PINE RIVERS SHIRE COUNCIL

PLANNING SCHEME POLICY 28

CIVIL INFRASTRUCTURE DESIGN

DESIGN GUIDELINES

DG 01	Roundabouts
DG 02	Engineering Drawings
DG 03	As Constructed Information
DG 04	Local Area Traffic Management
DG 05	Pavement Design
DG 06	**Recreational Trails – Planning, Construction and Maintenance**
DG T10	Landscape Construction on Road Reserves, Parks and Drainage Reserves
DG T11	On-Site Carparking and Service Vehicle Facilities

PINE RIVERS SHIRE COUNCIL

DESIGN GUIDELINES

DG 06

RECREATIONAL TRAILS PLANNING, CONSTRUCTION AND MAINTENANCE

PINE RIVERS SHIRE COUNCIL

DG 06 - DESIGN GUIDELINE FOR RECREATIONAL TRAILS – PLANNING, CONSTRUCTION AND MAINTENANCE

DG 06
RECREATIONAL TRAILS PLANNING, CONSTRUCTION AND MAINTENANCE

.0 INTRODUCTION

These design guidelines have been prepared as part of a Trail Master Plan for the Pine Rivers Shire which also incorporates a Trails Atlas and a Recreation Trail Strategy.

The guidelines provide a framework upon which construction and maintenance of trails can be planned and managed throughout the Pine Rivers Shire Council.

1.1.0 PURPOSE

The purpose of this design guideline is to:-

- provide a frame work for the assessment of recreation trails within the Pine Rivers Shire
- provide a process for evaluation of the environmental and landscape values and potential impacts on these values within a proposed recreation trail route
- provide a process for assessing and managing social, cultural and historic values that may be impacted by a proposed recreation trail route
- provide planning, construction and maintenance guidelines for recreation trails within the Pine Rivers Shire

2.0.0 LANDSCAPE SETTING DESCRIPTION

Land which may host trails within the Pine Rivers Shire Council includes a variety of landscape settings, each of which have a unique set of attributes.

2.1.0 WATERWAYS

Waterway corridors provide one of the strongest connections between geographic areas and between various communities within the Pine Rivers Shire. Waterway corridors are usually brought into the publicly owned open space network within the Pine Rivers Shire as part of the development assessment and approval process.

The Pine Rivers Shire has several significant waterway corridors within it boundaries including:-

- North Pine River
- South Pine River
- Cedar Creek
- Four Mile Creek
- One Mile Creek
- Lacey's Creek
- Freshwater Creek

Waterway corridors have many functions apart from the provision of open space including:-

- flood water conveyance
- ecological corridors between larger areas of remnant bushland
- important habitats for aquatic and semi-aquatic fauna and flora species
- remnant areas of riparian vegetation
- provision of visual amenity for local and visitors to the shire waterways
- water quality filtration

The location of recreation trails within open space area along waterways should only be undertaken with all the above functions taken into consideration. One of the significant constraints upon trail proposals involving waterways is the potential of introducing further (or new) impacts to the riparian zone.

The riparian zone is that area along all waterways which is usually contained within the high banks of the creek. Within the Pine Rivers Shire, these may contain a diverse range of flora and fauna species. The riparian zone can be used to introduce key concepts, such as:-

- the importance of waterways and the need to protect their water quality
- the importance of remnant vegetation
- the concept of 'habitats', both aquatic and terrestrial
- the need for the Pine Rivers Shire Council to retain these areas within an open space network

2.2.0 BUSHLANDS

The Pine Rivers Shire has several significant areas of bushland outside of those areas identified along the major waterways within the Pine Rivers Shire.

This bushland occupies several ridgelines and hilltops, particularly in western areas of the Pine Rivers Shire. However, there are also significant areas of bushland/wetland, which are associated with Hayes Inlet which forms the eastern Pine Rivers Shire boundary with Redcliffe City.

In terms of these Recreation Trail Design Guidelines, the key issues associated with bushland areas include:-

- recognition of important vegetation communities and minimisation of impact upon the same
- potential fragmentation of remnant vegetation
- erosion and other on-trail impacts
- potential for introduction of diseases and pests
- impacts on the habitat of local fauna

Conversely, bushland areas can provide important opportunities for locals and visitors alike to come to know and understand the natural values of these areas, through a carefully managed program of trail development and interpretation.

2.3.0 URBAN OPEN SPACE

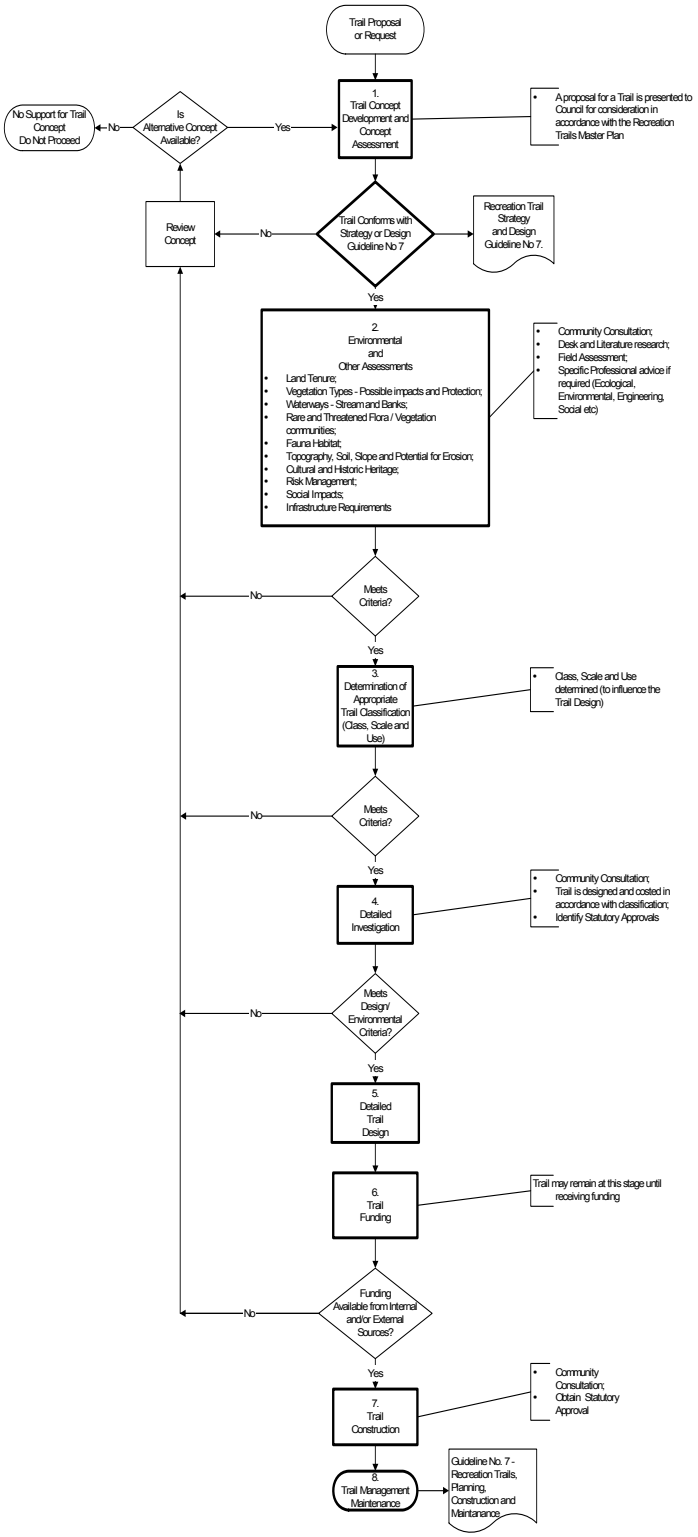
The urban/rural interface is predominantly located in a line which runs north-south through Eaton's Hill. The areas to the east of this line are largely residential while the areas to the west include properties which are larger and more rural in nature.

Trail proposals that traverse this interface need to consider the potential catchment of local trail users and proximity to rural land holdings. It is noted that apart from State Forest the majority of available open space in these areas is located along waterways.

It could therefore be difficult to develop short trail circuits for local communities, as trail opportunities within the rural areas are restricted to fewer portions of publicly owned open space. Therefore, it is likely that trails in this landform type will be longer circuits or through-routes.

3.0.0 THE TRAIL DEVELOPMENT PROCESS

3.1.0 FLOW CHART



3.2.0 TRAIL CONCEPT

When a trail proposal is presented to the Pine Rivers Shire Council as part of the Pine Rivers Trails Master Plan, or is proposed by a particular user group or organisation from within (or beyond) the Pine Rivers Shire, an initial assessment of the proposal is required, to ensure that it is broadly coherent with the Trail Master Plan and that it does not obviously generate inordinate negative impacts. Immediate reference should be made to the Pine Rivers Trails Master Plan and Trails Atlas for direct guidance on the proposal to hand, or for generic guidelines relating to the concept.

Some initial assessment of likely demand is warranted, and again the Master Plan should be of assistance in identifying desired routes and likely user groups. In essence, the proposal must pass a broad 'first cut' filtering process based on information provided in the Master Plan and upon local knowledge.

3.3.0 TRAIL ASSESSMENT

The trail assessment process is the most important stage of trail planning. These issues are examined in detail below and include:-

- Who is the likely primary user group; where are they coming from and how will they access the trail?
- What is the **location** of the proposed trail within the Pine Rivers Shire e.g. is it along a creek, along a ridgeline or along a road reserve (formed and/or unformed)?
- Does the proposed trail provide a recreational **link** between one community to another, and does it link into areas outside of an urban nature?
- Does the area contain **significant vegetation** as mapped by the State and/or Pine Rivers Shire Council;
- What is the location of the proposed trail with respect to any nearby **waterways?**
- What is the land **tenure** upon which the proposed trail is to be located?
- Are there **cultural** and/or **historic** sites/values that the proposed trail is to pass?
- What are the potential **social impacts** of the trail?

3.4.0 ENVIRONMENT ASSESSMENT

Assessment in terms of the environment is essential in establishing a Trails Network that meets or exceeds the Pine Rivers Shire Council requirement for an environmentally sustainable network of Recreation Trails.

A qualified Environmental Scientist/Ecologist or similar is required to assess the environs of the Trail Proposal to ensure that all issues of concern are addressed appropriately, and that trail construction does not occur to the detriment of the environment. The outcome of the assessment is important in identifying areas of a trail proposal that warrant the trail alignment being modified or in extreme cases completely relocated or cancelled due to environmental issues.

Issues to be addressed include but are not limited to the following.

3.4.1 VEGETATION COMMUNITIES

The Pine Rivers Shire Council has substantial information regarding the location and level of significance of all remnant vegetation patches within the Pine Rivers Shire. This information has been documented and has been mapped at 1:25,000 scale in the Pine Rivers Shire Biodiversity Conservation Priorities documents (PRSC, 2002 unpublished).

The levels of significance of vegetation have been divided into six categories, which include:-

- endangered
- not endangered, exceptional value
- exceptional value in part
- of concern
- of concern in part
- remnant vegetation
- non-remnant vegetation

This information, along with any other site-specific information such as documented and local knowledge, must be collected and used as part of the field investigations of the proposed trail route.

3.4.2 HABITAT (TERRESTRIAL AND AQUATIC)

Habitat is directly connected to the vegetation, however habitat of some species may not be contained within vegetation which has been identified as significant within the Pine Rivers Shire Council Biodiversity Conservation Significance Priority Mapping (PRSC, 2002, unpublished).

Therefore, in conjunction with the assessment of the vegetation within the proposed trail alignment the type, size and quality of habitats provided for terrestrial, semiaquatic and aquatic fauna and flora requires assessment. This assessment should include but is not limited to strata quality and include and assessment of the understorey and groundcover.

Assessment should also include analysis of fragmentation to be caused by any proposed trail.

3.4.3 RARE AND THREATENED SPECIES (FLORA AND FAUNA)

The Pine Rivers Shire Council, along with the State Government, has some information regarding the possible presence of rare and threatened flora and fauna throughout the Pine Rivers Shire. One of the indicators of the likely presence of rare and threatened (R and T) flora and fauna is the regional ecosystem status and the level of biodiversity conservation priority the Pine Rivers Shire Council has placed on a particular area. However, as part of the field assessment the collection of information must also include actual and potential for a particular area to contain and/or support flora and fauna species.

3.4.4 IMPACTS INTRODUCED BY PROPOSED TRAIL

The impacts identified as likely results of the construction and use of a proposed trail need to be assessed against proposed benefits of the trails. Impacts should be assessed against the area's habitat type and quality. Care should be taken not to introduce adverse impacts in locations where vegetation is in good ecological conditions.

Impacts to be assessed, minimised and avoided include but are not limited to:-

- weed introduction and spread
- direct impacts from construction and maintenance
- fragmentation of habitat
- impacts to water quality
- impacts from user groups – authorised or unauthorised

Where these and other impacts cannot be mitigated to the satisfaction of the Environment Services Department and these design guidelines generally, the trail should be realigned or rejected.

3.5.0 GEOGRAPHIC ASSESSMENT

3.5.1 SOIL AND TOPOGRAPHY

As the topography and the soil type are two elements that will determine the level of development necessary to construct a trail across the landscape, it is necessary to identify and understand the opportunities and constraints they present to a trail.

This information should be included on the mapping information to be used during the field investigations as part of the proposed trails assessment.

The Pine Rivers Shire Council has soils maps of most area within the Pine Rivers Shire and the topography is also contained in mapping format.

These resources must be used in the field when assessing a proposed trail alignment and the opportunities and constraints must be recorded to assist in the analysis of field information and in the trail design stage.

Care should be taken to ground truth the mapped data when in the field.

3.5.2 GRADIENTS

Connected with the assessment of the topography and the soils is the assessment of the gradients along the proposed trail alignment. The trail gradients will need to be acceptable to users, in accordance with these guidelines (refer to Section 5.2.2 of this Design Guideline).

Trails that involve grades exceeding the absolute maximum grade or length of absolute grade are required to be assessed for acceptable solutions (i.e. steps or switchbacks). Should an acceptable solution be unachievable the trail should be realigned or should not proceed.

3.6.0 CULTURAL AND HISTORIC HERITAGE

The Cultural Heritage Coordination Unit (Queensland Government, Department of Natural Resources & Mines) guidelines shall apply in the process of trail design and construction. Relevant information obtained through cultural heritage search requests or discussions with appropriate tribal representatives shall be included with the environmental and other assessment information as part of the trail development process.

Should an artefact be located (during trail design or construction), which is not mapped and may be either of cultural or historic significance, the location should be recorded using GPS and photographed in-situ. The information should be delivered to a suitable person within the Pine Rivers Shire Council or the State to determine it significance.

Sites of cultural and historic significance may be utilised as part of the local interest aspect of a recreation trail proposal. However, some sites may not be suitable for exposure to a recreation trail. It is important that the level of significance and exposure be determined in the trail design stage so that appropriate trail location and protection can be designed and costed as part of the trail planning.

3.7.0 LAND TENURE

Land tenure is an important element in the location of a trail. All trails should be located within public lands, which include:-

- the Pine Rivers Shire Council owned lands
- reserves which the Pine Rivers Shire Council manages
- State Lands such as National Parks, State Forest etc
- road reserves
- unallocated State Lands

As part of the trails assessment process an appropriate agreement must be obtained for the location of a trail from the respective land management agency or section within the Pine Rivers Shire Council.

3.8.0 RISK MANAGEMENT

Risk management is an important issue which needs to be assessed as part of the field assessment process. The appropriate location of recreation trails can reduce the potential risks that may be associated with a trail. Locations that may present a potential risk to recreation trails users include:-

The location of a recreation trail on top of or immediately below a cliff face:-

- narrow ridges
- steeply sloping lands
- creek crossings
- boggy wet soil
- road crossings

The level of potential risk needs to be assessed and taken into consideration in the trail alignment and/or design.

3.9.0 SOCIAL IMPACTS

Social impact are those impacts which are associated with a trail in terms of the impacts on the trail user or impacts a trail has on persons who live adjacent to a trail.

3.9.1 ADJOINING SOCIAL IMPACTS

Pine Rivers Shire Council requires written notification to be provided to landholders adjoining a proposed recreation trail.

Therefore, the potential impacts of a trail to adjoining landholders will need to be considered in the trail assessment stage. Where possible, those adjoining landholders should be provided the opportunity to participate in the trails assessment and design stages to ensure their concerns and needs are fully considered.

This consideration should also extend to the siting and development of associated infrastructure for a trail such as car parking, rest points, trail heads etc.

3.9.2 ON-TRAIL SOCIAL IMPACTS

Social impacts also occur along a trail and these impacts predominantly involve the interaction between users and user groups. For example, the interaction between walkers and bike riders along a trail needs to be considered particularly with Class 2 and Class 3 trails.

The trail design and classification needs to identify possible locations where conflicts between trail users may occur, e.g. steeply sloping sections or tight corners and allowance made to minimise these potential social impacts.

The other social impact is from the surrounding land use on a trail user. This may be in the form of impact on visual amenity from views of houses or other structures and noise impacts from machinery and vehicles or other residential noise.

3.10.0 INFRASTRUCTURE REQUIREMENTS

The trails assessment stage must also identify all infrastructure requirements that will be necessary for the construction of a trail. The trail data sheet should provide an indication of the size and quantity of various infrastructure elements required within the trail so that these can be included into the design and costing stages of the trail. These infrastructure requirements include:-

- car, bike and horse float parking
- signage
- bridges/boardwalks
- creek crossings
- trail surfacing
- in-trail infrastructure such as steps, ramps etc.

4.0.0 TRAIL CLASSIFICATION

4.1.0 CLASSIFICATION

The class of the trail will depend on the landscape through which it is to traverse and upon the user group for whom the trail is being planned. Early reference should be made to the Master Plan for guidance with regards to appropriate classifications for specific trails and user groups.

At the core of the classification process is the desire to ensure a comfortable and appropriate 'fit' between the trail and its users, and the trail and its host environment. Developing a Class 1 trail with high levels of infrastructure in a remote location with a relatively constrained target market is not reasonable.

In defining the trail class, a careful balance is required between infrastructure development (which can assist in protecting the environment) and minimal construction that may seem to ensure minimal impact. Consideration should also be given to the longer term issues of ongoing management and maintenance, and it is here that the value of a higher level of development may become more apparent.

It is reasonable that longer trails may incorporate more than one Class over their full length. This may indeed be appropriate, given changing environments and varying usage levels. Similarly, changes between intended use will occur over the length of some longer trails. It is essential in this case that the change point between the user types is constructed to encourage users not to use trails inappropriately.

In summary, defining the Class of the proposed trail will assist with:-

- ensuring an appropriate level of infrastructure development
- minimising environmental impacts both during the construction phase and in the longer term
- ensuring the trail meets the needs and expectations of its majority user groups
- old existing trails should be utilised wherever possible as access tracks to the construction site so as to minimise the environmental impact of the trail development

4.2.0 TRAIL CLASS DESCRIPTIONS

Not all trails are the same. Some are short and well developed, designed to cater for high numbers of less-experienced users. Others are longer, more challenging and less developed, featuring less built infrastructure. Different trail 'types' have different design and construction requirements.

Table 1 provides a description of the various classes of trails identified within the Pine Rivers Shire Council Trails Atlas and the Pine Rivers Shire Council Recreation Trails Master Plan.

For the purpose of the Recreation Trails Design Guideline, the 6 classes prescribed in Australian Standards "Walking Track Signage and Classification" have been combined into three general Classes. Additionally, these walk trail classes have been broadened to encompass cycling and horse riding, rather than producing marginally different tables of classes for individual user groups.

Table 1 – Trail Classification

PRSC Trail Classification (for all trail types and uses)	CLASS 1	CLASS 2	CLASS 3
Approximately equivalent to Australian Standards AS 2156.1-2001 (for Walking Tracks only)	AS Classes 1 and 2	AS Classes 3 and 4	AS Classes 5 and 6
Overview	Large numbers can travel easily in natural environment, with moderate - high level of interpretation and facilities. Frequent encounters with others expected	Visitors can travel in relatively undisturbed natural environments on defined and distinct trails. Need moderate fitness; interpretation not common. Occasional encounters	Visitors need good outdoor knowledge to follow less distinct trails. Frequent opportunity for solitude.
Trail conditions	Generally modified or hardened surface, relatively wide (for user group)	Generally modified surface, mostly clear of obstacles though debris and other obstacles possible. Moderate width (for user group)	Limited surface modification. Route may be indistinct in parts. Generally "single" width for user group
Trail path width	Refer Table 2	Refer Table 2	Refer Table 2
Gradient	12.5% or less Can include short steep sections with steps however, they are to be avoided if possible.	Generally 18% or less Limited to user group, environmental and maintenance considerations only.	Generally 18% or less May include steep sections with minimally modified surfaces appropriate to user group.
Direction and other signage	Frequent. Markers at all intersections. Extensive use of management and safety signs	Markers at all intersections. Occasional use of management and safety signs	Limited - only for management and safety purposes
Infrastructure	Can include seats, tables, viewing platforms, trailhead facilities and car parking.	Relatively infrequent, except for safety and environmental purposes	Generally not provided except for safety and environmental purposes
Terrain/user experience	Users need little or no previous experience; generally suited to most fitness levels	Need moderate skill level, some experience, reasonable fitness and self reliance	High degree of skill and experience required
Examples	Mungarra Reserve bike trail	Bunyaville State Forest Trails	More remote Brisbane Forest Park trails

Figure 1: Class 1 Trail

Figure 2: Class 1 Trail - Boardwalk

Figure 3: Class 2 Trail

Figure 4: Class 3 Trail

5.0.0 TRAIL DESIGN GUIDELINES

5.1.0 INTRODUCTION AND OVERVIEW

In this section, specific guidelines, acceptable solutions and requirements associated with the design and implementation of trails are given.

5.1.1 OBJECTIVES

The emphasis on fitting recreational trails to their environment requires a different approach to design with less reliance on fixed, geometric design than is necessary for roads or buildings. Trails cannot be "designed" completely in an office, and cannot – or should not – be built straight off a plan.

High levels of sensitivity and a very real 'feel' for the land are the critical elements of successful trail design. Further, a strong empathy with both the natural environment and the needs of the trail users will aid substantially in producing an appropriate 'design'.

The trail design process should build on information gathered during the earlier assessment phase. It is now that the various factors already identified must be addressed to ensure the final product is coherent with the concept – and with the entity which passed through the assessment process.

The objectives in trail design are:-

- to develop a trail which meets an expressed need within the community
- to undertake the assessment a trail to ensure it complies with the Pine Rivers Shire Council "Recreation Trails Design Guideline"
- to ensure there is consultation undertaken with the local community, proposed users groups and/or stakeholders, including traditional owners
- to design a trail which complies with the Pine Rivers Shire Council "Recreation Trails Design Guideline"
- to construct a trail which reflects to outcomes of the consultation process and complies with the Pine Rivers Shire Council open space management and trails design guidelines
- to ensure trails developed along or across waterways that waterway quality and aquatic and terrestrial habitats are protected and enhanced

5.1.2 SUMMARY OF ACCEPTABLE SOLUTIONS

(i) Gradients for trails will generally conform to those in Figure 6.

(ii) All trail surfaces are hardened with as suitable material as indicated in the following figures:-

a) Class 1 and 2 trails surface
- Hardened surface Figure 15 and 16
- Boardwalks Figure 17 and 18
- Bridges Figure 20 and 21

b) Class 3 trail surface
- Figure 19

(iii) Minimal width for trails will generally conform to those in Table 2.

(iv) All environmental practices are to conform with Section 5.3 and 5.4 of the Recreation Trails Design Guideline. In addition:-

a) Trail design must result in 0% net loss of significant vegetation within the trails corridor

b) All off-sets from top-of-bank are to be stated and justified

c) For trails proposed within top-of-bank justification must be provided for the location with alternative solutions for location, benefits and constraints of these alternative trail location solutions.

(v) All crossings across waterways are to be:-

a) Bridged (see indicative Figure 20); or

b) Where suitable infrastructure exists these need to certified as suitable for the particular use; or

c) Where suitable in-stream causeways may be appropriate for minor waterways where existing hardened access is available down the waterway bank. Justification is to be provided if these elements are to be used in the trail design.

(vi) A Trails Design Plan is to be completed and submitted to the delegated Pine Rivers Shire Council officer/s for assessment. This plan is to include:-

a) a scaled contour map

b) a detailed description of the site, including proximity to private property and adjacent land use

c) location of all significant vegetation and habitats within the proposed trails corridor e.g. within 30 metres of the edge of the disturbance line for the trail

d) details of the trail head including parking, access design and design

e) the class, user group and setting of the trail

f) the trail design specifications including engineering certification of all trail structures e.g. bridges, boardwalks and platforms

g) summary of consultation process including stakeholders consulted

h) environmental Management Plan including vegetation management, environmental weed management, fauna habitat management (aquatic and terrestrial), erosion and sediment control; hydraulic management

i) social impact mitigation practices

j) user impact management

(vii) A Site Rehabilitation Plan is to be prepared with the Trails Design Plan to rehabilitate the trails corridor during and following construction.

(viii) A Trails Signage Plan is to be attached to the trails design plan identifying type, materials and location:-

a) Directional signage

Direction signage must conform to Australian Standards for Walking Tracks Part 1 (AS2156.1-2001) and the Pine Rivers Shire Council Design Manual and Standard Drawings. The frequency of such signage is set out in the Trail Classification table (Table 1).

b) Interpretative signage

Interpretive signage should be a feature of all trails, especially those in Class 1 (and to a slightly lesser extent Class 2). It should be of a vandal-proof form, such as anodised aluminium.

c) Regulatory signage

Regulatory signage should be located at the trails heads to inform the trail users of the conditions of use. It should be of a vandal-proof form such as anodised aluminium.

5.2.0 ACCEPTABLE DESIGN SOLUTIONS

5.2.1 TRAIL SITING

The siting of the trail is arguably one of the most important aspects of trail design. As discussed earlier it is not something that can be easily accomplished sitting in an office working from a map.

The opportunity to identify and/or qualify site constraints and opportunities are best done in the field. These include environmental, heritage and social considerations, drainage issues, access for construction and maintenance, local features and other points of interest.

The amount of effort and attention to detail at this stage of planning a trail can greatly reduce problems that could eventuate as the trail work progresses. It can also greatly reduce ongoing maintenance and management costs over the longer term.

Figure 5 provides a graphic representation of the siting of the three trail classes across as sloping landscape.

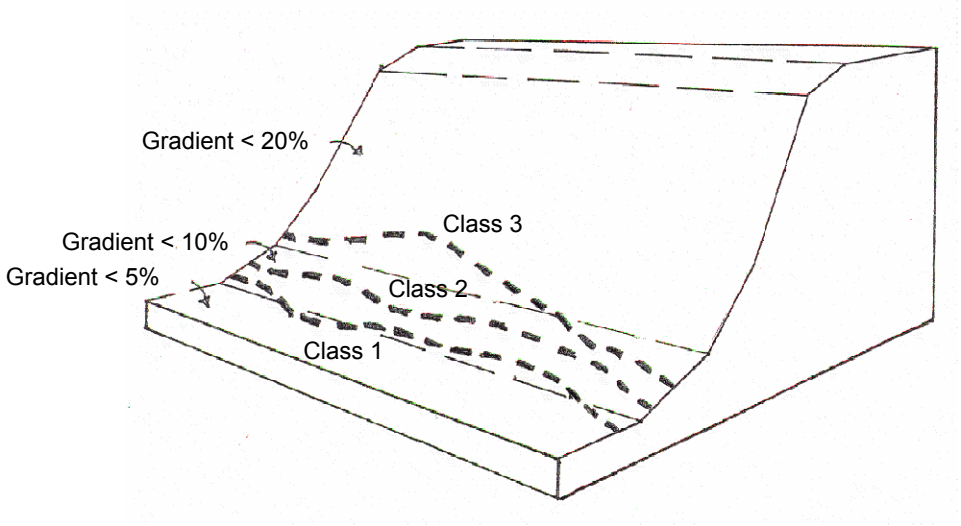


Figure 5: Siting of Trail on Sloping Land

N.B: This Figure represents the foot of a ridge or hill, not high/low banks of a waterway
(Adapted from Northern Territory Reserves Board, Park Walking Track Manual, 1977)

Trail siting aims to minimise the impact on its surrounds, while maximising user experiences.

5.2.2 TRAIL GRADING

Grading along with drainage are primary considerations in trail design. Grade considerations greatly influence erosion control measures and frequency of maintenance. (Blamey 1987).

- Minor Trail Grades: 3 to 8%
- Moderate Trail Grades: 8 to 25%
- Major Trail Grades: above 25%

Trail grades less than 3 percent may experience drainage problems. Grades of 3 to 8 percent are ideal.

Grades from 14 to 25 percent should not exceed 30 metres in length. Avoid grades approaching 30 percent unless the trail section is short and stable from erosive forces.

No grade should be so steep that erosion becomes a problem. Do not create 0 percent trail grades as falls are required for trail drainage.

Long stretches of a given grade should be avoided. The grade should undulate gently to provide natural drainage and eliminate monotonous level stretches and long steep grades tiring to the walker. (Redlands Trails Manual. EDAW)

Figure 6 shows trail grading and limits of slope for each class. These limits have been adapted from Australian Standard 2156.1-2001.

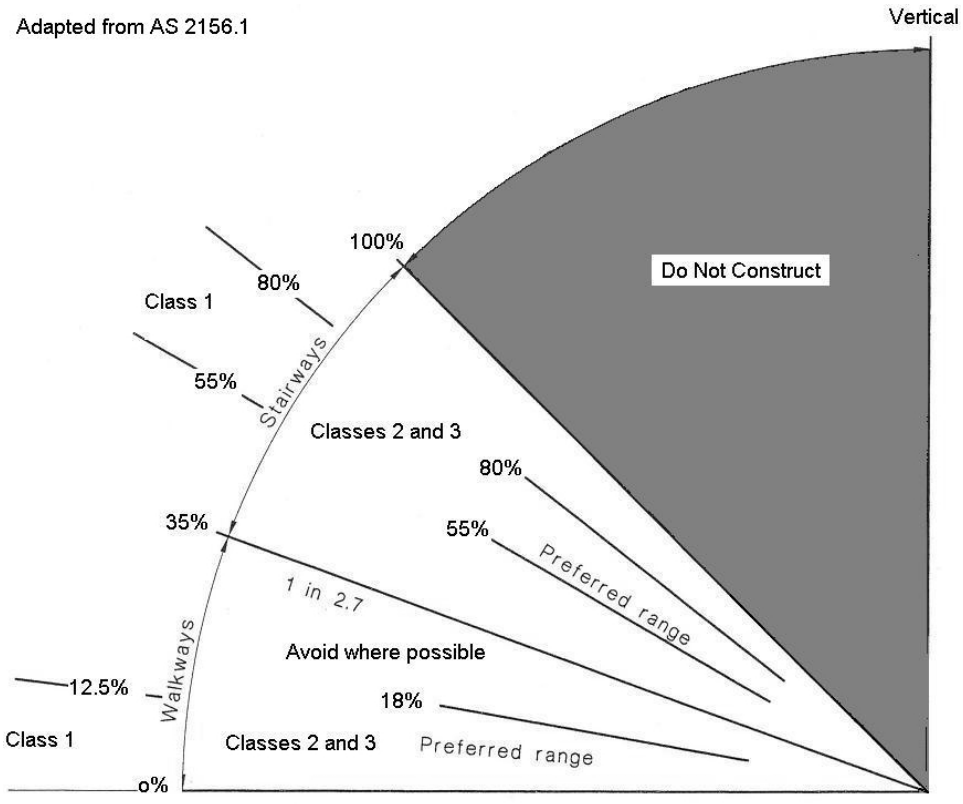


Figure 6: Limits of Slope

(Based on Australian Standard – Walking tracks – Part 2: Infrastructure Design)

Note: - This Design Guideline uses a three Class type classification which incorporates AS Class 1 and 2 into PRS Class 1, AS Class 3 and 4 into PRS Class 2 and AS Class 5 and 6 into PRS Class 3.

Stairs or steps are required for trail grades above 35%. Figure 7 illustrates a step detail for Class 2/3 gravel trail.

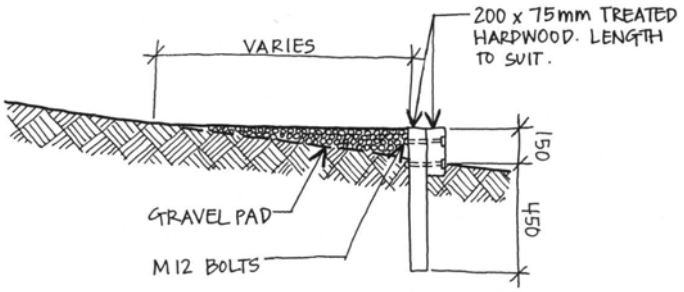


Figure 7: Step Detail

5.2.3 TRAIL ACCESS

Controlling access to trails is an important issue in the development of an effective recreation trail network. In situations where user class restrictions apply, signage is the preferred form of initial control at the construction stage. However, use and access on these trails should always be monitored to determine whether any form of access control is required.

Unauthorised use such as trail bikes is of primary concern on all trail routes as the conflict between all of the approved user classes and a trail bike is invariably dangerous due to the noise and speed.

Methods of access control include turnstiles, gates, and horse-gates.

It must be noted that all motorised vehicles as defined by the Traffic Act and which includes motorbikes and cars, trucks etc are not permitted onto or within the Pine Rivers Shire Council open space unless they are on a defined and constructed road.

5.2.4 TRAIL WIDTH

The width of the trail greatly influences the experience users have while travelling along the trail and to a large degree characterises the class of the trail. Issues associated with comfort, safety environmental impact and amenity are all in part determined by trail width.

Table 2 details appropriate trail width and clearance guidelines for each trail class by user group.

Class 1						
Trail User	Figure	Trail Width		Trail Clearance		
				Width		Height
		Minimum	Maximum	Minimum	Maximum	(m)
W	8a	1.5	1.8	2.1	2.4	2.4
B	9a	1.8	2.4	2.4	2.4	2.4
W+B	10	1.8	1.8	2.8	2.8	2.5
B+H	11	2.0	4.0	5.0	5.0	3.0
Class 2						
Trail User	Figure	Trail Width		Trail Clearance		
				Width		Height
		Minimum	Maximum	Minimum	Maximum	(m)
W	8b	1.0	1.2	1.5	2.0	2.4
B	9b	1.2	1.5	2.4	3.0	2.4
H	9c	1.2	3.0	2.2	5.0	3.0
W+B	10	1.8	1.8	2.8	2.8	2.5
B+H	11	2.0	4.0	5.0	5.0	3.0
Class 3						
Trail User	Figure	Trail Width		Trail Clearance		
				Width		Height
		Minimum	Maximum	Minimum	Maximum	(m)
W	8c	0.5	0.6	2.1	2.4	2.4
B	9b	1.2	1.5	2.4	3.0	2.4
H	9c	1.2	3.0	2.2	5.0	3.0

Note: W = Walk, B = Bike, H = Horse

Table 2 - Trail Widths

5.2.4.1 NOMINAL TRAIL WIDTHS FOR WALKING TRAILS

(Source Brisbane City Council Natural Area Reserves Design Manual, 1996))

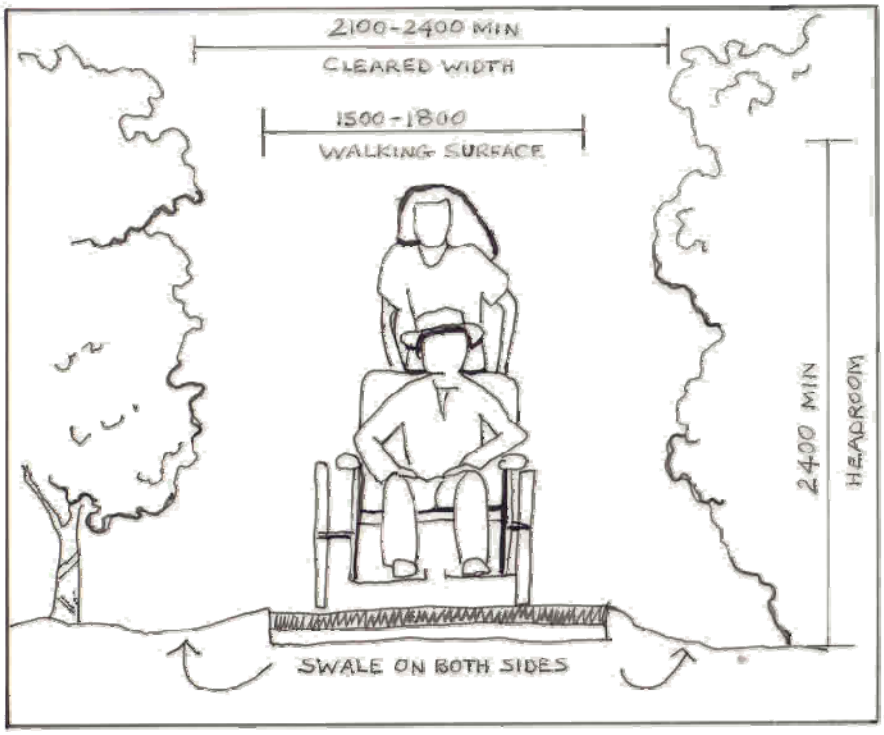


Figure 8a: Access and Mobility Class 1 Trail

Figure 8b: Walking Trail – Class 2

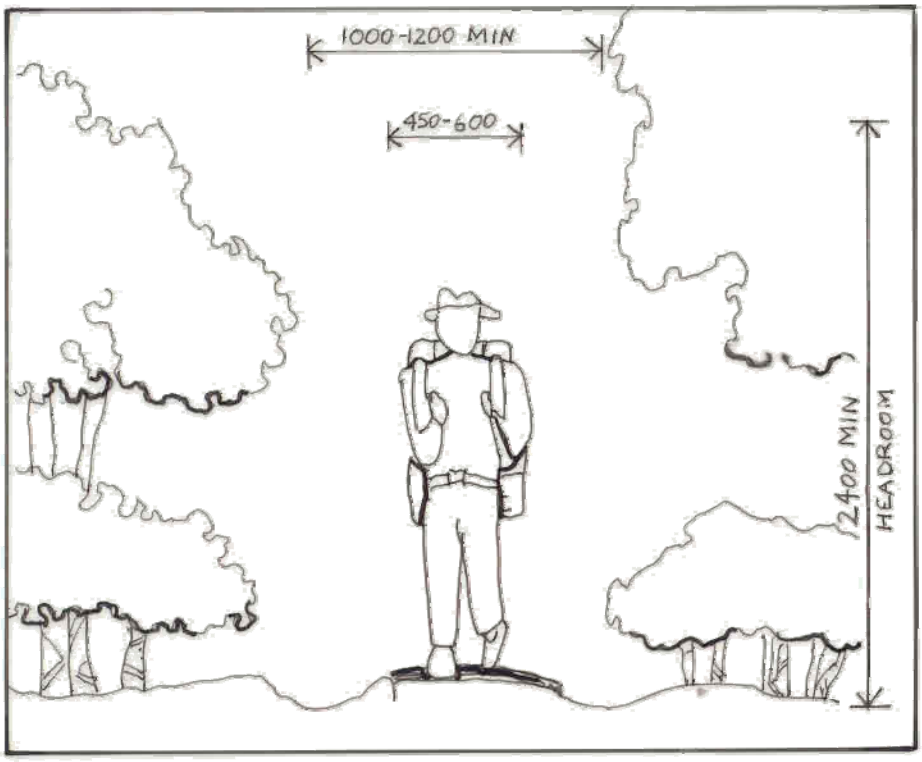


Figure 8c: Walking Trail Class 3

5.2.4.2 INDICATIVE CYCLE AND HORSE TRAILS

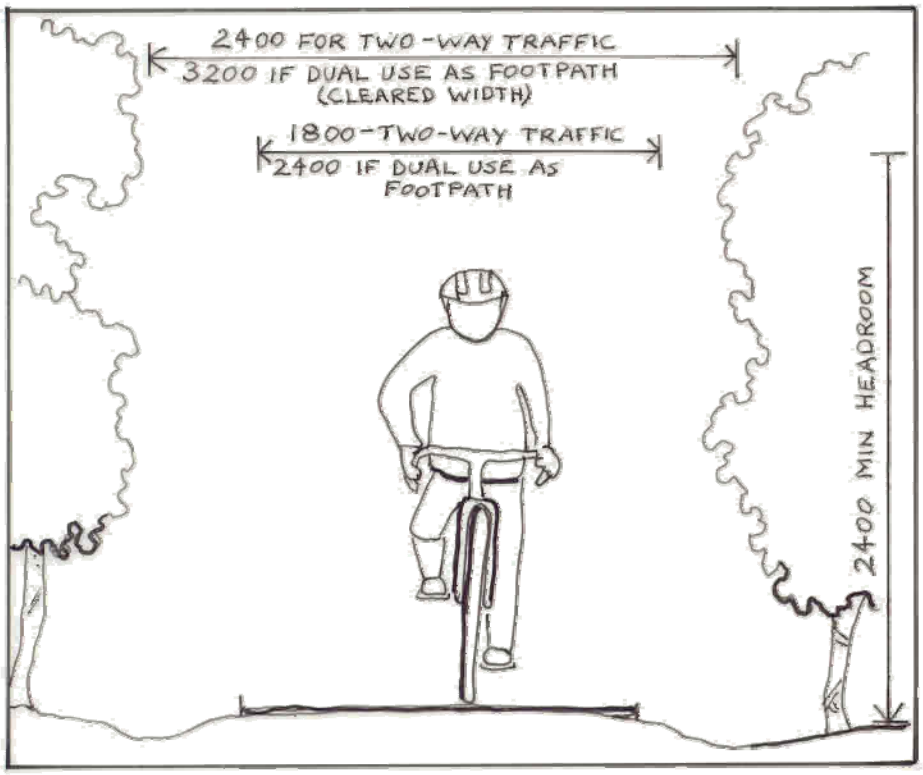


Figure 9a: Bike Trail Class 1

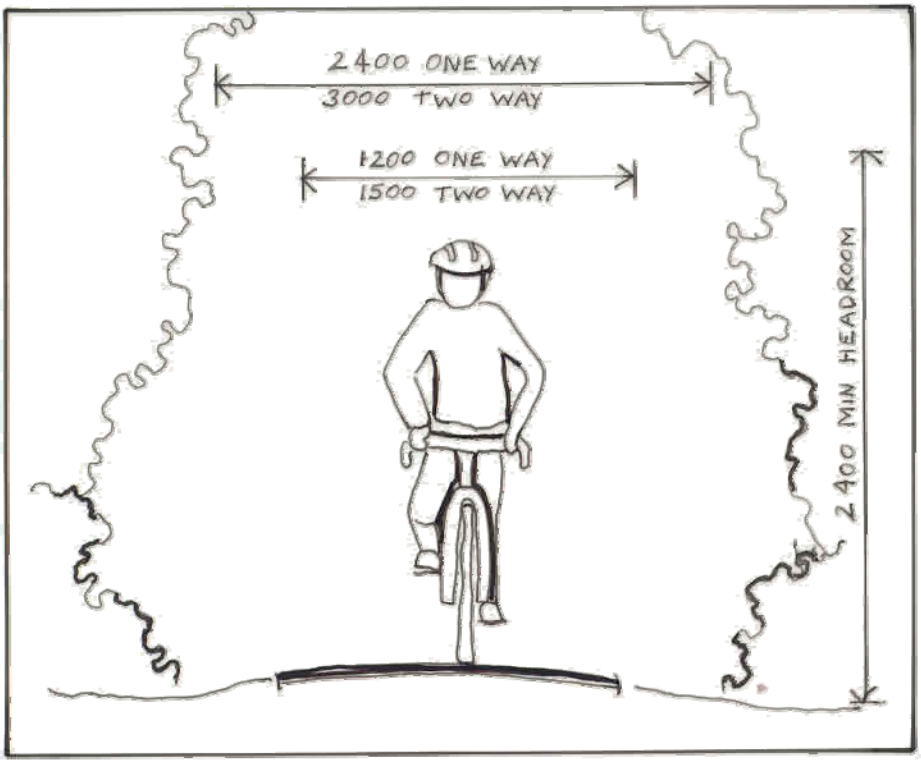
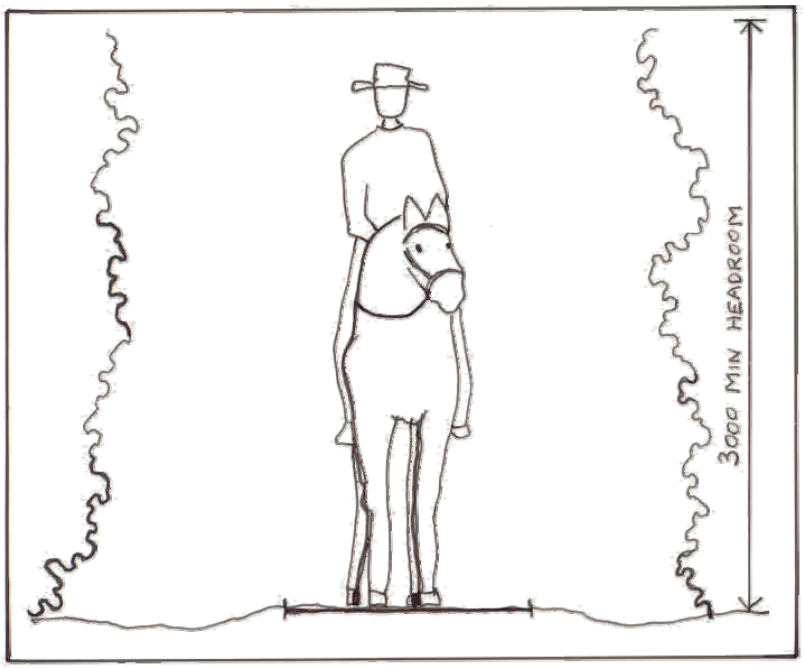


Figure 9b: Bike Trail Class 2 or 3



1200mm minimum width; 3000mm maximum width

Figure 9c: Horse Trail Class 2/3
(Source Brisbane City Council Natural Area Reserves Design Manual, 1996)

5.2.4.3 CLASS 1 / 2 MULTI USE TRAIL

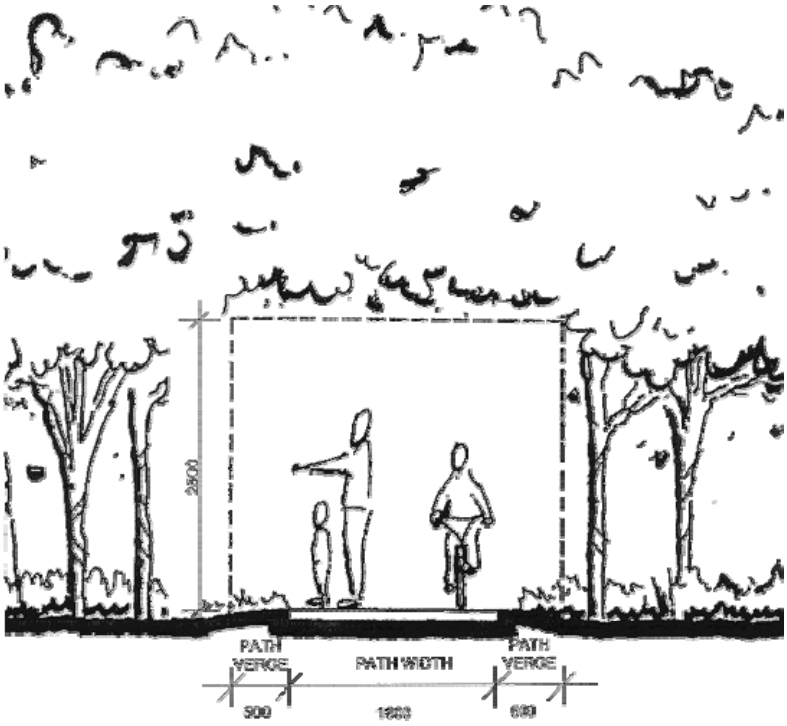


Figure 10: Class 1 / 2 Multi Use Trail
(Source Redland Trails Manual, 1998)

5.2.4.4 CLASS 1 / 2 MULTI USE TRAIL

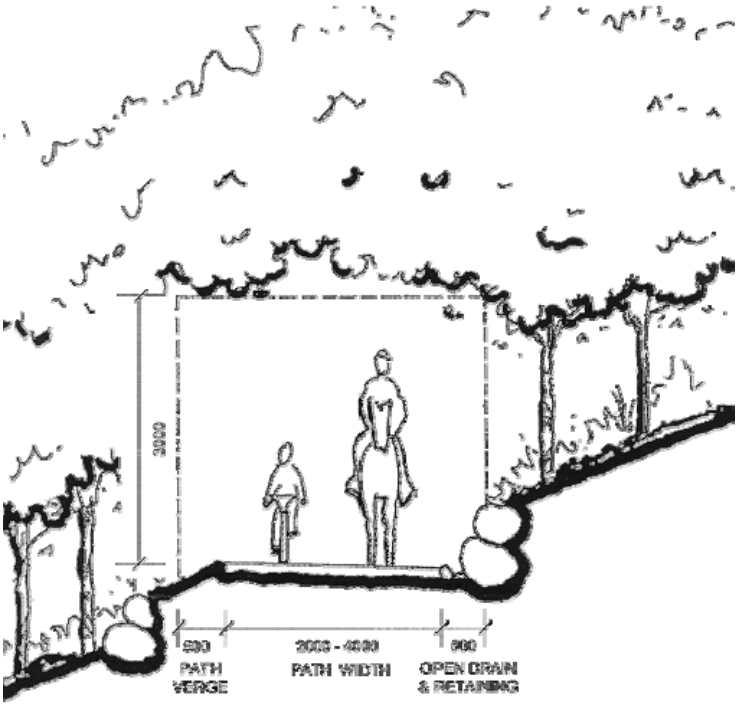


Figure 11: Class 1 / 2 Multi Use Trail
(Source Redland Trails Manual, 1998)

5.3.0 VEGETATION MANAGEMENT

These environmental practice notes provide a brief description of the practices that are to be utilised when constructing recreation trails through the various vegetation communities and land forms that are likely to be traversed by the Pine Rivers Shire recreation trail system.

5.3.1 EXCAVATION AROUND TREES

Where cut/fill is required near a tree the following guidelines shall be met:-

- Cut/fill < 200mm Minimum clearance from trunk = ½ Drip line Radius
- Cut/fill > 200mm Minimum clearance from trunk = Drip line Radius

5.3.2 MARINE AND INTER-TIDAL ENVIRONMENTS

All disturbance to be limited to the line of construction.

All construction works and vehicle/machinery movements shall be confined within the proposed trail envelope and shall not extend into adjacent areas in any way.

No off-site fill material is to be used to raise the natural surface levels and no impedance is to occur for the natural movement of tidal water:-

- removal of tree limbs is to conform to Australian Standard AS4373 - “Pruning of Amenity Trees”
- pylon construction must commence from the furthest situation from the entrance to the marine environment. All pylons are to be of the driven type only. Bored construction is not permitted.
- all natural surfaces are to be reinstated following pylon and head stock construction
- all construction waste is to be removed from the site and disposed in an approved manner at the end of each days work.
- a permit to disturb marine plants must be obtained from the Department of Primary Industries - Fisheries Division.
- other permits may be required and must be obtained prior to arrival on-site
- if concrete is being used, the site supervisor must ensure that the wash down area is not located adjacent to any drainage line or water body.

5.3.3 RIPARIAN AND WATERWAY CROSSINGS

All construction works and vehicle/machinery movements shall be confined within the proposed trail envelope and shall not extend into adjacent areas in any way:-

- a permit is to be obtained from the Department of Natural Resources - Water Resources Division if disturbance to the waterway bed and banks is required
- other permits may be required and must be obtained prior to arrival on-site
- creek bank works are to be undertaken a minimum of 10 metres from the top of the bank. Fencing of the work site is required to delineate this.
- creek banks (outside the trail corridor) are not to be disturbed and any groundcover is not to be removed during and following construction
- sediment and erosion control works must be undertaken both upstream and downstream of creek crossings to minimise siltation of those areas from disturbance during and immediately following construction
- trees with a Diameter Breast Height (DBH) greater than 200 mm are not to be disturbed and tree guards are to be placed around these trees if machinery is to be used within three metres of the tree trunk;
- trees with a DBH less than 250 mm are to be assessed by the Environmental Services Department prior to finalisation of the trail route
- tree roots are to be clean cut and treated with an appropriate fungicide immediately following disturbance
- removal of tree limbs is to conform to Australian Standard AS4373 - “Pruning of Amenity Trees”
- wherever possible the local trail alignment is to go through weed dominated areas as opposed to native plant dominated areas
- the trail width through undisturbed riparian vegetation must be restricted to the minimum allowable width for the class and user group
- Construction waste and litter must be removed from the construction site at the completion of every working day;
- If concrete is being used the site supervisor is to ensure that the concrete truck washes down in a location where the material will not find it way into the waterway or significant vegetation at any time. The wash down area is located a minimum of 50 metres from the construction site.

5.3.4 OPEN FOREST AND WOODLAND COMMUNITY

All construction works and vehicle/machinery movements shall be confined within the proposed trail envelope and shall not extend into adjacent areas in any way.

- Trees with a DBH greater than 250 mm ideally should not be disturbed. Where disturbance is unavoidable, appropriate protection measures should be used. Tree guards are to be secured to the tree if machinery is to be used within three metres of the trunk. A hazard evaluation should be prepared by a suitably qualified arborist at the completion of works if the trees are to be retained and the path is within felling radius

- Trees with a DBH less than 250 mm are to be assessed by the Environmental Services Department and Parks, Reserves and Landscape Services Department prior to finalisation of the trail route. A tree hazard evaluation should be prepared by a suitably qualified arborist at the completion of works if the trees are to be heavily disturbed and are to be retained where the path is within felling radius

- Tree roots are to be clean cut and treated with an appropriate fungicide immediately following disturbance

- Removal of tree limbs is to conform with the current Australian Standard and any regulatory Policies of the Pine Rivers Shire Council. Refer Australian Standard AS4373 - "Pruning of Amenity Trees"

- groundcover disturbance is to be kept to a minimum during the construction phase

- clean fill material can be used along trails in these environments

- excavated soil is to be stockpiled within the trail disturbance zone and protected from erosion

- water inverts are to be utilised along all trails of any grade. The number of water inverts is proportional to the grade of the trail. Steep trails require more water inverts, flat trail require a reduced number of water inverts

- natural fill material should be utilised where ever possible as long as it can be obtained from the trail disturbance zone

- natural rock, logs and dead wood features should be protected from disturbance where possible

- old existing tracks and trails should be utilised where ever possible as access tracks to the construction site so as to minimise additional impact to the surrounding vegetation and soil

- construction waste and litter must be removed from the construction site at the completion of every working day

- dead or dying trees need to be effectively managed during design and construction. A tree hazard evaluation should be prepared by a suitably qualified arborist if the trees are to be retained and the path is within felling radius. Appropriate clearance should be maintained from these trees to minimise disturbance to animals utilising the tree/s as habitat. Ideally, the trail must pass as far away from the tree as possible in consultation with the Pine Rivers Shire Council Environment Services Department. Trees should not be lopped without the approval of the Pine Rivers Shire Council Environment Services Department and Parks, Reserves and Landscape Services Department.

5.3.5 GRASSLAND COMMUNITIES

All construction works and vehicle/machinery movements shall be confined within the proposed trail envelope (disturbance zone) and shall not extend into adjacent areas in any way:-

- access across the grassland is to be restricted to the disturbance zone. Construction must be undertaken at the furthest location from the access point to the trail
- the disturbance zone should be slashed prior to construction and the boundary of the disturbance zone must be flagged or taped to define the disturbance zone for material delivery vehicles
- the site supervisor is to ensure that any activity that may cause an ignition of any dry grass has the immediate protection of basic fire fighting equipment and all staff have received training on its use and operation
- if concrete is being used the site supervisor must ensure that the wash down area is not located adjacent to any drainage line or water body and that concrete material does not find its way into significant vegetation
- all trail construction waste and litter must be removed from the work site and disposed of appropriately at the completion of the working day
- soil should be stockpiled within the disturbance zone and protected from erosion and sedimentation into the surrounding grasslands
- individual trees and shrubs should not be disturbed

5.4.0 TRAIL DRAINAGE GUIDELINES

Many trails are damaged by the action of water, resulting from inadequate consideration being given to drainage in the trail planning, design and construction process.

Drainage problems result from either surface or sub-surface water action, which causes either erosion of surface material, or acts to destabilise the base material.

5.4.1 SURFACE WATER

Surface water runoff results from rainfall, ground water springs and seepage. Trail formations often intercept this water and direct it along the trail surface. Structures to control surface water must be located on the trail at appropriate intervals, according to the local grade, rainfall patterns and trail surface material. It is critical that water velocity is kept low enough to ensure surface material particles are not displaced. Trail surface structures such as inverts should be included to facilitate the shedding of water from the trail surface.

The objective of water control is to catch and redirect water away from the trail surface.

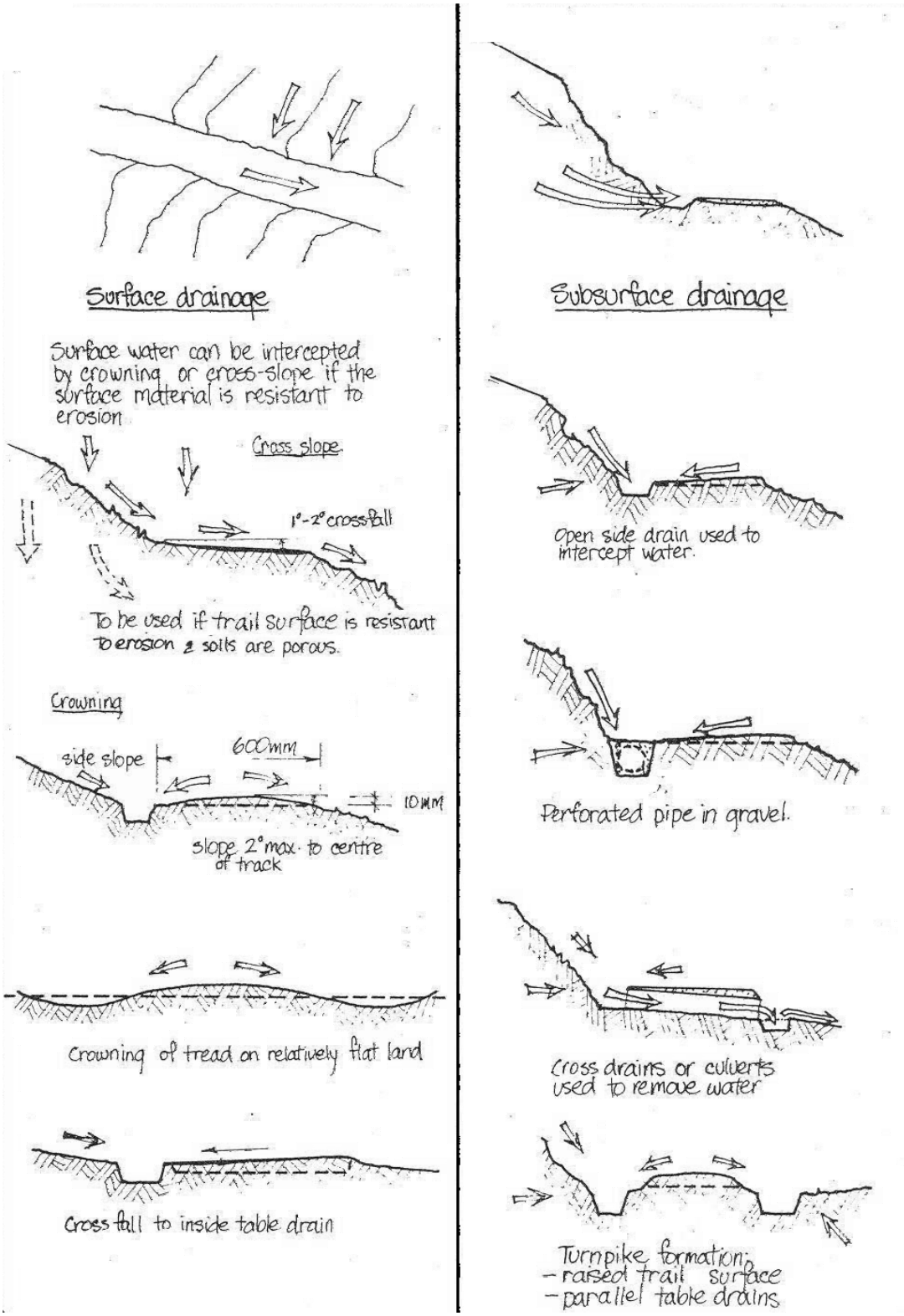
Refer Figures 12 and 13.

5.4.2 SUB-SURFACE WATER

The best solution for extensive sub-surface water on flat ground is to relocate the trail onto higher slopes or small stony ridges and bypass the trouble spot. Where relocation of the trail is not practical, a boardwalk must be constructed over the inundated area.

Refer Figure 12.

Figure 12: Indicative Surface and Sub-surface Drainage Treatments
(Source Walking Track Management Manual, ANPWS and DLPandW, Tasmania, 1996)



5.4.3 DRAINAGE TREATMENT OPTIONS

The following section describes a range of treatments that can be used to address drainage and water management for trails. These treatments will be used in different combinations determined by the localised drainage requirements determined by the results of the site survey.

5.4.3.1 TREAD CROWNING AND CROSSFALL

The cross section of the tread can be shaped to direct surface water off the trail. The tread can be crowned or built with cross-fall.

The use of tread chamber is a desirable method on flat terrain, or on side slopes with table drains. Tread cross-slope is best suited to trails located on side slopes. Cross-fall can be applied to flat terrain if table drains are incorporated in the overall design.

Guidelines for design and use of tread crowning and cross-fall:-

- cross-fall drainage can be used on any hardened and stable tread
- erosion resistant soils are ideal for this type of drainage
- use with a hard setting tread material
- trail grades should be minor to moderate
- attention should be given to water dispersal on both sides of the tread, especially on slopes

5.4.3.2 GRADE DIPS

Grade dips can be used to remove surface water at frequent intervals along a trail. Suitable trails should be of minor to moderate grade and located on a side slope.

Guidelines for the design and use of grade dips:-

- dips are built into the trail design at intervals dictated by the tread erodability and trail grade
- the tread is out-loped at the low point of the grade dip to divert the water from the trail
- grade dips should be built as part of the original construction. The overall design should allow for the adverse grade occurring in the dip.

Grade dips are cost effective in controlling erosion and provide additional user interest over a long grade.

5.4.3.3 TABLE DRAINS

Table drains intercept surface and sub-surface flow and carry it away to dispersal areas via culverts. Table drains are generally suited to use on any trail traversing a side slope where sub-surface water is a problem, or crossfall surface drainage is inappropriate.

Table drains may also be constructed adjacent to trails that run steeply down slopes, and which may otherwise themselves become watercourses. Slit traps and frequent cross drains may need to be installed to slow the water velocity and prevent scouring.

Guidelines for the design and use of table drains:-

- dig the table drain as close as possible to the trail edge. Whilst ensuring that the side of the trail will not collapse into the excavation. To prevent this happening, table drains can either be open (lined with timber or rocks if necessary), or filled with free draining granular material, with or without corrugated and perforated PVC pipe

- where runoff from slopes above the trail is excessive, an open drain should be dug on the uphill side of the trail to carry the runoff to suitable crossing points (grade dips, cross-drains, culverts)

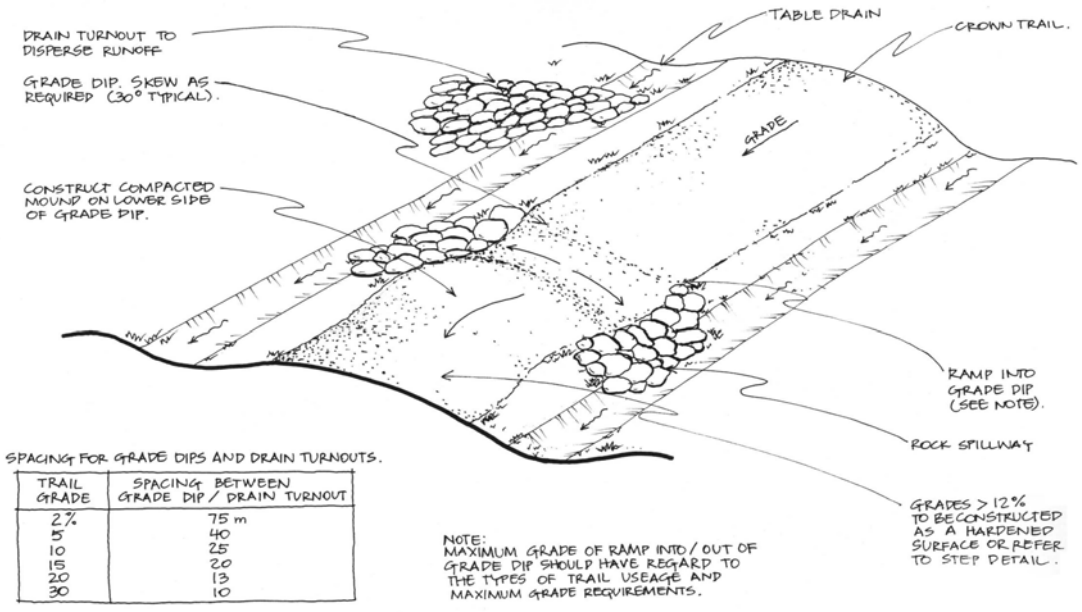
- frequent crossing or discharge points should be provided to prevent the build up of large volumes of water

- where scouring is likely to be a problem the bottom of the drain can be filled with crushed rock, gravel or slit traps installed

- table drains and cross-drains should be constructed to form a single working system

- the cross-section of the tread should be crowned, or crossfall installed, to drain tread surface water into the side drain

- installing silt traps to catch silt and build up the drain base material will prevent collapsing of the drain due to scouring. Silt traps will also act to slow the velocity of water. Extra cross-drains or culverts can be installed to channel away (and slow) the water in the table drain at more frequent intervals.



SPACING FOR GRADE DIPS AND DRAIN TURNOUTS.

TRAIL GRADE	SPACING BETWEEN GRADE DIP / DRAIN TURNOUT
2%	75 m
5	40
10	25
15	20
20	13
30	10

Figure 13: Drainage Treatment Options

5.4.3.4 TURNPIKE

A “turnpike” (trail formation with raised centre tread excavated from parallel table drains) is a useful method of raising the trail tread above the water table. This creates a raised and drained soil base on which to lay a surfacing material. It is especially useful in flat low land, water logged areas on boggy, or soft clay soil. Turnpikes should be used in deep soft clay or deep soil types. Suitable locations should be flat or gently sloping sites where the tread must be raised above persistent high water tables.

Guidelines for the design and use of turnpikes:-

- cross-drains, culverts and water dispersal drains should be installed as necessary to remove excess water from the table drains. The table drains should be allowed to drain freely into the downslope area
- in flat areas, with no effective drainage, the raised surface will still dry and provide support even if the table drains periodically contain some water
- drains should be large enough to minimise maintenance requirements, and to cope with heavy rainfalls
- on medium to steep grades water velocity in table drains must be adequately controlled with cross-drains, culvert and water dispersal drains
- a wide formation provides more stability when using wet soil. However the wider the tread surface, the less height obtained above the surrounding ground surface and water table.

5.4.3.5 DISCHARGE POINTS

Guidelines for the design and use of discharge points:-

- discharge points for both surface and sub-surface water must be protected from erosion forces. Natural rock or rock placements at discharge points can act to dissipate the water and prevent erosion
- always discharge water into well vegetated, stable areas or stable rocky areas
- silt traps can be incorporated into a drop culvert arrangement. These should be cleaned out at regular intervals
- erosion prone and denuded soil areas should be avoided if possible
- dissipation drains should be surveyed (use appropriate instruments on minor slopes) to locate the best direction of fall. Drains should be angled to rapidly disperse water, but at velocities that will not cause erosive action.

5.4.3.6 CULVERTS

Culverts are primarily used to pass water under a trail. Culverts are useful to:

- disperse water from table drains to the downslope side of a trail when cross drains could prove unstable
- in deep turnpike formations
- under trails requiring machinery access
- on high standard trails to aid access for all users (including disabled)
- where cross drains could be a safety hazard
- in moderate to high water volume areas where bridges are not warranted

Often these locations will be in natural drainage lines.

Culverts are most effective in natural drains where minimum excavation is required. In flat lowlands requiring turnpike tread sections, culverts can act as equalising channels to reduce the damming effect of the built-up tread.

Culverts may be made of concrete, plastic or other approved materials. Wooden, metal and rock culverts may only be used in remote areas if specifically approved.

Guidelines for the design and use of culverts:-

- culverts to be installed with gradients to suit the topography, to satisfy design parameters (refer to the Pine Rivers Shire Council Design Manual) and to take into account the potential for blockage
- provide for adequate drainage flow. Peak stream and river flows must be determined before decisions are made on culvert size (or bridge heights and widths) eg five, ten year flood levels. Refer to Table 3:-

Minor Culvert & Cross Drainage	
Class 1	2 year
Class 2	1 year
Class 3	1 year
Bridges & Major Structures	
Class 1	10 year
Class 2	5 year
Class 3	5 year

Table 3
Design Average Recurrence Interval's (ARI) for Recreation Trails

- the culvert must be large enough to carry flood water, and its floor must be at the level of the (natural) drainage line bed. If there is a choice, the culvert should be wider rather than deep. Several moderate size culverts are better than one large one. The wider the culvert, the easier it will take water. Pipe diameters less than 300 mm may present frequent cleaning problems

- the trail should also be raised enough to impound a rush of storm water until it can flow through the culverts

- depending on the situation and the materials available, it may be more effective to construct a simple bridge

- in most situations bridges are more suitable than culverts for crossing large streams. Stream flow is least likely to be altered where bridges are used, with the result that downstream erosion, silting and disturbance of fish habitat are less likely to occur. Culverts block easily and should always be built as big as practical

- excavate trench if necessary. Culverts should be properly bedded in accordance with the Pine Rivers Shire Council Standard Drawings to ensure continued performance

- lay concrete foundation/apron if necessary. Lay pipe with collar (if any) placed into the flow, join pipes as specified by the manufacturer

- compact approved filling (free of sharp rocks) at the sides and top of the pipe. It should be put down in layers and thoroughly consolidated, to a total depth over the pipe of at least 150 mm;

- A headwall should be constructed at either end of the pipe to protect it, and to stop any flow through the fill around the pipe that will cause erosion

- the height of the headwall should generally equal the diameter of the pipe plus 150 mm, to take it level with the surface of the trail. If there is any chance of a vehicle crossing a culvert, (even if it is not legally entitled to do so), build the culvert strong enough to withstand it. A piped culvert can be broken by the passage of a single vehicle, and is awkward to repair. If it is possible to get a vehicle up the trail, it is likely to be useful to do so for future trail management. Therefore, install a minimum pipe to allow a trail width of 2.5 metres. Pipe culverts should be protected with at least 300 mm of backfill, if vehicular use is anticipated. Plastic and timber pipes are not recommended for trails with vehicular use.

5.4.4 SITE SURVEY FOR WATER MANAGEMENT

A site survey is essential to evaluate the local drainage conditions to ensure appropriate drainage treatments are used for water management. The following should be considered when undertaking a site survey for assessing water management:-

- inspect the trail area in both wet and dry weather conditions

- identify water erosion problems as being of either surface or sub-surface origin

- mark with pegs where water runs onto the trail. Take photos of problems areas. These may be useful during later construction work in drier conditions

- when surveying sub-surface water trouble spots on the trail, look for places where water raises to the surface, usually at the foot of steep slopes or where solid rock is exposed and places where water flow can be intercepted and taken from the trail

- determine the soil type and consider its erodability

Consider which of the following methods of <u>controlling surface water</u> is most suitable to the situation:-

- relocate trail around problem area
- install trail crown, cross-fall or grade dips
- install trail grade dips, table drains or cross drains
- install table drains and/or upslope interceptor drains to divert the water flow away from the trail.

Consider which of the following methods of controlling sub-surface water is most suitable to the situation:-

- relocate the trail to avoid the problem area
- install table drains with cross drains, culverts or deep interception drains
- install perforated pipe if open drains are not practical. This pipe can also be installed in the trail base if gravel is used
- install raised tread surface with parallel table drains and create a turnpike formation (extremely high water table locations)

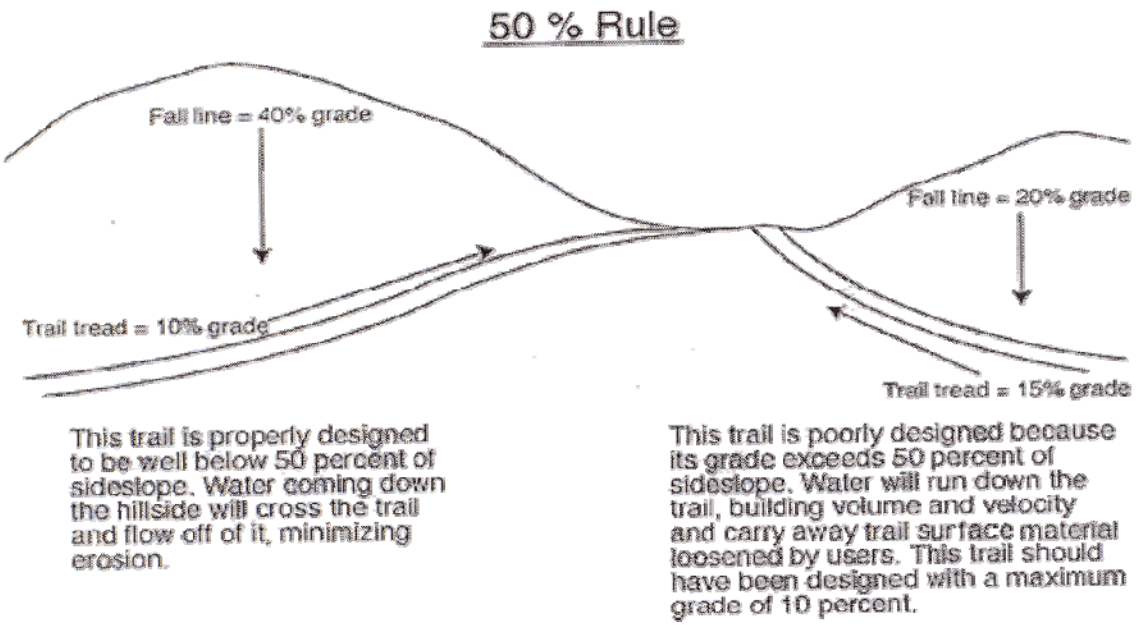


Figure 14: The 50% Rule for Site Survey and Water Management
(Source IMBA Building Better Trails- Designing, Constructing and Maintaining Outstanding Trails, 2001)

5.5.0 TRAIL CONSTRUCTION SPECIFICATIONS

The following specifications relate to the three classes and four user types as specified in the Pine River Shire Council Recreation Trails Master Plan.

5.5.1 CLASS 1 – CONCRETE

Specification
❖ Service provider to locate and protect underground and above ground services; ❖ All site clearing is to be limited to the alignment and nominated clearances for the trail. All material is to be mulched and reused to protected down slope areas and exposed soil; ❖ 2% cross fall to trail; ❖ Tooled control joints to be provided at 1.8 m CCD. Every third joint to be an expansion joint; ❖ Excavate 100 mm soil for road base if ordered. Compacted road base foundation is to be provided where directed by a Pine Rivers Shire Council superintendent in low lying, poorly drained or low bearing capacity soils; ❖ All tree roots damaged during site works are to be clean cut and covered with clean soil as soon as possible following inspection by a Pine Rivers Shire Council superintendent; ❖ Ensure side are protected by backfilling with material from the site.

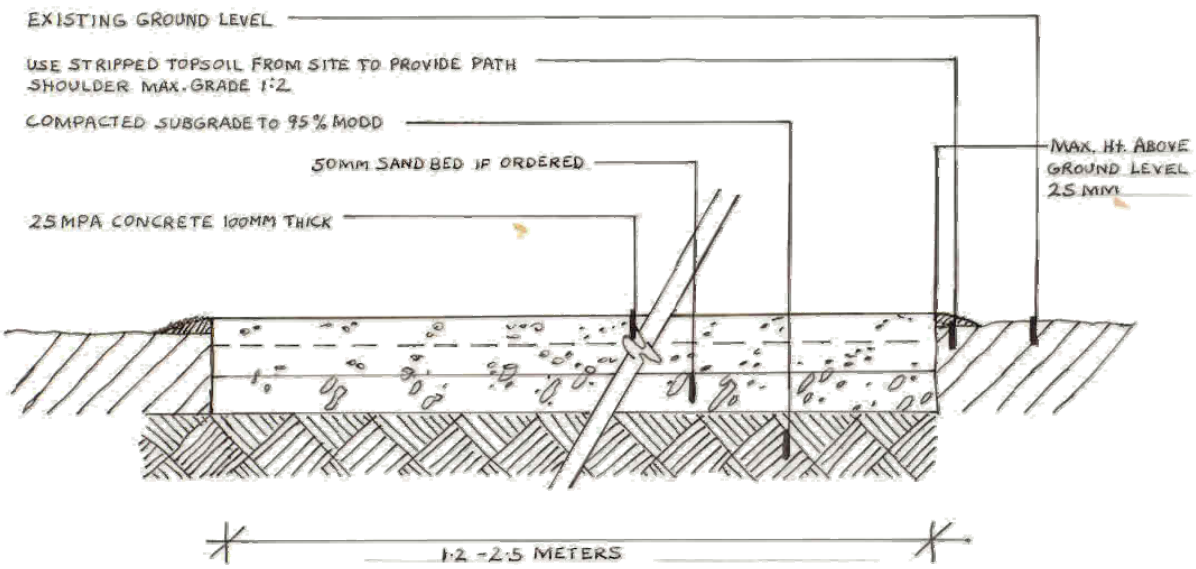
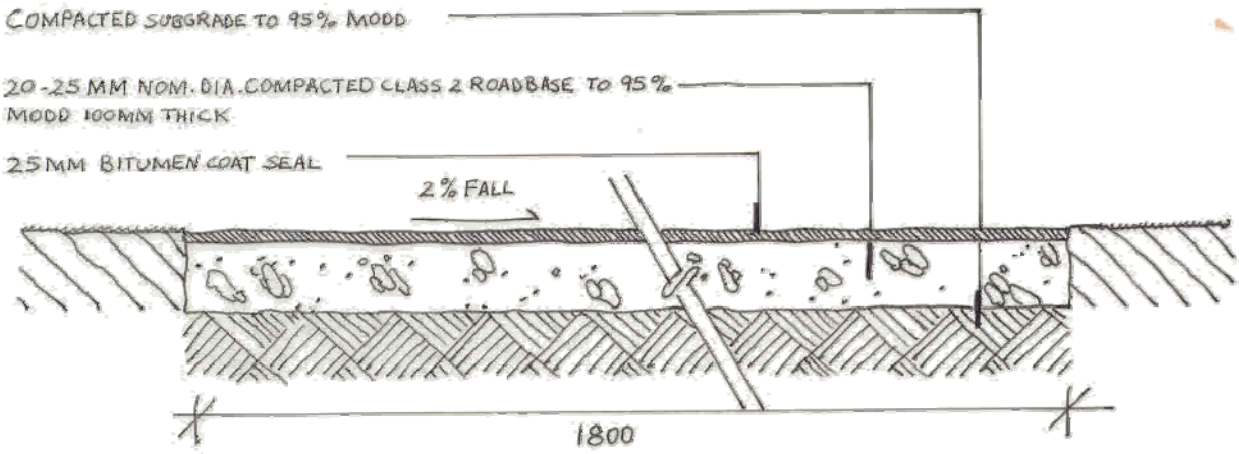


Figure 15: Concrete - Class 1 Trail
(Source Redland Trails Manual, 1998)

5.5.2 CLASS 1 – ASPHALT

Specification
❖ Service provider to locate and protect underground and above ground services; ❖ All site clearing is to be limited to the alignment and nominated clearances for the trail. All material is to be mulched and reused to protected down slope areas and exposed soil; ❖ Excavate trail alignment to 120mm depth for road base and surfacing; ❖ Road base to be Class 2.1 material; ❖ Asphalt surface shall consist of Pine Rivers Shire Council standard 2 coat seal; ❖ 2% cross fall to trail; ❖ Bitumen binder shall be clear “Shell Mexphalte C” or similar product; ❖ All tree roots damaged during site works are to be clean cut and covered with clean soil as soon as possible following inspection by Council’s supervisor; ❖ Ensure trail surface is flush with finished ground level.



Width Varies – Refer trail classification table

Figure 16: Asphalt - Class 1/2 Trail
(Source Redland Trails Manual, 1998)

5.5.3 CLASS 1 / 2 – BOARDWALK

Specification
❖ Boardwalks to comply with AS 2156.2-2001 and are to be certified by an appropriately qualified Engineer; ❖ All timber for posts, bearers, joists to be appropriately treated and of a hazard class suitable for the intended location; ❖ Treated Hardwood decking should be of a cross section dimension of not less that 120 x 50mm. Treated softwood decking should be of a cross section dimension of not less than 140 x 45mm, or as specified by the Engineer. Fasteners to be No. 14 type 17 stainless steel roof batten screws of an appropriate length for the thickness of timber; ❖ Refer to Table 2 for trail width requirements; ❖ All fixtures to be galvanised for general applications and stainless steel for marine applications and comply with relevant current Australian Standard. All decking screws are to be stainless steel; ❖ All boardwalks greater than 1000mm above ground level, over waterways or marine environments to contain hand rails. Boardwalks below 1000mm to have kick rails.

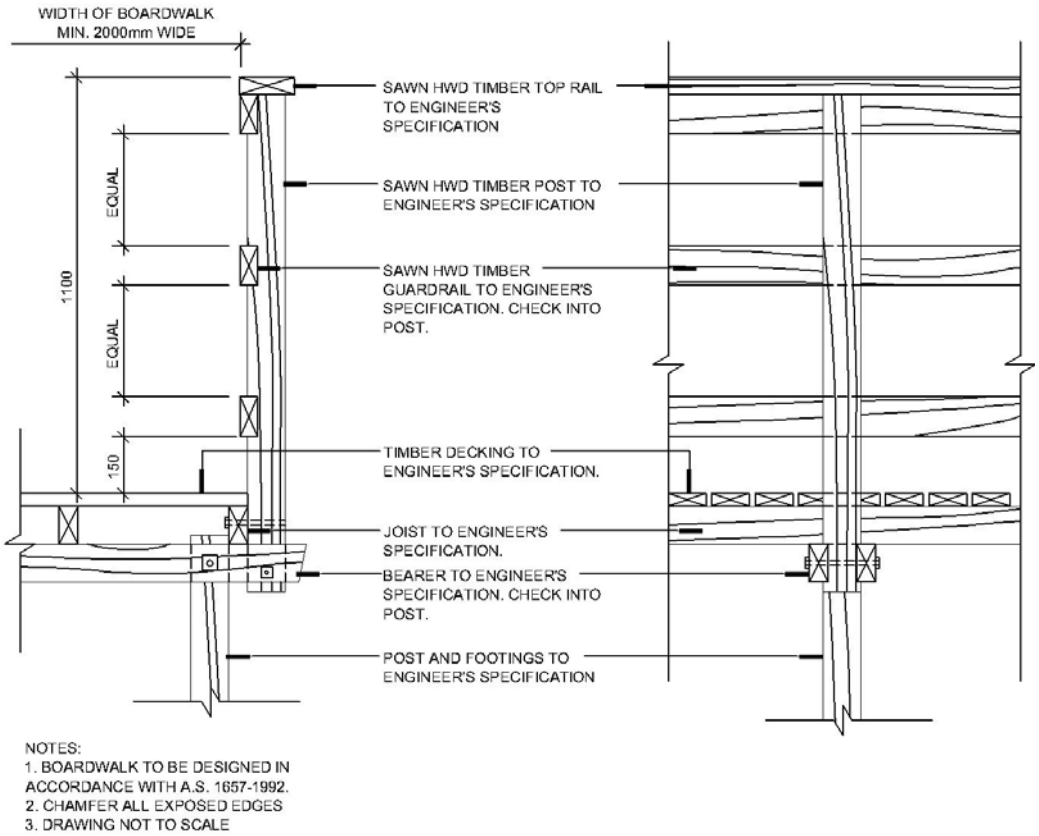


Figure 17: Indicative Boardwalk Detail and Handrails - Class 1/2 Trail
(Source Redland Trails Manual, 1998)

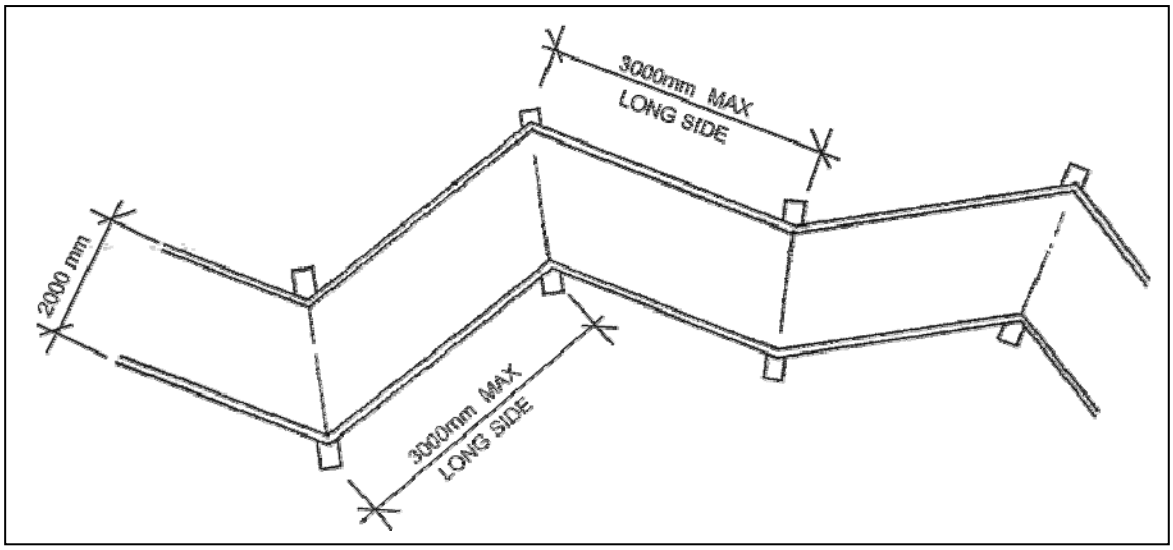


Figure 18: Indicative Plan View
(Source Redland Trails Manual, 1998)

5.5.4 CLASS 1 / 2 UNSEALED PAVEMENT TRAIL

Specification
❖ Paving material is to be suitable for the proposed user; ❖ Walking and cycling decomposed granite 100mm depth, stabilised with Portland cement or similar binding product; ❖ Horse riding surface can be coarse sand with a binding agent. Appropriate grades need to be selected and erosion control works need to be undertaken to ensure stability of trail surface; ❖ Trail surface to be maximum of 25mm above natural surface; ❖ Trail width to comply generally with Class type and user group/s – Refer trail classification table; ❖ All tree roots damaged during site works are to be clean cut and covered with clean soil as soon as possible following inspection by Council's supervisor; ❖ Geofabric if ordered to be laid to manufacturers specifications; ❖ Ensure surface fall on both side of the centre line at 2%; ❖ All site clearing is to be restricted to the trail alignment and nominated clearances for the trail.

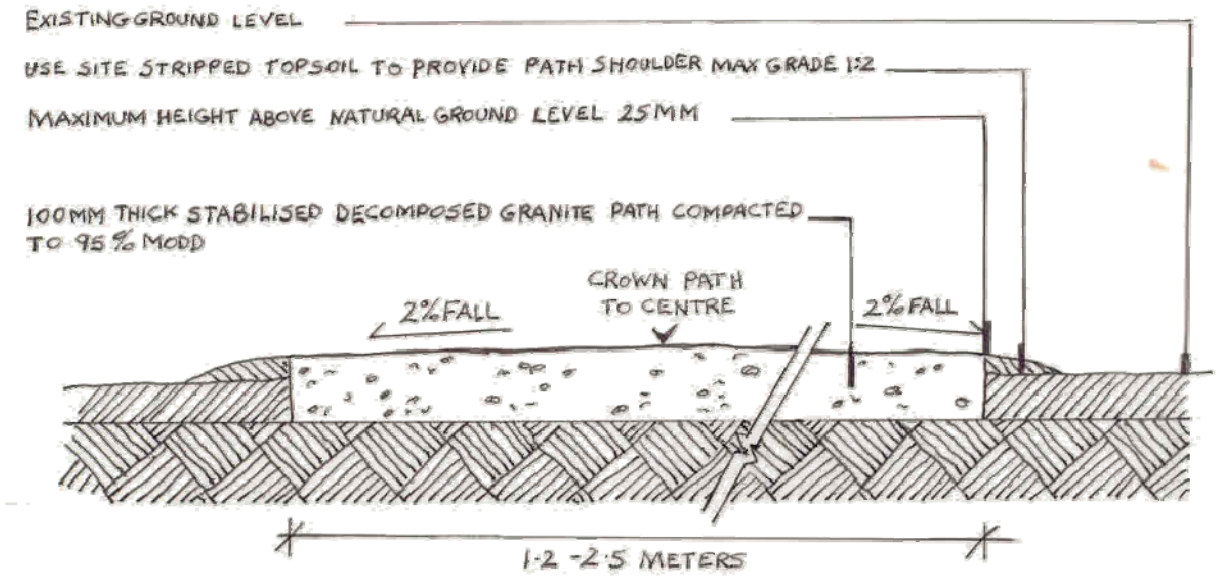


Figure 19: Indicative Earthen (decomposed granite surface) Treatment
(Source Redland Trails Manual, 1998)

5.5.5 CLASS 1 / 2 BRIDGES

Specification
❖ Bridge deck shall have a minimum width of 2,100 mm; ❖ All bridges shall be designed for each site and be certified by a structural engineer; ❖ Class 1 and 2 trail bridges with a height greater than 1,000 mm or located over waterways or marine areas shall contain handrails; ❖ Bridge construction shall not result in any damage or increased risk of damage to stream bank stability. All footings are to be a minimum of 500 mm from top of bank, unless a centre support is necessary; ❖ No tree greater than 250 mm DBH shall be removed to locate a bridge unless specifically approved by Council's Environment Officer; ❖ All approaches are to be graded to the bridge decking. Disturbance to vegetation and top of bank is to be kept at a minimum.

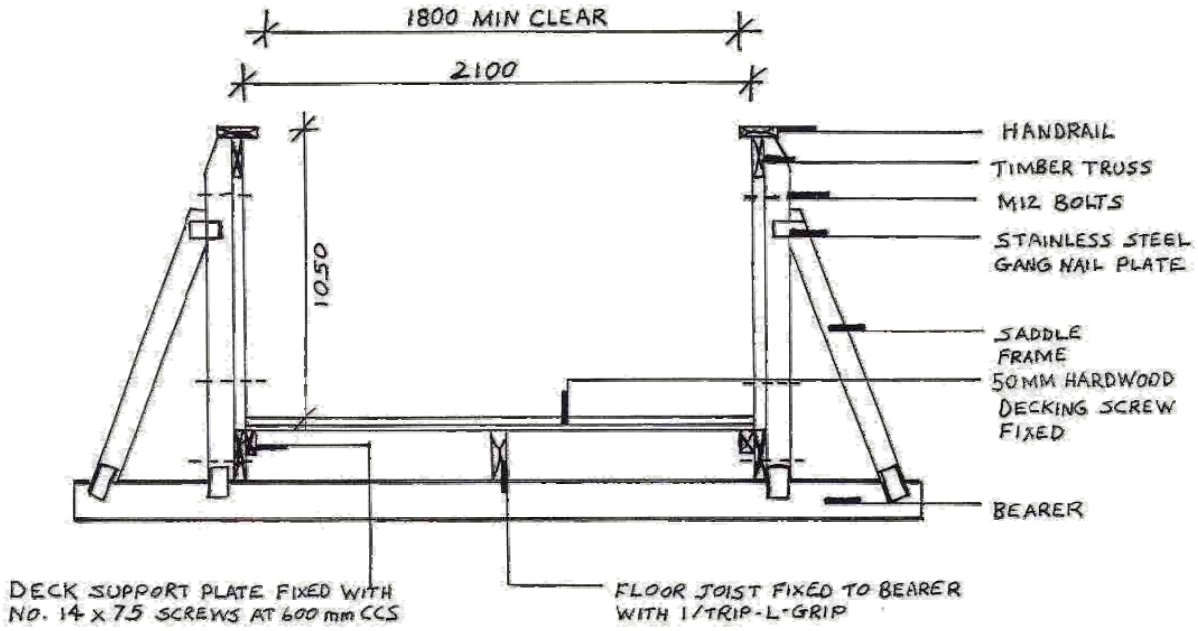


Figure 20: Indicative Bridge Design with Handrails - Class 1 and 2 Trails
(Source Redland Trails Manual, 1998)

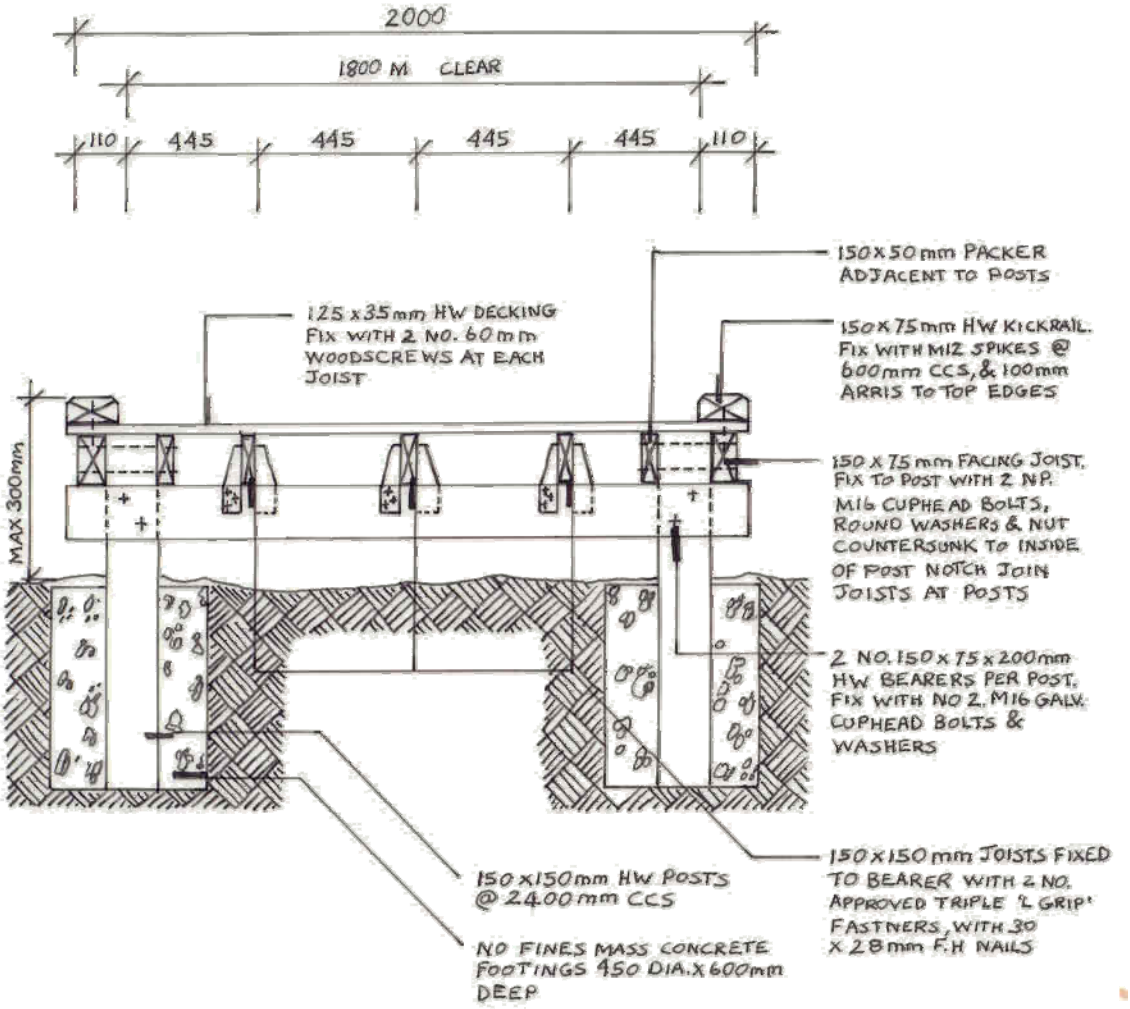
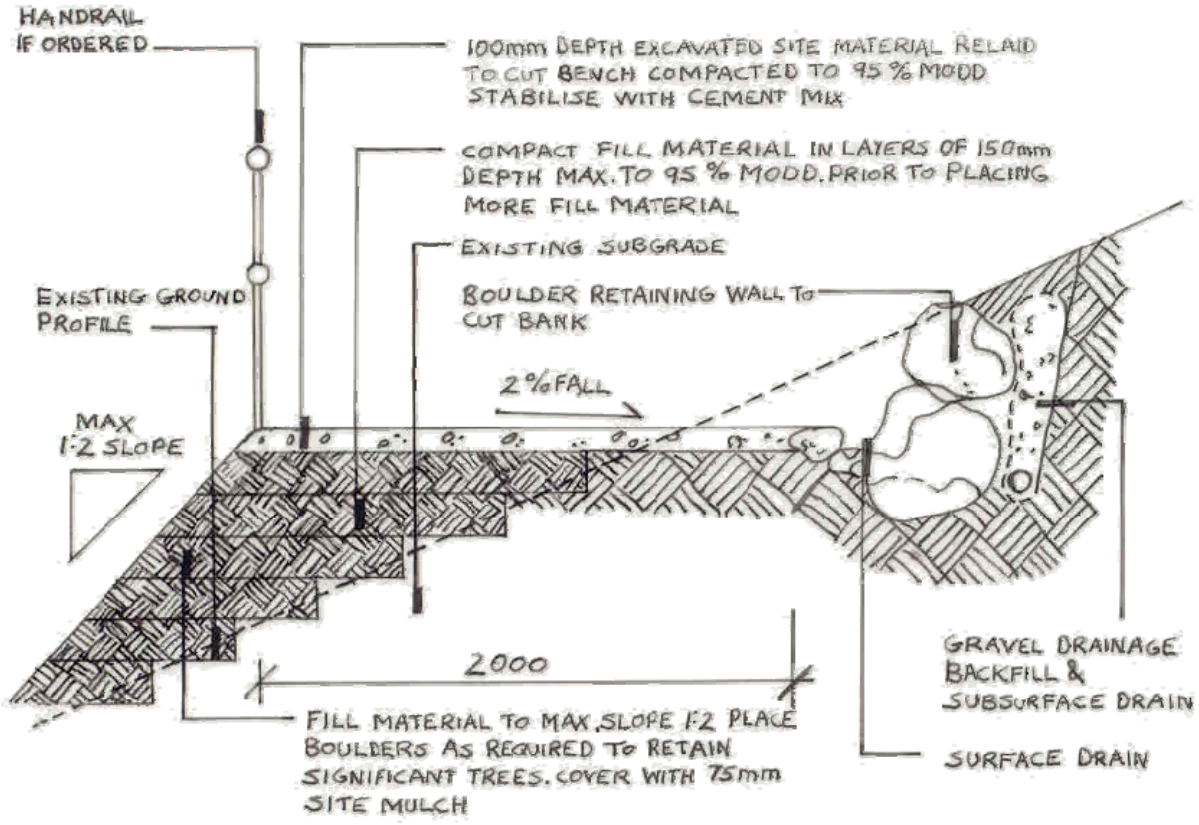


Figure 21: Indicative Bridge Design Without Handrails - Class 2 and 3 Trails
(Source Redland Trails Manual, 1998)

5.5.6 CLASS 2 AND 3 EARTHEN TRAILS

Specification
❖ Trail surface utilising existing soil material on site; ❖ All cut is to be used in the fill; ❖ The fill side can be supported using natural rock from the site or introduced material. No rock material is to be removed from a distance of 500mm from the top of the cut; ❖ Trail width to be no greater than 1200mm for a class 3 trail and 2000mm for a class 2 trail; ❖ Inverts are to be located a regular intervals depending on trail gradient; ❖ Trail gradient is to be less than 1:8 with steeper section allowable for short lengths; ❖ 2% cross fall to trail; ❖ All vegetation removal is to be limited to the trail alignment and nominated clearances.

Figure 22: Indicative Cut and Fill Earthen Class 2 and 3 Trails



(Source Redland Trails Manual, 1998)

5.6.0 SIGNAGE

Signage used on trail systems is important, as it is the principal way of communicating messages to the trail user. Signs provide information related to the trail and its function/use within the trail hierarchy.

It is extremely important, when designing signs, the materials and colours chosen should not only be sympathetic with the landscape setting, but also ensure that they are durable, readily seen and easy to read.

The overuse of signs and the use of very large signs should be avoided. (AS 2156.1-2001)

The types of signs used and frequency at which they occur, play an important role in defining the 3 trail classes described within this guideline. The following guidelines apply for each trail class:-

- ***Class 1 Trails*** - Signs for management and interpretation purposes may be used frequently. Arrow type trail markers shall be used at intersections

- ***Class 2 Trails*** - Signs and trail markers may be used for direction. Limited signage for management and interpretation purposes

- ***Class 3 Trails*** – Signs are limited and only for management and safety purposes

Where possible, for the purposes of these guidelines, the descriptions and definitions used for signage have been taken directly from AS2156.1-2001 to ensure a consistent approach. However, as the Australian Standard has been developed primarily for walking tracks signage which is specifically for cycling and horse riding may not fully comply with the standard contained in AS2156.1-2001.

The Pine Rivers Shire Council has developed a suite of trail marker signs, which should be used as the default signs for trails. In specific situations the Pine Rivers Shire Council may support the use of purpose made and site specific signs for a particular location, consistent with an approved interpretation/information theme.

Placement of signs should cause minimal adverse impact on natural areas or culturally significant sites.

5.6.1 ADVISORY SIGNS

Advisory signs are those which specify recommended equipment and precautions for use of the trail. Advisory signs should be placed at trailheads and, where possible, integrated into the design of facilities.

Advisory signs may include the following information:-

- registration and reporting recommendations
- equipment recommendations
- personal safety recommendations
- environmental protection, e.g. minimal impact practices
- skill and fitness levels required
- specific conditions

Note: Information provided on advisory signs should also be provided in promotional material.

5.6.2 DESCRIPTIVE SIGNS

Descriptive signs are those which specify the characteristics of a trail, and are generally placed at the starting point of the trail.

On descriptive signs, the following information is recommended for the safe and enjoyable use of the trail:

- trail rating (Class 1-3)
- type of trail (e.g. loop, one way, return);
- effect of weather conditions
- elements of interest, trail conditions or difficulties (e.g. facilities, waterfall, slippery rocks)
- opening and closing hours of the trail
- distance to designated point
- estimated completion time and whether the time is one-way or return
- direction of the initial course of the trail
- graphic image/ map for orientation

5.6.3 INTERPRETIVE SIGNS

Interpretive signs are those which convey educational material about a natural or cultural feature of a trail.

The style, content and placement of interpretive signage will generally be determined by the issues associated with the specific trail project, the Pine Rivers Shire Council design requirements and the feature being interpreted.

5.6.4 REGULATORY SIGNS

Regulatory signs are signs which specify the legal requirements and regulations associated with the use of a trail.

Regulatory signs should nominate prohibited activities i.e. trail bike riding.

Placement of regulatory signs must comply with relevant design codes regarding setback and overhead clearances from the trail.

5.6.5 WARNING SIGNS

Warning signs are signs which warn of a particular danger or dangerous condition.

Placement of warning signs will be determined by the location of the trail in relation to the particular danger or dangerous condition.

Legal advice will be required to determine format, content, and placement of warning signs. A warning sign plan detailing this information is to be provided to Pine Rivers Shire Council for approval by Council's Solicitor prior to the installation of signs.

Warning signs should include the following information:-

- appropriate pictogram
- statement of danger
- statement of consequences
- statement of precautionary actions

5.6.6 DIRECTIONAL SIGNS (TRAIL MARKERS)

Directional signs (trail markers) are signs that identify the direction of a trail.

Trail markers should have the shape of a directional arrow or an isosceles triangle, as appropriate to the trail classification. Design specifications for directional signage should be in keeping with AS2156.1-2001. The Pine Rivers Shire Council has developed a suit of trail marker signs, which should be used as the default signs for trails. In specific situations the Pine Rivers Shire Council may support the use of purpose made and site specific signs for a particular location, consistent with an approved interpretation/information theme.

In using directional signage it is emphasised that management objectives should be considered of paramount importance when decisions are made regarding the placement and use of markers. Markers should be used to aid management objectives and in a manner which will not create additional problems.

Markers should be provided at intervals such that intended trail users are assisted in finding their way from either direction. Overuse of markers should be avoided. Actual spacing will depend upon trail classification, definition and continuity, and local site conditions such as vegetation cover, topography and weather.

For direction on the placement and height of markers refer to AS 2156.1-2001.

6.0.0 TRAIL MAINTENANCE

Trail maintenance is an important consideration for both existing and proposed trail systems alike. Failure to incorporate trail maintenance into planning and budgetary considerations at an early stage will in the long term undermine a valuable community resource and cost the Pine Rivers Shire Council and the community far more than the money saved in the short term. Construction of new trail systems should not be considered unless adequate funding and resources are available to implement a maintenance program immediately following their completion.

The class of the trail will largely govern the frequency and level of trail maintenance.

- ***Class 1*** Trails require the largest commitment to maintenance as they have high levels of use, large amounts of signage and infrastructure and substantial modification or hardening of the trail surface. Class 1 trails have a wide range of users with varied experience and fitness levels and subsequently carry a significant duty of care by the Pine Rivers Shire Council. Trails in this class will need to be regularly monitored and inspected to ensure trail deterioration is reduced and the Pine Rivers Shire Council exposure to liability is minimised. Inspections should be carried out every 30 to 90 days or as soon as possible after major natural events such as fires and significant storm events.

- ***Class 2*** Trails require a less intensive level of management as they will generally have less usage and attract users of a higher skill level, have fewer structures and signage and less modification of the trail surface. Inspections should be carried out every 6 to 12 months. Any built facilities should be managed for public risk.

- ***Class 3*** Trails will require low management intervention. Trails will be monitored on a regular basis and following major natural events like cyclones and forest fires. Any built facilities will be managed for public risk. Inspections should be carried out at an interval of 6 to 18 months.

The following issues are key considerations in the development of a trails inspection program.

6.1.0 DRAINAGE

The regular and rigorous maintenance of drainage systems is vital in ensuring the longevity and functioning of the trail system. Without adequate maintenance, drains can be rendered useless which leads to extensive water damage to the trail. Regular maintenance, especially after heavy rainfall, is essential if the investment made in the trail system is to be protected.

Compared to the cost of repairing extensive water damage, the cost of regular maintenance is minimal. Maintenance will generally involve cleaning material from silted up or blocked drains. However, if water is scouring under or around inverts, or scouring of table drains occurs then problems such as these should be stabilised as soon as possible to minimise negative long term effects. If scouring or drainage problems recur on a regular basis, consideration should be given to upgrading the drainage or that section of trail being realigned or re-graded. Should a trail require realignment, the re-alignment is subject to all of the conditions that are applicable to new trail development.

Maintenance of drains involves checking an absolute minimum twice a year or with the regular trail inspection, whichever is the greater. Any drain blockages should be cleared as an urgent priority following inspection. In erosion prone environments, or after heavy rain, more frequent maintenance inspections, sometimes monthly, are will be necessary. Wash out material should be replaced on the trail surface if any damage occurs. (Redlands Trail Manual, EDAW).

6.2.0 VEGETATION

Overhanging or fallen vegetation can have a significant impact on user experience and safety and on heavier used trails damage may result to the surrounding environment where people go around the obstruction. Vegetation should be managed in accordance with the trail width and clearances outlined in Section 5 of this Guideline.

Dead and dying vegetation along a trail route should be identified and monitored on a regular basis in accordance with the class of the trail in question. All dead or dying trees that have a possibility of falling across a trail must be inspected by relevant Pine Rivers Shire Council officers to determine alternate solutions to removing the tree from site. A tree hazard evaluation should be prepared by a suitably qualified arborist if the tree(s) are to be retained and the path is within felling radius.

These solutions may include lopping the tree and "replanting" the tree (following trimming) away from the trail. For Class 3 trails only trees that pose a serious hazard should be removed. All trimming or clearing of vegetation should be carried out in a professional manner and follow recognised horticultural and arboricultural practices, in compliance with relevant Australian Standards.

6.3.0 WEED MANAGEMENT

The management of weeds is particularly important to ensure the unique biodiversity of the Pine Rivers Shire can be protected. Trail construction and maintenance activities can present an avenue for the introduction of environmental weeds into areas which were previously resilient against the spread of environmental weeds.

Many of the landscapes within Pine Rivers Shire have been impacted and degraded by a range of historic land use practices, however there are still significant areas which little or limited environmental weed impacts. It is essential these areas be protected from the further movement of environmental weeds.

The management of recreation trails in both construction and maintenance must have as one of its primary objectives, the management and control of environmental weed species along the trail.

Weed management is to be part of the programmed and reactive management practices which Council is to undertake on all trails under its control. These management practices may include:-

- hand removal
- herbicide application
- a combination of hand and mechanical removal augmented by herbicide application
- rehabilitation of disturbed areas to allow for great competition of resources within a particular area

It is also noted that environmental weed management during the construction of a trail and particular those trails which abut waterways or traverse remnant bushland areas, must be part of the site works to minimise the movement of environmental weeds into recently disturbed areas.

6.4.0 VANDALISM

Vandalism to trail infrastructure can greatly detract from the visitors' experience, compromise the safety of users and left unabated, can lead to unnecessary deterioration of trail infrastructure. Every effort should be made to remove or repair acts of vandalism as soon after they occur as this, along with regular enforcement, has proven to be the one of the best ongoing deterrents.

6.5.0 SURFACE MAINTENANCE

It is important to ensure that the surface on hardened trails such as concrete and asphalt as well as timber boardwalks and bridges is suitably maintained in a safe condition. Subsidence and/or slippage of the soils strata can result in hardened surfaces dislodging and becoming a hazard to the trail users.

Additionally, timber can swell and shrink resulting in the decking of boardwalks and bridges buckling or the fixtures weakening or being torn away from the joist. It is essential that a programme of trail inspection is implemented to reduce exposure to risk and to ensure that repairs are made in a timely manner.

6.6.0 COMMUNITY REPORTING

One of the best ways for a Local Government to manage its trails network is through partnerships with local users and/or groups that can report on incidents where the trail of associated infrastructure is in need of repair.

6.7.0 ASSET MANAGEMENT

Recreation trail condition assessment and monitoring shall be included in the Pine Rivers Shire Council Asset Management Programme. Information shall include trail audit and risk assessment.

7.0.0 BIBLIOGRAPHY

Standards Australia, 2001. Australian Standard AS 2156.1-2001 Walking Tracks Part 1: Classification and Signage. Standards Australia International. Syd.

Standards Australia, 2001. Australian Standard AS 2156.2-2001 Walking Tracks Part 2: infrastructure design. Standards Australia International. Syd.

EDAW. 1998. *Redland Trails Manual*. Redland Shire Council. Unpublished.

The International Mountain Bicycling Association. 2001. *Building Better Trails - Designing, Constructing and Maintaining Outstanding Trails* (Knowledge from the Subaru/IMBA Trail Care Crew). www.IMBA.com .

DELM, Tasmania. 1996. *Walking Track Manual*. Dept of Environment and Land Management Parks and Wildlife Service.

BCC. 1996. Natural Areas Reserves Design Manual. BCC unpublished.

Northern Territory Reserves Board. 1977. *Park Walking Track Manual*. NTRB Unpublished.