Council is responsible for construction and maintenance works on roads and road reserves under their control. The Operational guidelines address the functional values of roads and road reserves and provide guidelines for all construction and maintenance works to ensure that they are carried out with due regard to the other values of roads and road reserves, especially, conservation and cultural and recreational values. These values are described in Part 1 of the *Roadside Management Plan*.

The Operational guidelines apply to all levels of Council, contractors and service authorities for any works on roads and road reserves within the Shire of Nillumbik that are under the control of Council. Its application is also relevant to roads managed by VicRoads within the Shire where the use of guidelines offered through these Operational guidelines is encouraged.

1.1 Aims of the Operational guidelines

The aims of the Operational guidelines are to:

- develop road design and maintenance practices which recognise road safety needs, facilitate road use by vehicles, preserve existing roadside pathway infrastructure, and seek the preservation of environmental, recreational and cultural values
- provide systems and procedures to standardise roadside management practices
- increase understanding of the issues involved in roadside management
- clarify responsibilities for roadside management
- encourage greater communication between Council officers, contractors, service authorities and the community
- offer clearer direction for contractors, service authorities and other service providers undertaking works on roadsides.
- offer clearer direction for all Council officers involved in planning and design of works, maintenance activities and vegetation protection works on roads and roadsides.

1.2 Principles

The operational guidelines have, where relevant, been divided into two phases of works (i) planning and design; and (ii) construction and maintenance.

Underpinning all phases and all aspects of construction and maintenance works on road reserves are the following basic principles.

- Safety for road workers and road users is recognised and is paramount.
- The roadway is viewed as an integral component of the surrounding environment and its catchment.
- Good design practices need to ensure minimal disturbance to the ground and vegetation and achieve protection of flora and fauna values and conservation needs.
- Good design practices need to ensure the preservation and maintenance of existing roadside path infrastructure.
- Works should be environmentally sustainable and effective in the long term.
- All disturbed areas require rehabilitation.

- Soil erosion, sediment generation and stormwater run-off are minimised.
- Reduce potential for spread of weeds.

These operational guidelines form part of a suite of documents relating to the management of Council land and assets and are to be used in conjunction with the *Municipal Fire Prevention Plan* (to be superseded by the Municipal Fire Management Plan), the *Road Management Plan*, the *Recreational Trails Strategy*, *Nillumbik Weed Action Plan* and other complementary strategies which are developed. The EPA guidelines for road construction and stormwater runoff protection are also a useful reference document. Of particular note here also is the publication, *Sediment Control on Unsealed Roads: A Handbook of Practical Guidelines for Improving Stormwater Quality* (Cardinia, Casey and Mornington Peninsula Councils and EPA, 2004).

1.3 Pre-works

Prior to any planning and design works, the conservation value of the roadside vegetation must be noted and taken into consideration in progressing the works. This information is available via the mapping generated for production of this Plan (Appendix 1).

Other values of the road also need to be considered such as whether it is a Priority or Fuel Modified roadside (as defined by the Municipal Fire Prevention Plan), part of a recreational trail, contains rare, threatened or significant species of flora or fauna, or is a strategic wildlife corridor. These guidelines are to be followed irrespective of the conservation rating of the roadside. For High and Moderate Conservation Value roadsides, prior to any works, it will be necessary to develop an Environmental Management Plan detailing specific work practices and prescriptions to protect the site's values. A Task Risk Assessment could also be required to assess risk associated with particular tasks.

There may also be circumstances where preliminary environmental impact scoping could be valuable. Appendix 11 at the end of Part 2 provides guidance in this regard. In some circumstances it may be necessary to carry out a broader consultative process to resolve any conflicts which may arise when there are competing demands and interests in a section of roadside. This consultation or referral process, also known as a conflict resolution process is described in Appendix 12.

1.3.1 Pre-works checklist

1. Check roadside conservation value category:
 - if Low follow the Operational guidelines
 - if High or Moderate, liaise with the Environmental Works Unit to determine the values of the roadside and or what additional planning or mitigation steps are required. Note: this process only needs to occur once, for regular maintenance work this does not need to occur every time prior to works.
2. Check requirements to obtain a planning permit for works under the Nillumbik Planning Scheme.
3. Check to see if the roadside forms part of a Priority or Fuel Modified roadside (as defined by the Municipal Fire Prevention Plan), or fire access road. If so, liaise with the Emergency Management Coordinator or Municipal Fire Prevention Officer.

4. Establish whether the road or roadside form part of a recreational trail link, either as identified and mapped in the Recreational Trails Strategy 2011 or as an informal local link.
5. As part of the planning of works, walk the route in order to:
 - identify areas suitable for turning around, passing bays, overnight parking and/or for removing vegetation
 - identify areas to be protected and 'no go' zones
 - identify areas where pest plants may invade
 - identify areas where the potential run-off may create problems with drainage and erosion.
6. Ensure the Environmental Management Plan (EMP) and Task Risk Assessment (TRA), as required, have been completed to address risk issues and mitigation of impacts from works.
7. In accordance with requirements of the EMP and TRA, vehicles and machinery working within the road reserve should ensure they are cleaned of seed, plant debris and soil from the previous job prior to entering the site so that highly invasive weed species such as stipoid grasses (e.g. Chilean Needle Grass) are not spread.
8. Ensure that road material is sourced from reputable suppliers to minimise spread of weed seed.
9. As part of the development of the EMP and TRA, nominate the location of the nearest site designated for disposal of spoil or weeds.
10. As part of the development of the EMP and TRA, nominate methods for disposal of vegetative material where it is to be removed, e.g. chipped and used as mulch, cut for firewood or milled for timber, or if it can be left on site to assist with habitat provision.

2 SITE OPERATIONS

2.2 Box clearance

Objective: Maintain box clearances (i.e. a vegetation-free rectangle along the road corridor) as stipulated in the *Road Management Plan* in order to allow adequate movement of road traffic at any time and for the safe passage of road machinery and emergency vehicles, especially those involved in fire suppression and for residents attempting egress or access of properties to flee fire situations.

Guidelines

A. Planning and design

- Box clearance is exempt from a planning permit if works remove the minimum extent of vegetation necessary to maintain the safe and efficient functioning of an existing public road.
- Proposals for box clearance works on high conservation significance roadsides should be discussed with Council's Environmental Works Coordinator to obtain appropriate advice so that works can be undertaken with minimal impact.

B. Construction and maintenance

- Overhanging limbs or vegetation will be removed in accordance with the box clearance guidelines (five metre height and approximately one metre past the edge of the table drains, Figure 6) and with minimal impact and disturbance to the roadsides environmental values (refer 4.1 Vegetation Removal) where vegetation:
 - poses a threat to safety
 - forces vehicles into narrow and/or unstable sections of road
 - increases road maintenance costs
 - damages Council or private equipment
 - blocks the line of sight
 - provides insufficient clearance for all road users, especially emergency vehicles.
- Inspection of overhanging vegetation is to be included in any road maintenance and construction program.
- Clearance or removal of vegetation is to be carried out with minimal disturbance to the soil and existing vegetation using sound removal and pruning techniques (Australian Standard 4373-2007 Pruning of amenity trees) and equipment, including:
 - felling trees/branches onto roads to minimise disturbance to the ground and to vegetation on the road reserve
 - using correct pruning techniques (refer 4.1 Vegetation Removal)
 - pruning for habitat value retention
 - using verge mowers where applicable
 - retaining logs (e.g. with diameter greater than 30 centimetres) for habitat and where not feasible consider relocation to another site
 - allowing larger felled vegetation which cannot be retained or chipped on-site to be cut into smaller pieces and left for collection by the public.
 - mulching smaller felled indigenous vegetation for use on-site or elsewhere.

- Where possible, weeds should be removed from site and disposed of.
- Use of heavy machinery/vehicles on the road reserve within the drip line of trees should be minimised to avoid root damage and soil compaction (Figure 12).

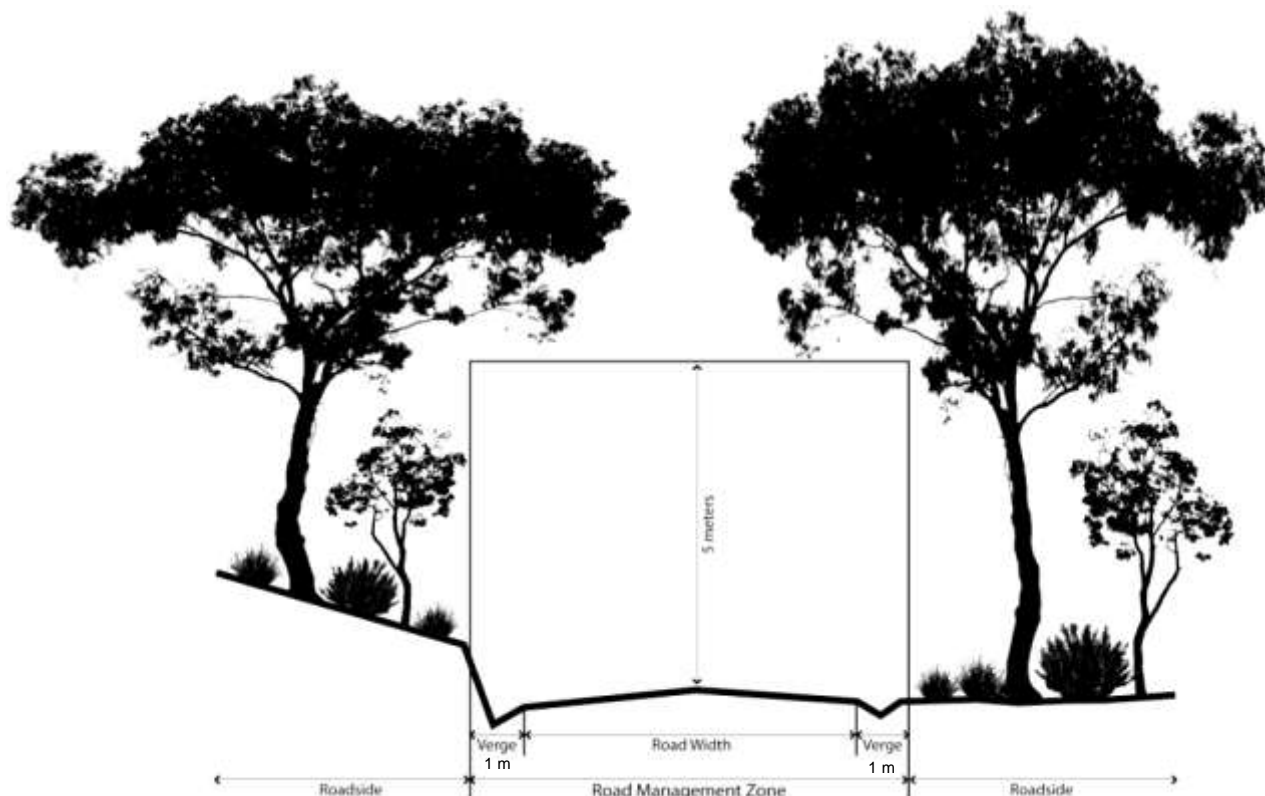


Figure 6. Recommended box clearances

2.3 Line of Sight Clearance

Objective: Maintain appropriate sight line clearances to allow adequate vision for the movement of traffic.

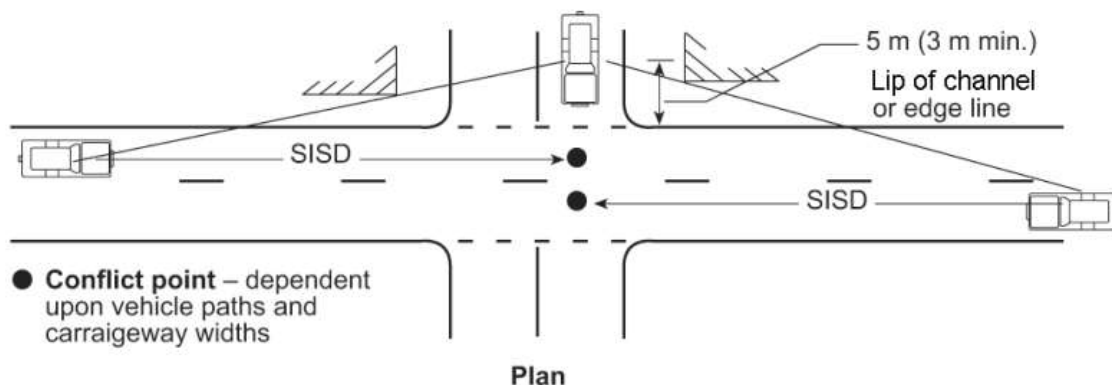
Guidelines

A. Planning and design

- Line of sight clearance is exempt from a planning permit if works remove the minimum extent of vegetation necessary to maintain the safe and efficient functioning of an existing public road.
- Proposals for sight line clearance on high conservation significance roadsides should be discussed with Council's Environmental Works Coordinator to obtain appropriate advice so that works can be undertaken with minimal impact.
- Clearances may be larger at points where increased sight lines are needed such as around road curves and at intersections, or where clearance is necessary around roadside infrastructure and to ensure signs are clearly visible to approaching traffic. The amount of clearance required at road curves will be determined on a case by case basis.
- Safety of road users will be the key determining factor in the management of roadside vegetation on road curves.
- Clearance at intersections requires that vegetation will be managed to provide safe sight distance for approaching traffic. The amount of clearance required will be determined by the specific site requirements. Factors such as road design and

category, speed limits, topography, and the type of vegetation will be determining factors.

- The Austroads Standards should be used for determining clearance for sight triangles at intersections (
- Figure 7).



Design Speed (km/h)	40	50	60	70	80	90	100	110	120	130
SISD (m)	73	97	123	151	181	226	262	300	341	383

Figure 7. Austroads Standards for Safe Intersection Sight Distance (SISD). Adapted from the Austroads Guide to Road Design (2010)

B. Construction and maintenance

- Pruning vegetation for maintaining line of sight should involve removing only the minimum required amount of vegetation.
- Only vegetation that impedes visibility should be removed. Low lying shrubs and ground covers which do not impede visibility will be retained.
- Clearance or removal of vegetation is to be carried out with minimal disturbance to the soil and existing vegetation using sound removal and pruning techniques (Australian Standard 4373-2007 Pruning of amenity trees) and equipment, including:
 - felling trees/branches onto roads to minimise disturbance to the ground and to vegetation on the road reserve
 - using correct pruning techniques (refer 4.1 Vegetation Removal)
 - pruning for habitat value retention
 - using verge mowers where applicable
 - retaining logs (e.g. with diameter greater than 30 centimetres) for habitat and where not feasible consider relocation to another site
 - allowing larger felled vegetation which cannot be retained or chipped on-site to be cut into smaller pieces and left for collection by the public.
 - mulching smaller felled indigenous vegetation for use on-site or elsewhere.
- Where possible, weeds should be removed from site and disposed of.

- Use of heavy machinery/vehicles on the road reserve within the drip line of trees should be minimised to avoid root damage and soil compaction (Figure 6).

2.4 Hazardous trees

A tree is deemed hazardous if it has been assessed by a suitably qualified arborist and has structural flaws and/or poor health that as posing an immediate risk to property or life

Objectives

- Assess and make safe trees that have been deemed hazardous by a qualified arborist.
- Limit the potential for tree fall on to roads during fire events that could block egress or access.

Guidelines

A. Inspection

- Carried out by a qualified arborist.
- The tree assessment is risk based, and likely to occur given normal season weather conditions within the next 12 months.
- Each assessment is to be recorded.
- Assessments are to recommend the most appropriate method to reduce the hazard this may include pruning, removal, weight reduction.

B. Hazardous tree maintenance works

- All works are to be undertaken to *Australian Standard 4373-2007 Pruning of amenity trees*.
- Pruning of major and minor limbs to reduce the hazard risk of the tree.
- Habitat pruning is a technique used to prune back the smaller limbs leaving the large limbs for habitat. This pruning technique is to be used only when the pruned tree does not remain as a hazard.
- If a tree is removed the stump must be removed to ground level.
- Felling trees/branches onto roads to minimise disturbance to the ground and to vegetation on the road reserve.

2.5 Machinery access, turnaround areas and overnight parking

Objective: Minimise vehicle and machinery movement on road reserves in order to limit disturbance to vegetation and ground compaction.

Guidelines

A. Planning and design

- Design specifications and site plan must indicate areas suitable for access, parking and turning.

B. Construction and maintenance

- Vehicles and machinery are not permitted off-road, unless there is a designated turning bay or driveway available for the purpose of manoeuvring.

- Vehicles and machinery are not permitted to be parked on high or medium conservation value roadsides, and are to avoid drip lines of trees in medium-low and low conservation value roadsides.
- Use existing, designated machinery access, turnaround and overnight parking areas.
- On narrow unsealed roads, if designated access/parking and turning areas do not exist and are required, they are to be created and maintained at approximately one kilometre intervals except where constrained by topography and vegetation. If possible select a Low or Medium-Low Conservation Value roadside where:
 - there will be least disturbance to indigenous vegetation, soil and animal habitat such as an existing clearing or an area covered by exotic grasses and weeds
 - the area can be cleared and covered in crushed rock to provide a clear parking area
 - such areas can double as passing bays, fire refuges or act as a fuse break – if such an area is no longer required it is to be rehabilitated to its original state or better.

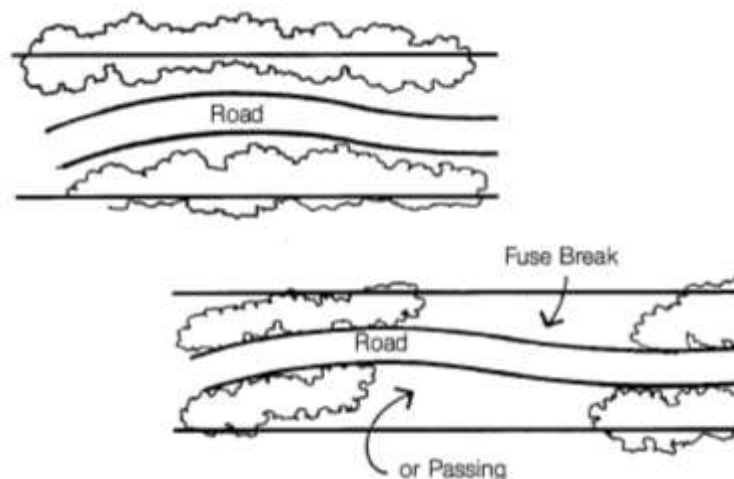


Figure 8. Existing cleared area which can be designated as a passing bay for vehicle/machinery parking or as a fuse break.



Figure 9. Clearly identify area of disturbance or machinery access or 'Construction Zone'.

2.6 Vehicle and machinery servicing and hygiene

Objective: Ensure all grasscutting and earthmoving machinery working in the road reserve and their tyres are cleaned so as to be free of weed seeds and soil borne pathogens before commencing work on other sites elsewhere in the Shire.

Guidelines

A. Planning and design

- When significant works are to be undertaken develop a hygiene strategy to:
 - determine the nature, source and extent of any possible weed or pathogen contamination
 - deal with the contamination of vehicles/machinery and/or to avoid contamination on-site
 - treat any contamination of vehicles/machinery off-site
 - confirm that the vehicle/machinery operator has followed the approved hygiene procedures before moving vehicles/machinery to a new site.
 - Ensure documentation of hygiene practices through their inclusion in Environment Management Plan (EMP) and Task Risk Assessment (TRA) procedures.

B. Construction and maintenance

- Develop and implement operationally feasible procedures to clean slashers and other machinery before moving to a new site.
- If possible, work from areas of least weed infestation to highest.

- Emergency servicing of vehicles/machinery may be carried out in the field providing:
 - vehicles/machinery are parked in a designated cleared area
 - no spillage occurs of fluids when servicing vehicles and machinery on the roadside when it is not possible to move to a more appropriate site
 - all packaging, used parts etc., are cleared from the site and that the site is reinstated if it is damaged by repair vehicles.

2.7 Job waste management

Objective: Dispose of job waste resulting from site operations with minimal disturbance to the roadside.

Guidelines

A. Planning and design

- Seek advice regarding the need for planning approval to temporarily store job waste at a works site.

B. Construction and maintenance

- Job related waste and litter is to be removed from roadsides and disposed of and/or recycled in a responsible manner.
- Waste materials from earthworks, resealing or re-sheeting, in particular that associated with bitumen works, is not to be disposed of on roadsides or parking sites, with agreed disposal sites nominated in the EMP.
- Investigate where surplus bitumen may be used to 'spray-seal' exposed surfaces of newly formed drains, to seal the surface and reduce dust and run-off after rain.
- Excess aggregate must be removed from roads and drains.
- Contractors are bound by an agreed checklist to adhere to the conditions of removal and disposal of job waste.

2.8 Stockpiles and dump sites

Objective: Locate stockpiles and dump sites to minimise negative impacts on the road and road reserve with material only to be placed on a site designated and managed for this purpose.

Guidelines

A. Planning and design

- Stockpiles and dump sites are to be located :
 - on public land of low conservation value
 - away from drainage lines, floodways and culverts
 - in areas of low visual amenity and/or landscape value
 - away from the bases or drip-lines of trees.
- Council will compile a list and map of all designated stockpile and dump sites to provide to contractors.

B. Construction and maintenance

- Use only designated stockpile sites, selecting sites closest to the job. Works supervisor is responsible for providing an up to date list and map of stockpile sites.
- Manage the stockpile to prevent erosion, wind-borne material loss and possible siltation of drains, roadside vegetation and waterways, or weed recruitment. Methods can include: enclosing the pile with a silt fence, establishing a cut-off drain, covering the stockpile, spraying for weeds, moistening it down and sealing it with sprayed binder and cellulose emulsion.
- Council is to be contacted prior to any application of herbicides to stockpiles or dump sites.
- To avoid theft from or damage to stockpiles, establish them as close to the time of use as practicable.
- All stockpile and dump sites are to be secured after hours to prevent theft of materials and dumping of household rubbish.

2.9 Excess materials

Objective: Minimise disturbance to vegetation and soil from removal of excess material, such as overburden from site operations.

Guidelines

- Rectification of disturbance to vegetation and the ground surface is a required element of the contracted works and is to be completed to the satisfaction of the Environmental Works Coordinator for high significance roadside reserves (See also 3. Revegetation and site rehabilitation).
- All overburden beyond the edge of the road formation is to be removed to as close as possible to the original natural surface level of the topsoil.
- Avoid a build-up of excess graded material against established vegetation growing on batters outside the road formation. Remove this material as it is generated.
- Excess material which cannot be safely retained on the road formation is to be stockpiled at a designated site.
- On narrow, unsealed roads designated vehicle or machinery turnaround, parking or refuge areas may be used to temporarily stockpile excess materials.
- Earth moving works are to keep disturbance of the ground and native vegetation to the minimum necessary to achieve the works.

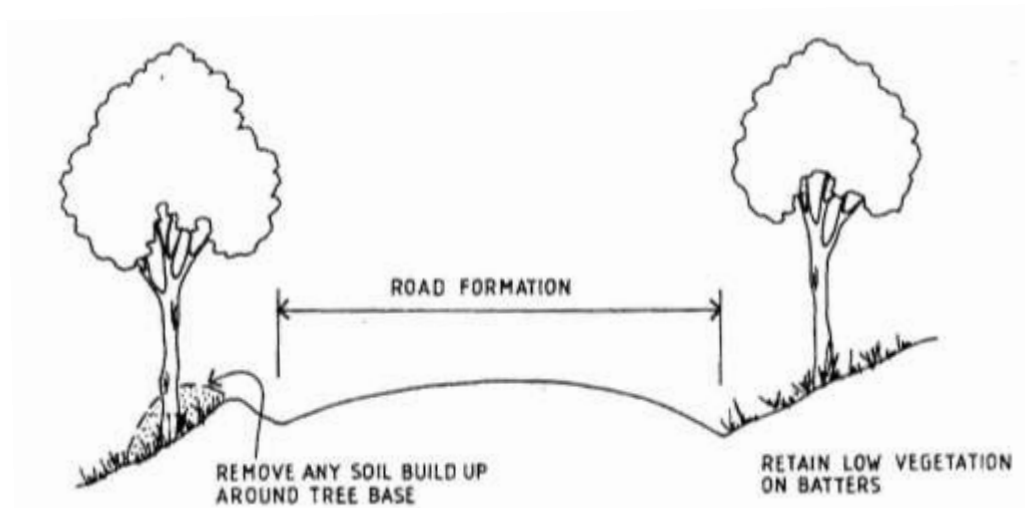


Figure 10. Treatment of excess materials



Figure 11. Excess materials should not be stockpiled against the base of a tree.

2.10 Road construction, widening and upgrading

Objective: Avoid and minimise environmental damage and negative impacts on vegetation, wildlife habitat and existing pathway infrastructure as a result of construction or maintenance works, while preserving a safe and efficient road system.

Guidelines

A. Planning and design

- Prior to any works relevant permits should be sought.
- Prior to any work and in order that vegetation protection and rehabilitation can be planned and implemented across departments, consult with Council's Environmental Works Unit (for works on high conservation significance roads), Infrastructure Development Section, and in the case of new subdivisions with the Development Approvals Section, so that road traffic, safety, recreational

usage, vegetation retention, heritage and other values, site distance, utility service locations, pest plant control and fire protection are considered at this time. An Environmental Management Plan (EMP) will be required in most cases, along with a Task Risk Assessment.

- Prior to each road construction project a timetable and budget for the works is to be formulated by the project proponent. This should include design, permit applications, construction, ordering materials, collecting seed, letting of tenders, reinstatement works etc., as required for each particular road.
- Works are to be designed so that they minimise vegetation loss and do not encroach within tree protection zones.
- Appropriate sediment control measures are to be incorporated into the design and planning of works to prevent excess materials being washed into roadside vegetation or waterways during construction. Refer to EPA *Environmental Guidelines for Major Construction Sites* 1996.
- When planning the sealing of existing roadways the environmental benefits should be considered in the prioritisation process. For example consider sealing roads with High Conservation Value and significant erosion first. Also prioritise areas in the vicinity of waterway crossings to reduce direct sedimentation of a given waterway.
- Prior to sealing a road the current recreational use of the road must be established. Where road sealing is proposed along a rural road and recreational values have been identified, a suitable trail on the roadside must be considered as part of the scope of works, with due consideration given to the Conservation Value of the roadside.
- Also see 7.0 Recreational Trails.
- Also see 3.2. Vegetation removal.

B. Construction and maintenance

- The boundaries of all construction operations must be clearly marked prior to commencing works. This can be done with temporary fencing.
- Vegetation to be retained within the construction zone is to be clearly marked and not disturbed.
- Where possible, work should be avoided within the drip line of trees so that root damage and soil compaction is minimised. This should be identified as part of the EMP and/or TRA process.
- Construction works are to be carried out in stages so that only a small works area is exposed at any one time.
- Vehicles and machinery are to be confined to access tracks and existing or proposed road alignments.
- Select the appropriate type and size of machine so that disturbance and impact to vegetation is minimised and the chances of successful rehabilitation enhanced.
- The importing or use of weed and/or disease contaminated materials for construction works on all roadsides is to be minimised by:
 - buying from reputable licensed quarries
 - monitoring new work sites for outbreaks of weeds

- treating any weed/disease outbreaks as soon as they appear and
- determining the source of infestation.
- Construction and maintenance contractors are to liaise with those carrying out rehabilitation works to ensure an appropriate finish and enable adequate preparation for rehabilitation.
- Begin reinstatement and prepare for rehabilitation of the site as soon as works are completed in accordance with the approved design, and when conditions are favourable.

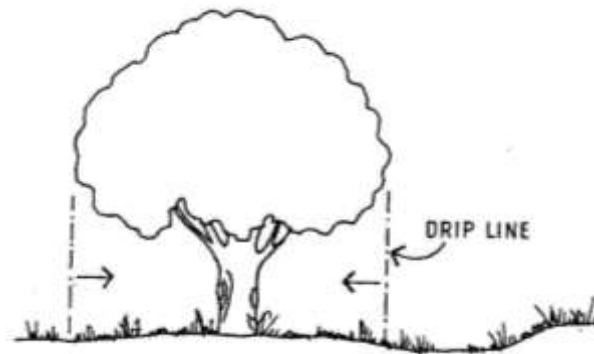


Figure 12. Avoid using heavy machinery and disturbing soil under tree drip lines

2.11 Road surface maintenance

Objective: Ensure the efficient and safe functioning of the road while minimising impacts on the roadside vegetation and wildlife habitat.

Guidelines

Construction and maintenance

- Vegetation beyond the road formation is not to be disturbed during road maintenance works without prior approval from Council.
- Borrow pits are not to be dug to extend fill to be used in road maintenance works on the roadside unless it is within the work area and remnant vegetation is not disturbed.
- Materials for road maintenance works on all roadsides must be sourced from reputable dealers and where possible, limit the spread of weeds by sourcing from weed free areas.
- When working close to existing trees, contractors are to avoid:
 - where possible working within the drip line of trees in order to minimise root damage and soil compaction.
 - where possible, placing sealed surfaces hard up against vegetation. If vegetation removal is required refer to section 3.1 of this document.
 - changing the finished ground level around vegetation.
- Material needed for road works is to be stockpiled on a daily basis on the road formation or in a cleared area in close proximity to the work site. Erodible stockpile material is to be covered or sealed.
- Road shoulders and unsealed roads are to be graded as required. Grading should:
 - not extend beyond the road formation

- ensure sufficient compaction of the road surface to ensure the new surface can adequately resist erosion
- avoid grading off the road crown.
- Spoil from grading is to be directed towards the centre of the road and removed to a designated dump site if it cannot be safely retained on the road formation and/or the shoulders. Soil is not to be spread onto the roadside, left in heaps, or windrowed onto the roadside vegetation or into the adjacent reserve.
- Where possible, original soil levels should be maintained. Soil should not be placed against tree trunks or on top of the existing soil level this can result in the death of the tree (Figure 13). Caution should also be taken not to alter the existing hydrology of the road reserve which may also result in vegetation death and weed invasion.

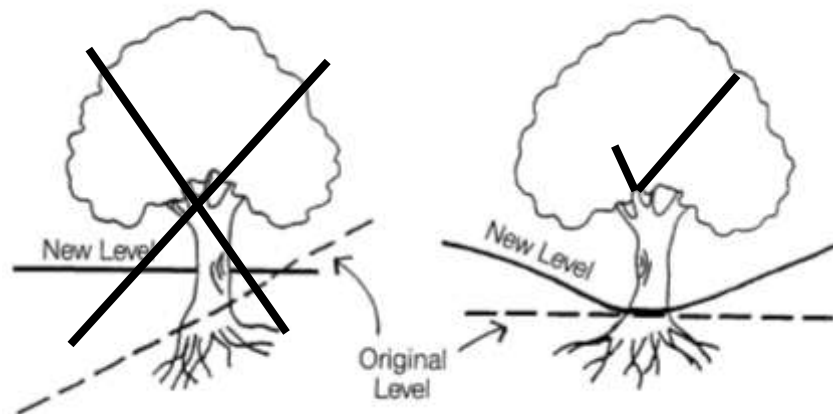


Figure 13. Maintain original soil level. Soil placed against the trunk and/or on top of the existing soil level can result in the death of the tree.

2.12 Road drainage and erosion control

By law, Victorian councils have a responsibility to:

“...maintain and, where relevant, manage roads and infrastructure to minimise erosion and sediment and pollutant transport, particularly along urban, unsealed and forestry roads.”

(EPA Victoria, 2003, State Environment Protection Policy [Waters of Victoria]. Victorian Government Gazette)

This responsibility is specified in the State Environment Protection Policy (Waters of Victoria), thereby making this a statutory requirement.

Nillumbik has numerous unsealed roads which are all subject to erosion by stormwater and have the potential to generate substantial amounts of sediment. An unsealed road can produce one hundred times more sediment in stormwater runoff than a sealed road (ARRB Transport Research, 2002). In addition, stormwater is concentrated in drainage channels alongside roads to direct stormwater away from the road to protect the road structure and road users from flood waters. This combination of exposed surfaces and concentrated stormwater can lead to significant erosion problems and the potential for stormwater quality issues from excessive sediment generation.

Sediment and suspended solids are considered to be the most significant of all road runoff pollutants due to the numerous direct and indirect effects on ecosystem health. Sediment produced from unsealed roads is typically very fine. These types of particles have the potential to be suspended in stormwater for long periods and carried long distances through the catchment.

Discharge of muddy or turbid water into waterways can cause serious environmental damage. Reduced amounts of sunlight caused by sediment suspended in the water can affect the growth of plant life and makes it difficult for visual predators such as fish and birds to hunt. Sediment can also clog the gills of fish and other stream life and interfere with the uptake of oxygen.

Coarser sediment can be deposited in the waterway, thus changing the nature of the creek bed. High levels of sediment can fill pools, cover rocky bottoms and coat woody debris or 'snags'. This sediment deposition can smother fish eggs, plants, algae, insects, snails, worms and shrimps, and reduce the available habitat for breeding, shelter and feeding. As a result, fish and invertebrate communities within the waterway can be significantly altered.

Objective: Road-related drainage works should aim to minimise erosion, sedimentation and subsequent impacts on waterways.

Drainage works should be planned in accord with the following documents:

- *Water Sensitive Road Design* (Wong, Breen and Lloyd, 2000)
- *Sediment Control on Unsealed Roads: A Handbook of Practical Guidelines for Improving Stormwater Quality* (Cardinia, Casey and Mornington Peninsula Councils and EPA, 2004).

In addition, road drainage should also observe the following three principles:

- **Slow the flow** – slowing the flow of stormwater will reduce its carrying capacity and allow particles to settle. It has been shown that where the velocity of water is doubled, its capacity to erode and transport sediment increases 64 times (Cardinia, Casey and Mornington Peninsula Councils and EPA, 2004).
- **Reduce the volume of runoff** – a large volume of stormwater has increased capacity to erode and transport sediment. By diverting and dispersing water away from the road at periodic intervals, the catchment area of the roadway is reduced.
- **Catch and treat the runoff** – by identifying discharge points from the road, the runoff can be detained and treated before it reaches the stream. A variety of sediment trapping techniques are available depending on the characteristics of the site.

Guidelines

- The road formation should be maintained at a higher elevation than adjacent drains to prevent the road becoming a drain, except where drain capacity is exceeded and the road may therefore need to transmit flood flows and in rare cases where the road might be designated as a floodway in order to protect nearby assets.
- Where possible road design should limit water collected into drains to runoff from the road surface and not also collect runoff from adjacent land, though this is not always possible, especially where slopes exist adjacent to road reserves.

- Rainfall runoff from roads and into roadside drains should be channelled to a natural point of discharge (a stream or valley) where it is practical to provide connection for discharge to the stream or regional drain. Where this is not practical, flows should be guided onto the adjacent land via relatively frequent and short channels so as to minimise volume and velocity of stormwater. This should be undertaken with the formal agreement of the adjoining landowner.
- Where constraints exist in managing volume and velocity of stormwater, where funds are available, an option may be to construct a vegetated pond (or series of ponds) to pool flows and reduce energy.
- The type of drain and treatment is to be selected according to the slope of the land, soil or rock type, and conservation status of the roadside.
- Maximising the amount of vegetation retained and minimising ground disturbance will minimise erosion.
- Earthworks on steep slopes and along streams must be minimised.
- Earthworks on High and Medium value roadsides and in significant roadside habitat and wildlife corridors must be minimised.
- Channel gradients are to be kept as low as possible to reduce velocities and possible erosion.
- Adjoining landholders are to be consulted where roadside drainage enters their properties.
- Where formal recreational trails, as identified in the Recreational Trails Strategy 2011, or other intersects occur on roadsides the design and construction of road drainage and erosion solutions should take into consideration the ability of recreational users to exit/enter roads and to cross drains and culverts.
- Stormwater run-off and sediment capture is to be provided for as soon as the project is begun as per the EPA *Environmental Guidelines for Major Construction Sites* 1996. Sediment capture must be a deliberate element of works design and should be provided for through various means including sediment pits, silt fences, hay bales, rock check dams and other means. The detail of sediment capture must be outlined in a site Environmental Management Plan (EMP) covering the proposed works and their environmental impacts. Sediment capture may also be covered in a Task Risk Assessment (TRA) for the proposed works where this is also required.
- When grading roads, windrows are to be pulled onto road pavement and removed onto a designated dump site, unless the material can be safely spread and compacted.
- As soon as practicable, newly exposed surfaces must be stabilised by revegetation, paving, sealing or mulching.

There are three different types of road profile (Figure 14). The use of an out-sloping crossfall can be effective in reducing the concentration of road drainage water. It allows diffuse drainage off the road into the environment and avoids the need to concentrate drainage in table drains. Alternatively, where there are erosive soils and drainage water needs to be contained, the use of an in-sloped crossfall can be effective in reducing drainage impacts.

The choice of the most appropriate pavement crossfall design will depend on the local environmental, topographical and safety factors (Cardinia, Casey and Mornington Peninsula Councils and EPA, 2004).

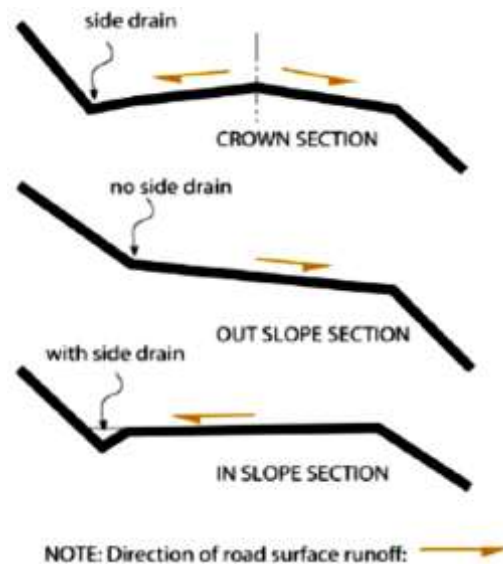


Figure 14. Three types of road profile

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2.12.1 Table drains

Table drains are the drains that run parallel with a road often on each side and receive run-off from its crowned surface. They are usually the principal means by which road drainage is managed.

2.12.1.1 Shape

The shape of table drains is important with drains requiring sufficient capacity to carry required flows and adequate integrity to resist the erosive action of stormwater. A flat-based profile will minimise scour by providing wide, shallow channel. Low sloping sides will also reduce the risk of the drain sides undermining and failing.

Ideally and where funding permits, drains should be of parabolic or trapezoid cross section. ‘V’ or steep-sided ‘U’ shapes are less desirable, although they are quick and easy to construct and maintain with a grader, they are extremely prone to erosion along the invert as all the tractive forces generated by the flowing water are concentrated along a narrow corridor. Drain sides should be no steeper than 3 horizontal: 1 vertical and an excavator or backhoe is better suited to achieving the preferred shape than a grader (Cardinia, Casey and Mornington Peninsula Councils and EPA, 2004).

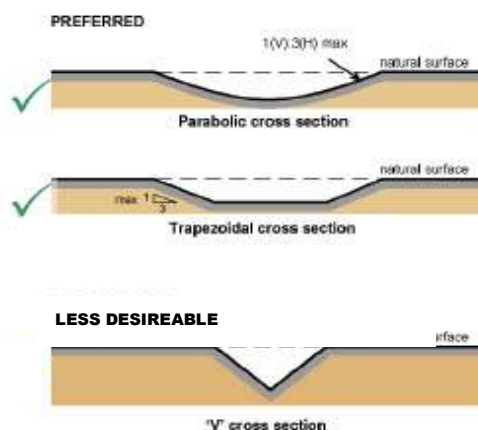


Figure 15. Optimal Table Drain Shape

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On rural roads especially, there is usually little formal design of table drains and at times their capacity can be easily exceeded in flood events. This can lead to damage to the road surface and even danger to motorists from localised ponding of water. Usually table drains remain unsurfaced and therefore additional measures are required in order to capture sediment.

More important than any sediment control measure, is simply preventing table drains (and cut-off drains) from discharging directly into waterways. These channels provide an easy pathway for sediment to reach streams and adversely impact on water quality.

2.12.1.2 Means to prevent sediment transport along table drains

There are a number of options available by which sediment transported in table drains can be prevented from entering streams. Where funding and resources allow, the following types of Check Dams may be used:

- Rock Check Dams – installation of small rock barriers at regular intervals along the table drain to dam water and permit sediment drop-out.
- Silt Fences and Hay Bale Check Dams – can also be placed across the table drain or even used in tandem to facilitate sediment capture.
- Biodegradable or Synthetic Log or Gravel Sausage Check Dams – biodegradable logs can be made from coir (fibre from coconut husks), straw or wool and typically break down over three to six months. Synthetic logs have a longer life than biodegradable materials and some can be reused if they only have a temporary use at one site. Gravel Sausages are permeable sacks made of either geotextile or synthetic netting filled with coarse sand or rock aggregate up to 50 millimetres.

2.12.1.3 Grassed or vegetated swales

Table drains can also undergo a grassed or vegetated swale treatment in order to trap sediment. Such a treatment would involve revegetation of the constructed table drain with various types of vegetation ranging from mere grassing with exotic species, through to possible revegetation with indigenous sedges, semi-aquatics, grasses and other suitable species. This would provide greater water infiltration through flows being slowed via the vegetation as opposed to being rapidly transported down the drain where a slashed grass cover exists. Sediment capture and some pollutant removal would also be possible, especially through the use of the indigenous semi-aquatics which are capable of attaching pollutants to their stems. Swales are most effective on low to moderate slopes with a gradient between two per cent to four per cent (Cardinia, Casey and Mornington Peninsula Councils and EPA, 2004).



Figure 16. Grassed or Vegetated Swale Drain Formation

In some situations, table drains alongside unsealed roads are not able to sustain vegetation growth due to large volumes of runoff at high velocities which disturb root zones. The large volumes of sediment generated from unsealed roads can also smother

vegetation and prevent growth at those locations where sediment deposits. Maintenance requirements of table drains also mean that drains require regular cleaning, thus damaging or removing vegetation, especially where table drains are narrow and vegetation has mainly been planted in the floor of the drain, or where machinery scrapes the whole of the drain (floor and sides) in seeking to remove build-up of sediment.

These problems highlight the importance of good design where a grassed swale treatment is the preferred approach. Design should seek to, within reason, resourcing and site constraints, increase the width of the drain and reduce its depth with formation of a less pronounced pilot channel enabling low flows to readily disperse within the drain area potentially forming a number of flow paths. This will tend to overcome the concentration of flows that leads to increased velocities and root disturbance. In addition, it has greater potential to increase the spread of sediment deposition, thus resulting in less smothering. There would also tend to be less frequent need for clean-outs as other flow paths are likely to be available should the initial flow path become choked with sediment. Any vegetation disturbed as part of the clean-out would also be more likely to recover where it was surrounded by remaining vegetation as seed would be available from these plants and therefore the need for revegetation work could be minimised.

2.12.1.4 Lining of table drains

Where necessary, such as on highly erodable soils, table drains can be stabilised with a cement treatment or spray sealants so that the drain does not become a source of sediment itself.



Figure 17. Cement-treated table drain on Rankines Road, Strathewen

In certain circumstances, another option may be to use rock rubble placed in drain sections to slow and disperse the flow. Rocks must be large enough to resist dislodgment by peak water flows and it is recommended that an assortment of rock sizes be used, instead of a single uniform size. Rough angular rock is more resistant to scouring, as it interlocks and resist overturning better than smooth rounded rock. The base of such drains should be evenly graded to prevent water ponding and becoming stagnant. The rock rubble should be laid in the same shape as the table drain to prevent water diverting around the rock. Use of a geotextile underneath the rock will reduce the likelihood of water undermining the rock. Such a treatment is relatively expensive, but may be necessary in certain situations of steep grades and erosive soils. Rock lining can also help trap sediment.

2.12.1.5 Table drains – Operational guidelines summary

Objective: In design and operational works, minimise erosion of table drains and their capacity to transport sediment to receiving waters through employment of the various treatments described herein.

Guidelines

Planning and design

- Undertake design of table drains to ensure they can transmit the 1:5 year ARI storm event, noting that a revision of ARI events is likely to be formalised in the near future with current 1:5 year capacities likely to be revised down to 1:3 year or thereabouts. Where possible capacity issues should be addressed by increasing width, not depth of drains. An increased number of cut-off drains may need to be considered to assist with meeting updated ARI information.
- Where possible, design table drains to, reduce concentration and velocity of run-off so that the integrity of the drains can be maintained and points of discharge from the drain (e.g. at cut-off drains, or connection to streams or other drainage lines) can be managed effectively without causing undue scour. Where necessary, construct grade controls included to reduce energy/velocities and potential for headward erosion cuts.
- Design table drains to have as flat and as broad a profile as possible within site constraints – parabolic or trapezoidal shapes can be used as a guide.
- Where table drains are employed in areas of highly erodible soils (often the case in Nillumbik), consider sealing of drains or lining with rocks to reduce the energy of flows and limit erosion.
- On High and Medium Conservation Value roadsides, table drains should be sensitively designed and where possible permit opportunities for sediment dispersion within the drain channel, or allow sediment drop-out at various points where flows are checked by rock or other devices.
- Avoid discharging road drainage to natural drainage lines or streams without appropriate energy dissipation that can minimise scour and erosion and without treatment for sediment deposition.
- Where a vegetated swale approach is employed, use species that permit passage of flows, reduce potential for weed invasion and will not produce excessive biomass thereby choking and potentially diverting flows out of channel.

Construction and maintenance

- Monitor table drains for signs of erosion.
- Ensure periodic clean-outs are conducted in a way that minimises damage to drains and protects vegetation where it has been used to trap sediment.
- If table drains are cleaned with a rotary drain cleaner, grade excess material into roadway and remove. Special care needs to be taken in areas where the soil is subject to slumping. Here, a back hoe may be more suitable than rotary cleaning of drains, prior to use of a rotary drain cleaner in table drains, establish whether any service utilities are at risk of damage.

2.12.2 Cut-off or mitre drains

2.12.2.1 Definition

Cut-off drains are also sometimes called turn-outs, push-outs or mitre drains. They divert water away from the table drain into a suitable area of the road reserve adjacent to the table drain. Their function is to reduce the volume and velocity of stormwater flow along the table drain. This helps preserve the capacity of the table drain to manage flow volumes while also reducing velocities. The cut-off drain also allows sediment management through permitting some of the sediment load in the table drain to drop out into the cut-off drain. Cut-off drains have been found to effectively remove sediment load of runoff water by up to 50 per cent (Cardinia, Casey and Mornington Peninsula Councils and EPA, 2004).

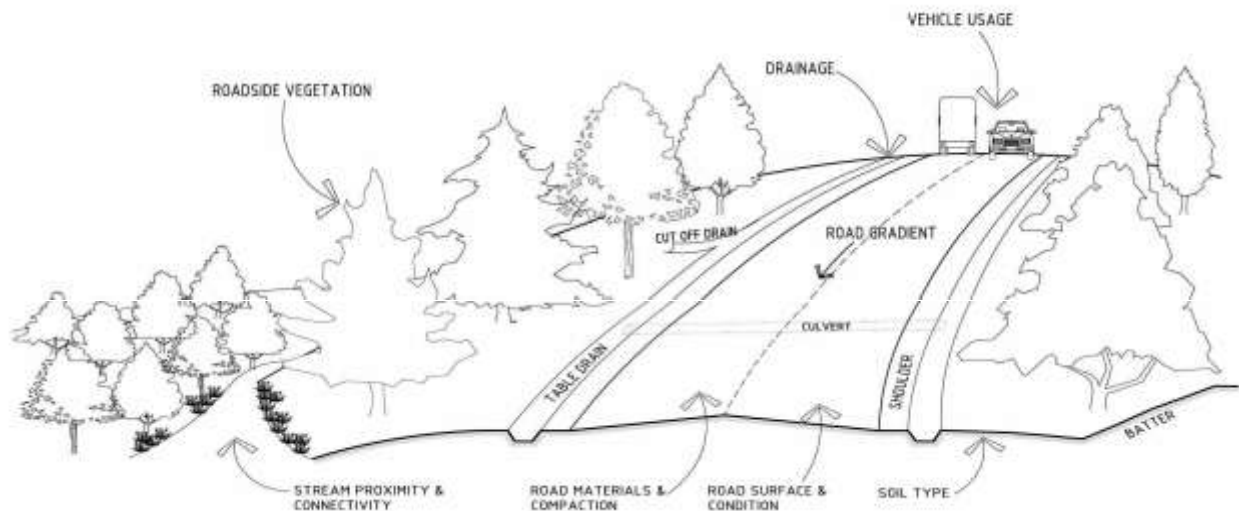


Figure 18. Cut-off and table drains

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2.12.2.2 Impacts of cut-off drains

Cut-off drains have the potential to negatively impact on roadside vegetation through a number of means. Firstly, cut-off drains can convey and concentrate stormwater in a localised area of the roadside reserve in a manner which changes natural hydrologic regimes. Should a cut-off drain be directed to an area that was previously not impacted by stormwater runoff, indigenous vegetation could potentially be changed due to the new hydrology. This could potentially cause tree or shrub death or result in significant weed invasion as opportunistic weeds occupy the wetter soils. In the case of high significance areas, such changed conditions are an unacceptable threat to vegetation and cut-off drains must be designed to enter reserves at points where lower significance vegetation is located.

In addition, vegetation can also be impacted by sediment smothering where cut-off drains discharge a high sediment load to a particular point and sediment accumulation over time smothers indigenous vegetation. Where sediment is eventually removed, this may also cause loss of indigenous vegetation and open up opportunities for weed invasion.

2.12.2.3 Design of cut-off drains

Cut-off drains should:

- **have a broad flat base** (> one metre width) with gentle sides and feathering at the exit point

- **be adequately spaced** as the greater the distance between cut-off drains, the greater the stormwater volume and velocity. Distance between cut-offs should be determined in part by the amount of grade of the road, although it should not be inferred that flat sections of road would not need cut-off drains. In these circumstances cut-off drains would not be critical for velocity management, but they would still be important for sediment and flow volume management. As a general rule, cut-off drains should be placed approximately 100 metres apart with intervals between cut-off drains shortened with increasing steepness. Table drain liners or check dams can also be used as an alternative to cut-off drains to control erosion and sediment
- **ensure that discharge of the cut-off drain onto steep slopes is avoided** or carefully managed as this can cause further erosion beyond the road reserve and potentially impact on stream banks in the vicinity should they be located nearby. These circumstances can readily occur where a cut-off drain is located in the floor of a natural valley and the reserve width in which to disperse and/or treat the stormwater is limited. In such cases the critical issue is to manage velocities through stepping flows down slopes via the use of small ponds and drops to reduce velocity. Should this not be possible due to reasons of space, a pipe and drop pit may need to be employed to take flows from the road to a point at the bottom of the slope where it can be discharged on flatter ground.
- **have an evenly shaped outlet** (or end) so that the concentrated flow is converted back to sheet flow that is more widely distributed into the road reserve. In this way stormwater and sediment can disperse over a wider area, rather than be concentrated in a localised area. By treating the cut-off outlet with either vegetation or rock rubble the sediment load transported beyond the defined drain length can be substantially decreased. In addition, sediment can be trapped at the end of cut-off drains via silt fences, hay bales, check dams, or a small sacrificial sediment pond that allows settling (see further 2.12.3 below). All of these measures are obviously more expensive than a simple bladed cut into the roadside reserve, but such measures need to be employed where there is high conservation significance vegetation, or where sediment management is a critical issue.
- **use semi-aquatic indigenous vegetation** on the floor of cut-off drains to help take up excess moisture and thereby help protect remnant vegetation from increased stormwater volumes. Vegetation can also assist with creating sheet flow conditions at the outlet of the cut-off drain

Construction and maintenance

- All cut-off drains are to be cut in the same place (subject to need) at each regrade.
- Cut-off drains require regular inspections as per the *Road Management Plan* to monitor weed infestations, the condition of surrounding vegetation and erosion at the outlet. The drain inlet may also need to be reopened if blocked by road grading. Regular maintenance to remove deposited sediment should ensure that cut-off drains do not gradually become deeper and wider where that would impact significant vegetation. Machinery should avoid damaging or removing adjacent vegetation.
- When cleaning drains:
 - no spoil from drain maintenance operations is to be deposited on roadside vegetation.

- spoil is removed to a designated dump site, unless it can be safely retained or re-used on the road shoulder. Do not spread spoil on the roadside or leave in heaps or windrow onto roadside vegetation.
- where funding and resources are available, cut-off drains may be cleaned out with a back hoe rather than a grader blade.
- Avoid locating cut-off drains into areas of significant bushland or in areas identified as High Conservation Value.
- Roads are to be left in a clean and safe condition after maintenance works.

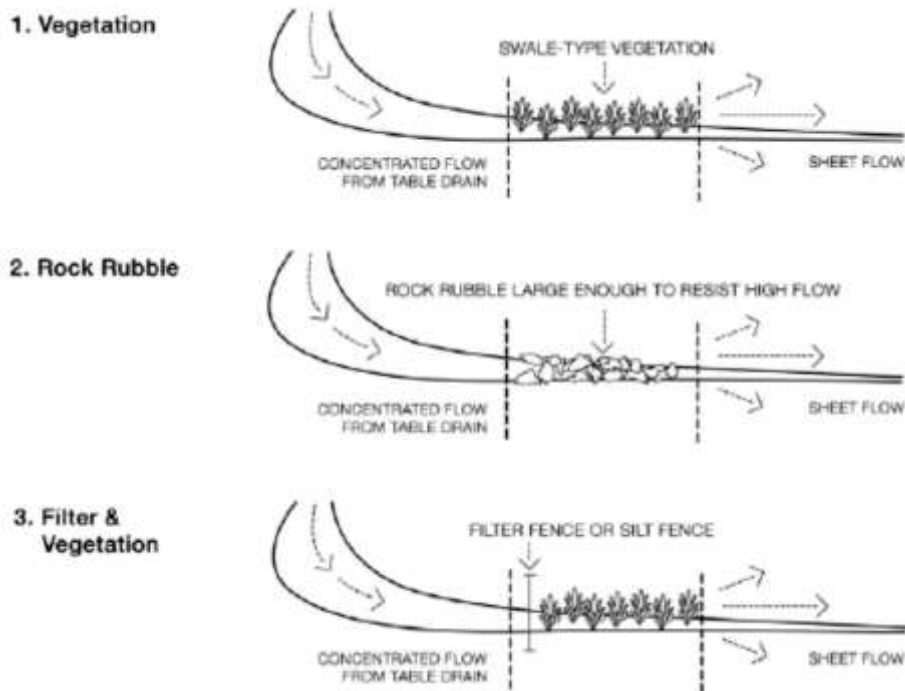


Figure 19. Treatment methods for cut-off drains to minimise sediment run off
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2.12.3 Settling ponds

Settling ponds may be used to help settle and filter sediment and leaf litter in road run-off and can help to maintain water quality in local streams through their localised capture of sediment. They are possibly best employed at the outfall of cut-off drains, though there may be situations where they could be employed as part of a table drain, although this would need to be measured against the risk of blockage of outlets and over topping in flood events and spilling onto the road should they be located in close proximity to the table drain.

The major constraint on use of settling ponds is not only the additional expense – which could be relatively small depending on size – but the area required to construct a pond that can achieve worthwhile sediment detention without being of such a small size that regular clean-outs would be required. This would also tend to work against their employment on table drains.

In any case, settling ponds could only be deployed on low conservation significance roadsides as their construction would cause extensive disturbance.

Construction and maintenance

- Settling ponds are to be formed and maintained with minimal disturbance to vegetation. Procedures for de-silting should be checked with EPA, but generally wet silt should be left in small piles until dry enough to spread and/or remove to landfill.
- Ensure that settling ponds are not a hazard to young children and are designed with a shallow fringe prior to any deeper waters.
- Clean settling ponds out with a back hoe.

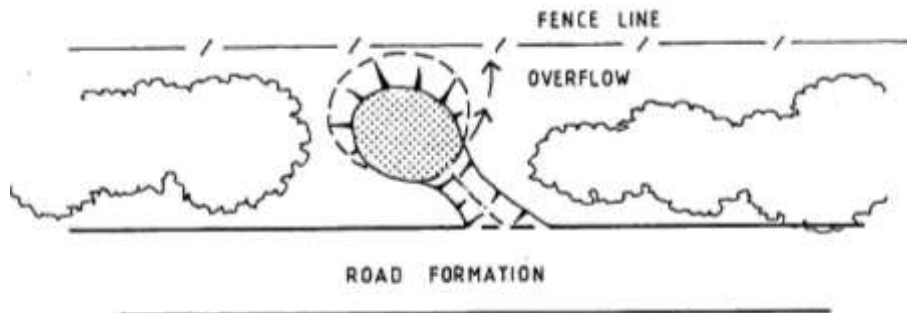


Figure 20. Typical settling pond

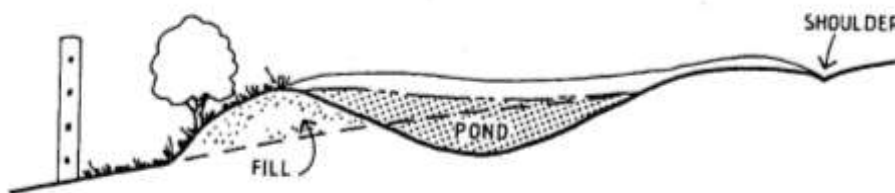


Figure 21. Settling pond, typical cross section

2.12.4 Culverts

Culverts are used on unsealed roads as cross drains to direct the flow of stormwater from the high side to the low side of the road. Similar to cut-off drains, cross drains should be adequately spaced to reduce the volume and velocity of stormwater in the table drain. Under average conditions cross drains should be a maximum of 150 metres apart. Optimum spacing distance can be determined by the 'rule of thumb method':

Spacing in metres = $300 \div \% \text{ grade}$

Objective: Ensure erosion scour and sedimentation at the points of entry and discharge of culverts are minimised.

Guidelines

A. Planning and design

- Depending on flows, culvert size, location and other site constraints, design culverts with:
 - where possible employ adequate protection of entry and exit points such that the concentration of flows caused by the culverts does not cause scour
 - where possible use energy dissipation structures (upstream and downstream ponds, large rocks or drop structures), to slow velocities and reduce scour effects

- provision of adequate, sympathetically designed bypass for flows in excess of culvert capacity
 - provision of sufficient grade through the culvert to prevent excessive sediment accumulation
 - consideration of the need for occasional clean-out in order to protect culvert capacity. Under drive-way culverts are the responsibility of the landowner to arrange clean-out
 - consideration of the need for occasional clean-out of upstream and downstream ponds to overcome any loss of capacity.
- If it is feasible to divert run-off to a nearby dam, consult with adjoining landowners and obtain their formal approval.

B. Construction and maintenance

- Ensure rockwork is sufficiently keyed in or grouted to prevent movement under high flow conditions.
- Monitor culverts, drop structures and any sediment ponds for sediment accumulation and conduct clean-outs to ensure retention of capacity.



Figure 22. Rocking of culvert outlet absorbs the energy of run-off and traps sediment (Ninks Road, St Andrews)

2.12.5 Roadside batters

During road construction, batters may be formed on the low side of the road (fillslope) and high side of the road (cutslope). Being an exposed area, batters can make a substantial contribution to sediment runoff. This can be overcome by establishing vegetation on the batter slope through grassing or planting with appropriate indigenous species where slopes permit.

Objective: Within site constraints, aim to design and construct roadside batters with shallow slopes in recognition that local soils are generally highly dispersive and erodible and that steep cuts will rill and potentially slump.

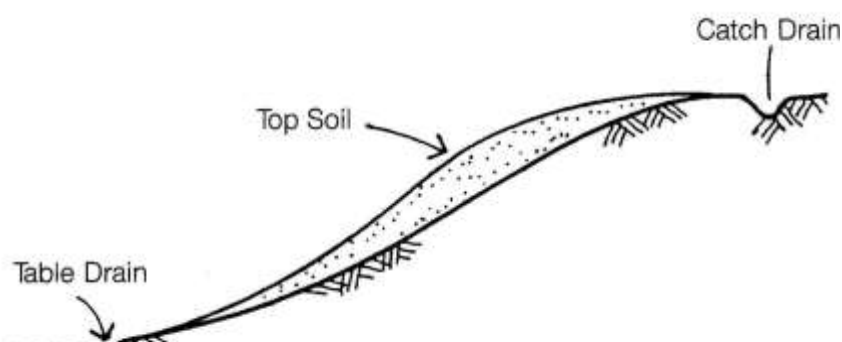
Guidelines

A. Planning and design

- Design batters to be no steeper than 1:3 and preferably shallower to prevent rilling and possible slumping given the generally highly dispersive local soils.
- Where site conditions do not permit batter grades of 1:3 and grades must be steeper:
 - where possible, step batters to create benches that can be revegetated
 - cover the batter with a geotextile and revegetate with appropriate indigenous species.
- Where site conditions are even more constrained, it may be necessary to build a retaining wall (especially if close to a boundary fence) or install a rock/wire gabion, although these options should be considered as a last resort as gabions have a finite life and eventually need replacement as baskets wear and rust.
- Design specifications are to indicate whether batter is to be spread with topsoil from the site, although this may not be possible on many steeper slopes unless a bench is created.
- Run-off down a batter to be minimised by designing a catch drain across the top of the batter to divert run-off away from the batter face (Figure 23).
- Ensure stabilisation measures are installed immediately after construction is complete.
- Vegetation can be established quickly using a variety of techniques, including rapid seeding of sterile rye grass. Installation of biodegradable matting can control erosion while the vegetation is being established.

B. Construction and maintenance

- Take care that grading activities do not undercut the batter.
- Monitor vegetative growth on batters to ensure vegetation stays low growing and free of regenerating trees that may ultimately interfere with box clearance.



2.12.6 Pit cleaning

Objective: Ensure regular maintenance of drainage pits and pipes so that blockages do not occur and proper function is maintained.

Guidelines

A. Planning and design

- Litter and/or silt traps are to be installed where appropriate to reduce potential for pits and pipes to become blocked with leaf litter, rubbish or sediment.

- Ensure contractors/staff are familiar with appropriate designated dump sites for depositing material from pit cleaning.

B. Construction and maintenance

- All pits are to be placed on a maintenance program for regular cleaning.
- When pits are being cleaned, check adjacent pipework and clear any blockages.
- Depending on EPA guidelines and requirements and methods of extraction (e.g. suction truck or otherwise), all extracted material to be removed from the site immediately and taken to an appropriate landfill.

2.13 Revegetation and site rehabilitation

Objective: Rehabilitate areas of roadside disturbed during construction and maintenance activities through re-establishment of indigenous flora while also considering existing plantings and planned uses of roads and roadsides.

Guidelines

A. Planning and design

- Vegetation removal will require a planning permit unless exemptions apply. Where a permit is required it is likely to include a condition that a rehabilitation and revegetation plan be prepared.
- Individuals or agencies wishing to carry out revegetation or rehabilitation activities on a section of roadside, should seek advice from the Environmental Works Coordinator/Environmental Planner and the Coordinator Emergency Management.
- During project planning, consideration should be given to:
 - appropriate timelines and funds for site rehabilitation
 - salvage of usable elements of the site (e.g. topsoil, seed from indigenous plants, logs)
 - indigenous flora may need to be grown and have seed collected elsewhere
 - appropriate seasonal timing of planting
 - a strategy to minimise the risk of weed establishment
 - follow up assessment, weed control and supplementary plantings if required.
 - reinstatement of formal recreational trails identified in the Recreational Trails Strategy 2011, or other assets that are likely to be disturbed, including access points.
- In planning and designing any revegetation works, existing and potential uses of the roadway and roadside verge are to be considered including:
 - location of a utility services (e.g. water, gas, power or telecommunications)
 - road safety and visibility
 - bushfire fuel hazard potential, including current fuel loads of the roadside reserve and consideration of adjacent dwellings, assets, land use and vegetation cover
 - access for emergency vehicles and road making/maintenance machinery
 - vehicle parking, passing bays and turning circles

- potential for designated stockpile site
- recreational pathways or trails, including access points and potential for obstructing existing pathways.
- The purpose of the vegetation to be established must be clear so that the species selected are appropriate. Functional considerations may include: screening potential; collision absorption potential through use of shrubby vegetation with limited woody content and trunk development; shade and shelter; and driver/passenger interest. Environmental considerations may include erosion control and weed suppression capacity, potential for conservation of flora and fauna and maintenance of ecological stability. Visual/cultural considerations may include the potential to add to landscape quality streetscape amenity and to frame or screen specific views. Heritage and cultural features might also be reinforced by use of vegetation.
- Species appropriate to the site's natural characteristics, features and constraints need to be selected.
- Select appropriate methods of establishment according to the site conditions, bearing the following in mind:
 - seedlings (tube stock, cells) are usually a quick and reliable planting method, but success depends on good quality plants, good site preparation and adequate maintenance, especially weed control
 - direct seeding is economical and maintenance inputs can be low where good weed control has taken place or the soil-stored weed seed bank is low, but results can be variable and dependent on favourable seasonal conditions
 - natural regeneration is ideal where nearby remnant vegetation is of desirable species though establishment can be variable and limited to the species present. Cultivation, scalping or herbicides can be used to encourage regeneration but where weeds are present soil disturbance is to be kept to a minimum.

Construction and maintenance

- Where possible retain salvageable elements of the site including:
 - plant rescue and/or collection of local indigenous plant seed
 - encouraging natural regeneration
 - top-soil and indigenous seed bank, giving particular attention to:
 - maximising use of existing topsoil at site:
 - avoiding mixing weedy topsoil with topsoil from weed free sites
 - avoiding mixing topsoil and subsoil
 - mounding of topsoil following earthworks to allow for settlement (see Figure 24)
 - compaction of backfill in layers no thicker than 300 millimetres to minimise shrinkage.
 - consideration of ripping to a minimum depth of 300 millimetres on compacted subsoil prior to spreading topsoil. On steep sites only contour rip and avoid tree drip lines
 - following the original height and contour of the land when rehabilitating after works and remove any unused spoil

- watering topsoil once it is spread to minimise dust and moisten prior to revegetation
- covering exposed ground as soon as possible to minimise weed spread and erosion
- o larger branches and logs for placement over site:
 - excess timber to be cut and left for voluntary collection by public
 - indigenous vegetation for chipping, mulching and re-use on-site.
- Avoid chipping and mulching weeds, instead they should be removed from the site and delivered to landfill or included in local composting/green waste collection system.
- Successful establishment requires good maintenance of plantings, appropriate species selection for the site and planting at the correct time, proper ground preparation prior to planting and weed control before and after planting.

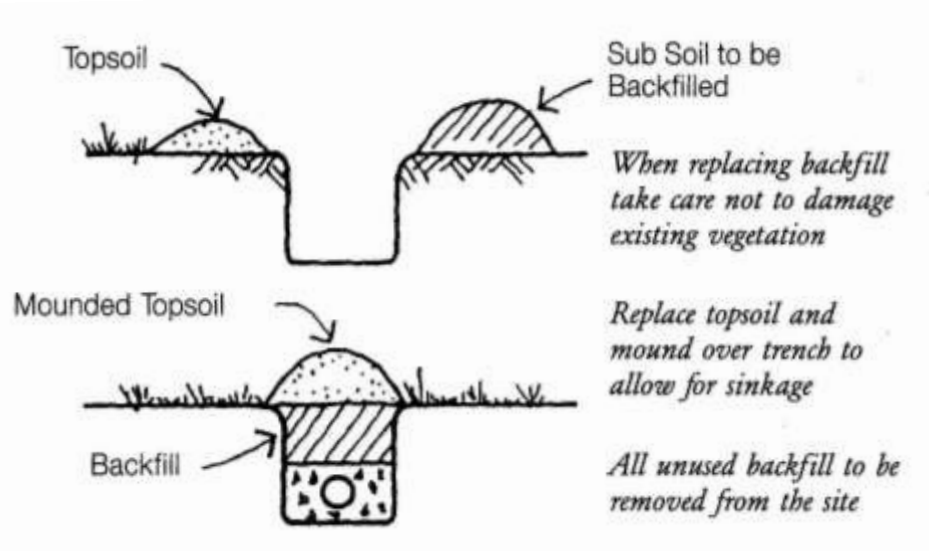


Figure 24. Correct placement of top soil and sub soil

3 VEGETATION MANAGEMENT

3.2 Vegetation removal

Objective: Remove the minimum vegetation necessary to do the job, and disturb all other vegetation as little as possible.

Guidelines

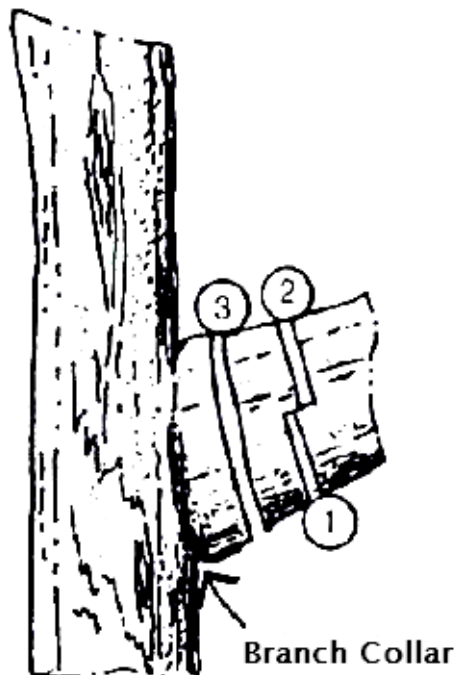
Planning and design

- Section 52.17 of the Municipal Planning Scheme requires Council to refer to the Department of Sustainability and Environment applications for a permit to clear native vegetation on roadsides. Exemptions to these controls relate to safety and road function, fire management, weed and vermin control and emergency access.
- Consider other relevant legislation: EPBC Act, FFG Act, Planning Overlays.
- Limbs which pose a threat to passing traffic (maintenance of box clearances), restrict the line of sight or are deemed a hazard are to be removed and are exempt from a planning permit.
- Where road construction or reconstruction works include the removal of vegetation, quite apart from the possible need for a permit, an Environmental Management Plan (EMP) for the works will be required along with a Task Risk Assessment (TRA).
- For further information regarding tree removal, refer to protocol (Appendix 13).

Construction and maintenance

- Identify and mark out works zone, avoid disturbing vegetation outside the works zone and construct temporary fencing if required.
- No vegetation is to be removed unless this had been approved at the planning and design stage.
- Consider habitat pruning and retention of stags.
- Use the Three Cut Method when pruning vegetation to minimise the extent of wounding.
- Timber is to be felled (using chainsaw and cherry picker) so that machinery does not enter the road reserve. If machinery has to move off the road formation or onto adjacent land this must be authorised by the responsible Council Officer or the owner of the land and should have been identified in the EMP and TRA.
- Vegetation to be felled in a safe manner that minimises damage to surrounding vegetation.
- Consider retaining logs for habitat in suitable areas. Otherwise larger felled vegetation which cannot be chipped either in a cleared area for recycling or relocated to the depot is to be left for collection by the public. In some cases, felled vegetation may have to be disposed of at a designated landfill.
- Smaller felled indigenous vegetation can be chipped and removed, or used on the site if specified.
- Where felled vegetation is to be sawn, split, or chipped, this should be undertaken with due regard to the understorey. Restrict these activities to as few sites as possible and use a cleared site if one is available close by.

- Noxious and environmental weeds are to be taken to designated landfill or green waste.
- Do not grub out tree stumps in environmentally sensitive areas or stumps that provide habitat. If stumps have to be removed for fire prevention works such as slashing they should be cut level with the ground or treated by a stump eater. Such activities and especially access by vehicles for these purposes need to be specified in the EMP and TRA.
- Tree stumps of no habitat value left after pruning or vegetation removal are to be cut as close to the ground as possible unless located where regrowth is desirable and likely to occur. Again these activities need to be specified in the EMP and TRA.



The Three Cut Method of pruning limbs is designed to minimise damage to the tree and the area exposed as a result of a limb being removed. The first cut is applied to the underneath of the limb to be removed to a depth of approximately a third into the limb or to the point where the weight of the limb prevents any further cutting. The second cut occurs on the top of the limb immediately above the undercut. This cuts through the rest of the limb and the previous undercut ensures that the severed limb falls cleanly without tearing any bark from the limb stub or trunk of the tree. The third cut removes the limb stub to a point which minimises the area of the trunk or limb stub exposed to the air, which in turn minimises the opportunity for disease organisms to enter the tree. It also allows effective callousing and future incorporation into the trunk.

Figure 25. Three cut method for removing large limbs and branches.

3.3 Removal of dead vegetation

Objective: Maintain habitat values of dead vegetation by only removing if it poses a risk to public safety or a high fire hazard.

Guidelines

A. Planning and design

- Removal of dead vegetation requires a planning permit unless exemptions apply.

B. Construction and maintenance

- Dead limbs overhanging box clearances are to be removed only after assessing public safety and environmental values.
- Council develops a storm damage response procedure for clearing roadsides of tree branches and foliage remaining after Council, SES/CFA crews have cleared away fallen trees.
- Hollows in dead trees and stumps often provide important habitat to native animals. Consider habitat pruning of dead vegetation where pruning is required.

- Retain felled limbs containing hollows on site for wildlife habitat or consult with the Environmental Works Unit for another site where limbs can be relocated so that they can continue to provide habitat.
- Unless exemptions apply, do not 'tidy up' areas of indigenous vegetation, leaf litter, rocks, trees with hollows, naturally fallen limbs and dead vegetation at various stages of decay, standing pools and marshy ground. These all provide quality habitat for wildlife and should be retained on the roadside. Consult with Coordinator Environmental Works and the Municipal Fire Prevention Officer if uncertain.

3.4 Vegetation and fire management

Section 4.1 in Part 1 outlined and discussed fire risk management for roadsides in Nillumbik. The purpose of this section is to overview operational procedures and guidelines for assisting with roadside fire risk management.

Roadside fuel reduction works are likely to be carried out either by local CFA brigades, Council or by adjacent residents concerned about fuel levels. In the latter case, under Local Law No. 5, a permit is required for the works (see section 1.6.3 in Part 1). Removal of native vegetation for fuel reduction requires a permit unless exemptions apply.

Exemptions for fuel reduction works include:

- documented works under the *Municipal Fire Prevention Plan* (to be superseded by the Municipal Fire Management Plan)
- exemptions under Nillumbik's Local Law No. 5 (see section 1.6.3 of Part 1)
- necessary works resulting from a fire prevention notice
- specific exemptions under the Nillumbik Planning Scheme.

Objective: Ensure fuel reduction works are planned with a clear and beneficial purpose and meet the objectives set for the particular road and that the works are carried out with minimal disturbance to the ground and existing native vegetation, and does not result in the spread or introduction of weed species.

Guidelines

A. Planning and design

- Works other than resident-initiated works under Local Law No. 5 need to be designated under the *Municipal Fire Prevention Plan* (to be superseded by the Municipal Fire Management Plan).
- All fire prevention/fuel reduction works should be undertaken with consideration of the Conservation Value of the specific roadside reserve, and any other unique features including value as habitat and occurrence of rare or threatened species. If fire prevention works are required on roadsides of High or Medium Conservation Value consultation with the Coordinator Environmental Works should be undertaken.
- When planning fuel reduction works consider the following.
 - o Utilising CFA's *Roadside Fire Management Guidelines* (2001).
 - o Where possible implement fuel management on Low and Medium-Low Conservation Value roadsides and avoid fuel management on High and Medium Conservation Value roadsides and strategic wildlife corridors. If fuel management is required on High or Medium Conservation Value

roadsides this should be planned in partnership with the Coordinator Environmental Works.

- o Consider locating fuel management on adjacent land when roadsides are of High or Medium Conservation Value.
- o Carefully consider fuel management works on roadsides where fuels on adjacent land are low and therefore wildfire potential is reduced.
- o Locate fuse breaks at road junctions, driveways, stream crossings or where powerlines cross to minimise ground and vegetation disturbance.
- o Where possible fuel reduction works should target reduction in exotic rather than indigenous flora, particularly addressing exotic pasture grasses and woody weeds.
- o Regenerating indigenous vegetation should be retained where it does not conflict with fuel management specifications.
- o Consider fuel reduction burns to be on a comparable rotation with ecological burning regimes.
- o Consider habitat and presence of rare or threatened flora and fauna.
- o Identify areas of regenerating vegetation prior to fuel reduction works and seek advice from the Municipal Fire Prevention Officer and Coordinator Environmental Works on whether this vegetation is a fire hazard or needs to be protected.

B. Construction and maintenance

- High and Medium Conservation Value roadsides:
 - o where practicable fuel management works to be undertaken with hand-held machinery
 - o no soil disturbance unless in the event of an emergency
 - o undertake works when soils are dry to minimise disturbance
 - o target removal of exotic rather than native flora and consider how management techniques can be modified to limit weed spread.
- Management techniques on High and Medium Value roadsides include:
 - o Burning:
 - burning regimes are to be determined by the ecological values of the roadside
 - periodic burning removes fine fuels and is particularly appropriate for roadsides dominated by native grasses
 - consult with the Municipal Fire Prevention Officer and the Environment Officer for guidance on burning intervals and time of year and specify in EMP
 - if burning is undertaken, it should be followed up with a comprehensive weed control program.
 - o Slashing/brush-cutting:
 - slashing/brush-cutting of understorey to be timed so that flowering and seeding of indigenous flora is permitted every second year. A reasonable regime being alternate slashing during September-November or during January-February

following seed set of grasses. Blades on machines are to be set no lower than 200 millimetres.

- o Manual techniques:
 - thinning of midstorey using handheld machinery (i.e. chainsaw, bladed brush-cutter)
 - removal of twigs, thin branches, and fallen bark by hand without disturbance to soil.
- Low and Medium-Low Value roadsides:
 - o on Priority or Fuel Modified roads (as defined by the Municipal Fire Prevention Plan) , fine fuels can be reduced by slashing grass, where there is sufficient width, to a minimum of three metres behind guide posts and to a height no lower than 100 millimetres
 - o target removal of exotic flora and examine management techniques that limit weed spread
 - o consider how habitat loss can be minimised
 - o select smaller equipment for slashing exotic grasses co-located with remnant trees or midstorey
 - o if burning is undertaken, it must be followed up with a comprehensive weed control program.

4 SERVICE AUTHORITIES

Installing new services and maintaining them can require substantial vegetation clearing which may also initiate erosion, weed spread and expose remaining vegetation to damage from winds.

Objective: Compliance with the Operational guidelines for all works on road reserves carried out by service authorities and contractors, including methods of undertaking works, vegetation removal and rehabilitation of work sites.

Guidelines

A. Planning and design

- At the time of a planning application or at notification of works commencement, Council will provide the service authority with a copy of the Operational guidelines, in addition to a map indicating the conservation value of the roadsides subject to works.
- Where beneficial, Council will investigate sharing of other relevant data with service authorities including weed mapping and rare or threatened species locations.
- When notified of specific works Council will consider any other specific areas of environmental concern where special management practices may be necessary, including rare or threatened species of flora and fauna, wildlife habitat, occurrences of priority weeds or disease organisms such as Cinnamon fungus. An Environmental Management Plan and a Task Risk Assessment will be required to be prepared by service authorities for approval prior to commencement of works.
- Where possible, new services on roadsides are to be located where least native vegetation disturbance will occur with consideration being given to location on the least significant side of the road or on abutting land that has been cleared. This may have various positive implications including: reduced environmental impact; lower construction costs; reduced maintenance costs; and possible trench sharing.
- Council reserves the right to enter into particular agreements with service authorities.
- Where a service installation is to be located on a High Value roadside, it may be necessary to undertake the Issue Resolution Procedure set out in Appendix 5, Part 2. Alternative sites may also need to be considered where high value sites could potentially be impacted.

B. Construction and maintenance

- Trees which present a long term maintenance problem by continually growing into powerlines, should be removed rather than pruned, and then replaced with more suitable lower growing species.
- Do not disturb any other vegetation except that which is necessary to undertake the works and which has been approved.

4.2 Cooperation amongst authorities and managers

Objective: to ensure that the relevant authorities are informed of the roadside management issues and guidelines documented in this plan

4.2.1 Adjacent municipalities and other land-management authorities

Where the Shire of Nillumbik shares a road boundary with another municipality (City of Banyule, City of Whittlesea, Shire of Yarra Ranges) or authority (VicRoads, DSE, Melbourne Water), it is important that prior to any works by any agency, they are aware of the values of the roadside and objectives and guidelines of this management plan.

General guidelines

- Ensure consultation between the relevant municipalities and authorities to provide works and maintenance programs consistent with the policies, strategies and/or roadside management plans of those authorities.
- Encourage inter-council/inter-authority engagement and liaison to share information and management tools.
- Encourage inter-council/inter-authority cooperation in identifying, protecting, and enhancing roadside vegetation and wildlife corridors across the broader landscape

4.2.2 Service authorities and Council contractors

Service Authorities with assets within road reserves include:

- water authorities – sewer pits, trenches and pipes, water supply valves, hydrants and pipelines
- gas – pits and pipelines
- VicTrack – rail tracks, crossings and signage used by both pedestrians and vehicles
- Telstra and other communication providers – poles, overhead and underground cables, pits and trenches
- electricity – poles, overhead and underground? electric cables, sub stations, pits and trenches
- VicRoads – pavements, surfaces, road drainage, kerb and channel and signage.

Successful implementation of this Plan requires knowledge of and adherence by all personnel involved with management of roadsides in the Shire. Prior to any work, Council should ensure contractors and service authorities are aware of this *Roadside Management Plan* and understand the requirements for its implementation.

General guidelines

- Council will ensure relevant authorities are informed of this Plan and investigate the potential for a formal agreement ensuring works are undertaken in accordance with its provisions.

5 SIGNIFICANT ROADSIDE AREAS

Significant Roadside Areas are those that have significant landscape, historic or conservation value (see 3.1 in Part 1).

Objective: Ensure the protection of significant roadside areas through signage and informing of Council works crews and contractors of locations and special management considerations and requirements and their enforcement.

A. Planning and design

- Tenders for works will be informed by information from Council regarding the values of significant roadside areas subject to works and the need to prepare an EMP and TRA should the tender be accepted.
- Roadside markers, signage and/or GPS tracking may be used in areas have high or medium conservation value.

B. Construction and maintenance

- Temporary fencing may be necessary to protect plants under immediate threat from new or ongoing construction and maintenance activities. In some areas permanent fencing may be necessary.

6 PEST PLANT MANAGEMENT

Objective: Prevent the further spread of weeds and maintain the diversity of indigenous vegetation and wildlife habitat in accordance with the *Nillumbik Weed Action Plan*.

Guidelines

A. Planning and design

- Adopt a biosecurity approach and the broad weed management objectives as outlined in Section 0 of Part 1 to controlling weeds on roadsides.
- Comply with the *Nillumbik Weed Action Plan 2008*.
- Where weeds require transport for disposal a contravention of the CaLP Act (1994) Section 71 may arise, seek advice from the Catchment Management Authority and address under the EMP and TRA. Incorporate a clause in Council's Works Specifications for Council and contractor works that requires safe movement and disposal of noxious weed propagules.
- Investigate signage (such as the Enviromark system developed by Greening Australia, Tasmania) and implementation with portable GIS hardware to indicate to Council and other authority's contractors the specific management issues relating to that section of roadside and consequent modification of management techniques.

B. Construction and maintenance

- Works must be undertaken by an approved contractor familiar with: weed identification; occupational health and safety obligations regarding the use of herbicides and equipment; and obligations under the *Road Management Act 2004* and the *Road Safety Act 1986* relating to works undertaken in road reserves.
- Works undertaken to control weeds should: avoid disturbing native vegetation and soil; utilise the most effective and cost efficient method, including

environmental cost considering effect on non-target species; treat isolated weeds or patches before the heavily infested sites; avoid removal of weeds after they have set seed in order to avoid spread; dispose of weeds so as not to cause further infestation offsite; and ensure follow up to prevent re-infestation.

- To minimise the spread of weeds and as one of a number of issues to be addressed under the EMP and TRA, contractors will indicate:
 - operationally feasible measures are implemented to clean vehicles and machinery of soil and vegetative material prior to arriving at the site so as not to spread weed seed, especially stipoid weeds.
 - all mulch, soil or other material brought on site is from reputable dealers and as free of weed seed and other propagules as possible
- In removing weeds take care not to damage habitat shelter for indigenous birds and animals, where the weed in question provides the only shelter. Control weeds in stages and revegetate with indigenous plants.
- Where operationally feasible, seek opportunities to modify existing slashing programs to reduce weed cover and encourage establishment of native species.

7 RECREATIONAL TRAILS

Objective: Recognise the importance of roads and roadsides for recreational use and be mindful of the Conservation Value of the roadside in which they are located.

General guidelines

- Recreational clubs and commercial enterprises wishing to use existing roadside trails for club events or commercial purposes are recommended to consult with Council prior to use. If there are no existing roadside trails on the proposed routes, Council must be consulted on the route.
- Proposed formal recreational trails have been identified in the Nillumbik Trails Strategy 2011. As outlined in the Trails Strategy design and construction of these trails should attempt to avoid or minimise impacts on native vegetation on High and Medium Conservation Value roadsides.
- If an existing or proposed on-road formal recreational trail has been identified in the Nillumbik Trails Strategy 2011, and if road sealing is proposed along that section, a suitable trail on the roadside must be considered as part of the scope of works, with due consideration given to the Conservation Value of the roadside.
- Prior to any road sealing, the current recreational use of the road must be established. Where road sealing is proposed along a rural road and recreational values have been identified, the issue will be referred to Council's Recreation Trails Advisory Committee (RTAC) to look at making provision for an off-road trail or if impossible, an alternative link. Any recommendation from RTAC will be referred to Council for consideration.
- All recreational users of roadside trails should minimise impacts upon native vegetation within the roadside.
- Trail-bikes are not permitted on roadsides.

8 REFERENCES

ARRB Transport Research (2002). *Environmental practices manual for rural sealed and unsealed roads: managing the roadside environment including erosion, sediment, drainage and vegetation*. Vermont South, Victoria

Cardinia, Casey and Mornington Peninsula Councils and EPA (2004) *Sediment Control on Unsealed Roads: A Handbook of Practical Guidelines for Improving Stormwater Quality*. Cardinia Shire Council, Victoria

Wong, T., Breen, P. and Lloyd, S. (2000) *Water Sensitive Road Design – Design Options for Improving Stormwater Quality of Road Runoff – Technical Report 00/1*. Cooperative Research Centre for Catchment Hydrology

APPENDIX 11. ENVIRONMENTAL IMPACTS / PRELIMINARY SCOPING FORM

The form below indicates some of the environmental impacts that need to be considered prior to undertaking any roadside works and should assist with consideration of planning and design elements.

PROJECT DETAILS	
Project Title:	
Description of proposed works or undertakings:	
Location of proposed works or undertakings:	
Postcode:	Melway Ref:
Background to proposed works; including reasons and/or need:	
Factors influencing design of, proposals for works:	

SECTION A1 – SOIL DISTURBANCE		
<p>Will project cause disturbance to soil? Soil disturbance includes:</p> <ul style="list-style-type: none"> Erosion – Is the site subject to erosion? Stormwater run-off – Will surface water leave the site? Flooding – Could it occur on or off the site as a result of works? Sedimentation/ siltation – Is sediment likely to leave the site when it rains? Subsurface water – Will it be affected? Dust – Will it be an issue during dry weather? Utility installation (e.g. water, power) Revegetation – will site require revegetation? Stockpiling – of excess materials 	No	No affects. Go to SECTION A2
	Yes	Describe likely extent and nature of soil disturbance:
Describe impacts arising from disturbance to soil and how the project will respond to these:		
SECTION A2 – VEGETATION PROTECTION and ENHANCEMENT		
Will project affect vegetation?	No	Go to SECTION A3
	Yes	Describe how any vegetation will be affected:
<p>Has the vegetation been assessed for quality and significance? <i>Attach any supporting 'significance' documentation</i></p>	No	Assessment required
	Yes	If yes, indicate by whom and what were the outcomes/ recommendations

Will project works involve:

<input type="checkbox"/> Removal of vegetation	<input type="checkbox"/> Tidying up site
<input type="checkbox"/> Trimming of vegetation	<input type="checkbox"/> Machinery activities
<input type="checkbox"/> Slashing of vegetation	<input type="checkbox"/> Stockpiles
<input type="checkbox"/> Disturbance of weeds	<input type="checkbox"/> Revegetation
<input type="checkbox"/> Working adjacent to vegetation	

Describe impacts on vegetation and how the project will respond to these:

SECTION A3 – FAUNA AND/OR WILDLIFE HABITAT PROTECTION

Will project affect native fauna or wildlife habitat? Will it directly disturb (or be adjacent to) wildlife habitat or a corridor?	No	No affects. Go to next question.
	Yes	Describe native fauna/habitat present at works site and how it will be affected:

Will project works be adjacent to or affect wildlife habitat or corridors	No	No affects. Go to SECTION A4
	Yes	Describe impacts on native fauna or wildlife habitat and how the project will respond to these:

SECTION A4 – PROTECTION OF WATER QUALITY		
Will the project affect water quality?	No	No affects. Go to Section A5
	Yes	Describe how the project is likely to affect water quality.
Where does water from project site flow to? <ul style="list-style-type: none"> <input type="checkbox"/> Into a creek, stream or river <input type="checkbox"/> Into a gully <input type="checkbox"/> Into private property <input type="checkbox"/> Into a stormwater drain 		
How will water quality be affected? <ul style="list-style-type: none"> <input type="checkbox"/> Additional stormwater flow from site <input type="checkbox"/> Siltation from site <input type="checkbox"/> Spread of weed seed from site <input type="checkbox"/> Is 'greywater' (sullage) evident? 		
Describe impacts on water quality and how the project will respond to these:		
SECTION A5 – MACHINERY ACTIVITIES		
Will the project involve the use of machinery?	No	Go to Section A6
	Yes	Describe what (and how) machinery will be used in carrying out the works.

Machinery requirements:

- Will it be confined to the site?
- Will a compound/depot be required?
- Will a parking area be required?
- Will a turnaround area be required?
- Will an access track be required?
- Will it be brought from another site?
- Will it require machinery selection?

Describe the impacts of machinery and how the project will respond to these:

SECTION A6 – OFF SITE AFFECTS

Will the project be affecting 'off site' areas?	No	Go to Section A7
	Yes	Describe what are the likely 'off site' affects from carrying out the works

How will 'off site' property most likely be affected?

- Will landscape outlook be altered?
- Will silt enter the property?
- Will weeds be introduced?
- Will there be dust?

Describe impacts on 'off site' property and how the project will respond to these:

SECTION A7 – SOCIAL, CULTURAL, HERITAGE and LANDSCAPE IMPACTS		
Are you aware if project will have any impact on any designated site of cultural, heritage or landscape significance?	No	Check with Land Use Strategy and Services Department
	Yes	Describe the nature of the significance and any statutory requirements:
Will the project have an impact on a designated site of cultural, heritage or landscape significance? If project is likely to have an impact on a designated site of cultural, heritage or landscape significance, has the project been referred for comment?	No	No affect
	Yes	What were the comments/ recommendations received and how have they been responded to?
Will the project have an impact on a formal or informal recreational trail?	No	No affect
	Yes	Describe the impacts on recreational values and how the project will respond to these.
Section A - Assessment Complete		

SECTION B – VEGETATION AND WILDLIFE HABITAT			
Is the vegetation:	No	Yes	Description
Species			
Native			
Exotic			
Wetlands			
Environmental and/or Noxious Weeds			
Vegetation type			
Trees			
Shrubs			
Groundcover			
Grasses			
Vegetation Significance			
Botanical Significance			
Zoological Significance			
Landscape Significance			
Heritage Significance			
Does the vegetation provide habitat:	No	Yes	
Hollow logs?			
Bushes?			
Leaf litter?			
Rocks and crevices?			
Trees with hollows?			
Dead vegetation?			
Pools of water?			
Marshy land?			
Does the vegetation provide a habitat link?			

APPENDIX 12. ISSUE RESOLUTION PROCEDURE

This procedure is used when the proposed use or development of a road or roadside reserve, or maintenance procedures related to road safety may have a significant impact on other roadside values. A reasonable period of time should be allocated to this procedure so that site values can be properly assessed and the various alternative options evaluated. At least one site visit may be necessary as well as the formation of a temporary working or consultative group representing the range of interested parties involved.

The temporary working group should include appropriate Council officers, contractor and works supervisor, appropriate expert opinion such as botanist, wildlife ecologist, CFA, services representatives as well as the adjoining landholder if works on private land could form part of the solution.

The following flow chart shows the sequence of steps to take to ensure that all possible aspects of the issue have been accounted for and that the site's particular values are acknowledged in determining the most satisfactory solution for the proposed works.

The accompanying potential impact assessment table or matrix is a useful checklist to have for the initial site visit. For example, if road widening is proposed and the section of the road has been identified as the site of a rare plant, the matrix can help identify other impacts such as the roadside vegetation acting as a windbreak for the adjoining property and/or if it is the only roadside vegetation remaining in the immediate area. Alternatively, if the site is of low conservation value, is very weedy but has a good landscape value, then the conditions of road widening would focus on preserving the landscape value. Provided all other works were carried out under the Operational guidelines, then the road widening proposal would be relatively straightforward.

For each particular situation it will be necessary to consider and work through, a range of options, scenarios, alternatives and solutions, including relevant legislation. Follow-up monitoring and evaluation must also be built into the implementation of any proposed solution. An example of the procedure is given as a guide below.

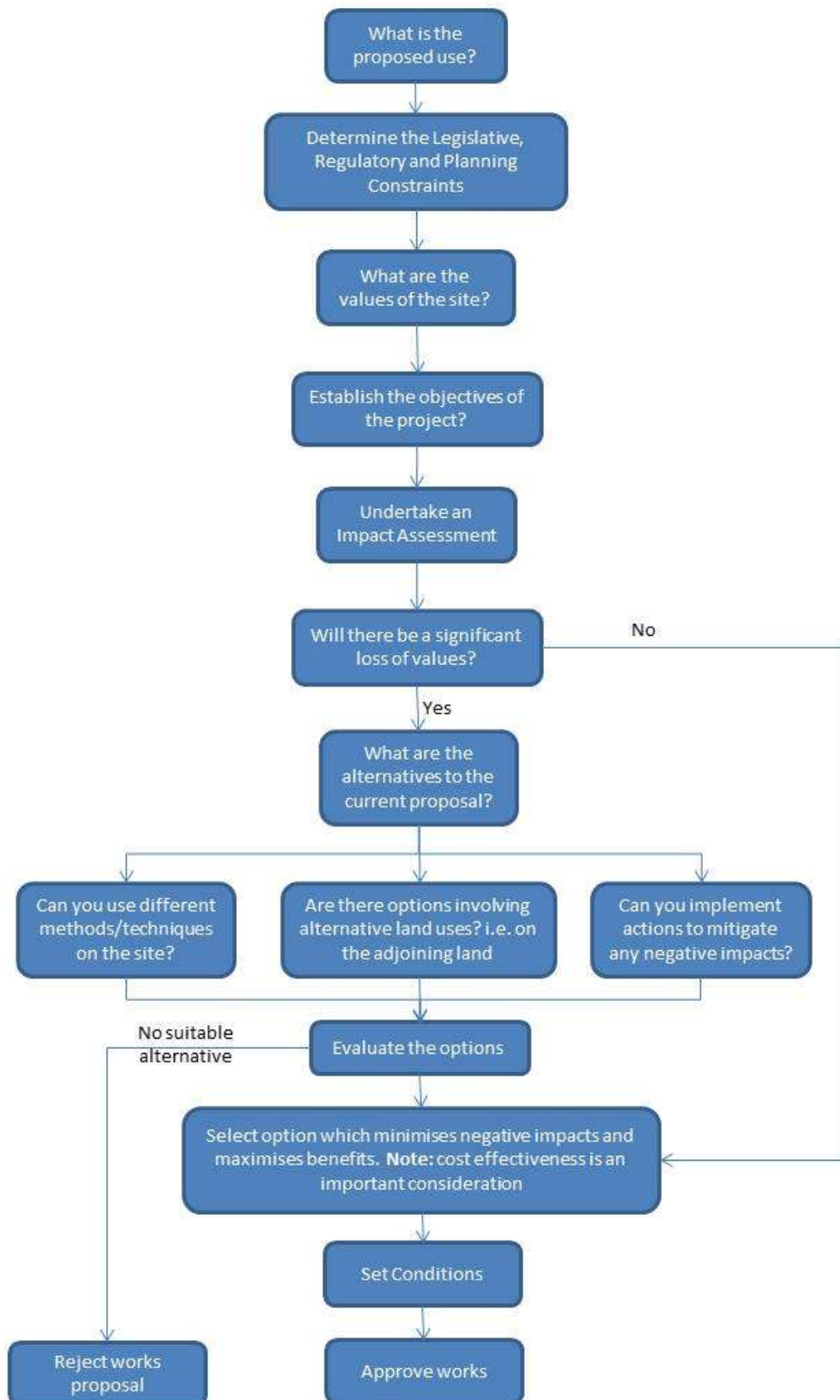


Figure 26. Issue Resolution Procedure

Issue Resolution Impacts Form																					
Date:		Location:																			
Unit:																					
AMG Grid Reference:										Melway reference:											
Road type: (Circle)		Sealed					Unsealed														
Road classification: (Circle)		Freeway		Primary			Secondary			Local Collector			Non-trafficable			Proposed					
Traffic density: (Circle)		Heavy					Medium					Light									
Name of recorder:																					
Other comments:																					
Use and Development Categories	<i>detailed use and development</i>																				
	safe passage for all road users																				
	access to properties																				
	threatened flora																				
	threatened fauna																				
	non-threatened flora																				
	non-threatened fauna																				
	habitat corridor																				
	landscape value																				
	fire protection-firebreak/barrier																				
	livestock movement																				
	windbreak, shade, shelter																				
	food supply for domestic livestock																				
	convenient location for utility services																				
	cultural interest																				
	recreation-way-side picnic spots																				
	groundwater uptake																				
	seed source for nurseries/landcare groups/shire																				
	trails and pathways																				
	protection from erosion/sediment run-off																				
	intactness of roadside vegetation																				
	impact summary																				
Road Development and Maintenance	road construction/widening																				
	machinery access/turnaround parking																				
	vehicle and machinery activity																				

How to use the Issues resolution impacts form

The values at the top of the table may be impacted upon by use or development; and the developments or usage are listed down the left side of the table.

The level of potential impact should be determined for each of the values across the table for a particular development or activity.

The level of this potential impact is dependent on a number of factors which include:

- size or amount of development or use
- level of the value that is being influenced (i.e. level of impact).

The level of impact may be shown as:

High	H
Medium	M
Low	L
Not relevant to this roadside	N
Unclear, seek further information	U

Levels of impact may be shown as positive (+) or negative (-).