Walking Track Management Strategy for the Tasmanian Wilderness World Heritage Area

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Appendices B–G and References

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Contents

B0 Information sources

(i) Most of the information in this review was located by an iterative process of reading the sources cited in the reference lists of research papers and other literature reviews. Major reviews were scrutinised to ensure as far as possible that all relevant research was taken into account.

An attempt to track down information using computer-based library databases such as the ABN, Enviroline, Arts and Humanities Search, Magazine Index and PAIS International databases met with minimal success because very little relevant information was available on computer-based databases at the time this report was compiled. The lack of such information was confirmed (in personal correspondence) by David Cole of the USDA Forest Service, one of the leading researchers in the field of wilderness-recreational management and one of the few people currently working fulltime in this area.

(ii) Most of the information cited in this review is accompanied by references to original research papers. Where other literature reviews are cited it may be assumed that the relevant research papers are cited in those reviews.

(iii) To minimise cross-referencing some information has been included in more than one section of this review.

B1 Biophysical impacts of recreation

B1.1 Overview of research

B1.1.1 History of research

The biophysical impacts of recreation in natural areas have been studied over a period of more than fifty years (see eg Bates 1935) and an extensive body of literature has been published in this area. Recent reviews of this literature have been published by several researchers, eg Kuss, Graefe & Loomis (1986) and Cole (1987 a & b). Research intensified in the 1960s and '70s in response to an upsurge in wilderness use and a corresponding dramatic increase in impacts, but declined in the 1980s.

Most of the recreational-impact research undertaken to date has been done in the USA where the majority of early (pre-1975) studies focussed on campsite impacts. By contrast most early European studies focussed on the impacts of trampling, particularly on surface vegetation (Liddle 1975b). The 1970s and early 1980s saw an increase in the number of papers published on the subject of track deterioration, both in Europe and in the USA, and by the mid 1980s several papers had been published in Canada, Australia, South America and elsewhere.

B1.1.2 Limitations of research to date

In his reviews of recreational-impact literature Cole (1987a,b) concludes that despite the quantity of publications in the field the quality of research has generally been low, and there are still large gaps in our knowledge particularly concerning the ecological consequences of recreational impacts. While we lack such information the acceptability of recreational impacts must still be assessed largely in aesthetic terms. Indeed, Cole claims that the bulk of recent research "continues to document the obvious" and has failed to take advantage of modern measurement technologies and statistical techniques. Similar remarks have been made with regard to the status of recreational-impact research in Europe. For example in 1976 Satchell and Marren concluded that research was unco-ordinated and nowhere near adequate in relation to the scale of the problem.

Recreational-impact research has declined since the early 1980s, and only a handful of researchers in the world are currently pursuing fulltime careers in this field (Cole 1987a). Several researchers have appealed for increased research funding, and in particular for increased investment in long-term studies (Schreiner 1975, Satchell & Marren 1976, Cole 1987a).

Research into recreational impacts in Australia has been confined to a handful of papers (eg Edwards 1977, Gibson 1984, Calais 1981), of which the latter represents the only detailed study of trampling impacts in the Tasmanian environment.

B1.1.3 Types of studies

Recreational impacts have been studied using a variety of approaches which can be broadly classified as analytical, experimental and predictive (Burden & Randerson 1972).

Analytical studies involve comparisons between impacted and non-impacted areas or between different impacted areas (eg different sections of a particular walking track), making the assumption that the observed differences are primarily due to human activities.

Experimental studies involve measurements of plots of ground before, during and after periods of trampling, which in some studies has been simulated using rollers (Ciezlinski & Wagar 1970) or mechanical feet (Kellomaki & Saastmoineur 1975). One way of comparing the susceptibility of different vegetation types and ecosystems to trampling is to measure the amount of trampling necessary to halve the biomass on experimental plots (Liddle 1973). Some experimental studies (eg Calais 1981) have included assessments of revegetation after trampling has ceased.

Both analytical and experimental studies tend to have the disadvantage of being site-specific; consequently the observed results may not be applicable to sites with different environmental conditions. By contrast predictive studies (eg Price 1981) involve measuring trampling impacts across a broad range of environmental variables (eg geological substrate, soils and vegetation type) and using the resulting correlations to predict the susceptibility of environments to recreational impacts. Examples of such studies are included in section B1.4.2.

The types of impact commonly measured in impact studies include loss of biomass, changes in species composition, changes in the physical and chemical properties of soils, track width, depth of erosion, aerial soil loss and campsite area.

B1.2 Extent of impacts

B1.2.1 National and local perspectives

Most of the published information on the extent of recreational impacts is confined to qualitative statements (eg Satchell and Marren’s 1976 assessment of the extent of impacts in Europe) or assessments of impacts in localised areas (eg Helgath 1975, Calais 1981). Some information exists on impacts throughout the USA as a whole, based mainly on the results of surveys of wilderness managers conducted by Godin and Leonard (1979) and Washburne and Cole (1983). The Godin-Leonard survey indicated that track and campsite deterioration was occurring in 80% of US wilderness areas.

In the survey conducted by Washburne and Cole the occurrence of vegetation impacts on campsites was reported by 71% of wilderness managers and soil impacts on tracks were reported by 61% of managers. Another indication of the widespread nature of recreational impacts in the USA is the statement by Burde and Renfro (1986) that maintenance costs generally exceed all other management costs in US wilderness areas. Cole (1985a) reported that more money is spent on mitigating track impacts in the USA than on any other form of impact in wilderness areas. In the same paper Cole reported that the occurrence of the intestinal pathogen *Giardia* in surface water is increasing in "many if not most" wilderness areas in the USA.

Few quantitative assessments have been made to date of the extent of recreational impacts in wilderness areas in Australia. Exceptions include Calais (1981), who provides an assessment of the condition of walking tracks throughout Tasmania's Cradle Mt - Lake St Clair National Park, and Hardie (1993) who reported that two-thirds of tracks inspected in a study of the Mt Bogong region of the Victorian Alpine National Park were unacceptably eroded.

B1.2.2 Percentage of area affected by impacts

Recreational impacts are generally highly localised, ie they tend to be concentrated in the immediate vicinity of tracks and campsites and remain negligible elsewhere (McEwen & Tocher 1976, Cole 1981a). Several researchers have estimated the area of impacted tracks and campsites as a percentage of the area of a particular region (eg a lake basin) or of an entire wilderness area or national park. Clearly the results of such calculations will depend heavily on the type of environment studied, the type and intensity of usage involved and the area relative to which the extent of impacts is compared.

Cole (1982b) estimated that 1.3% of a heavily used lake basin in the Eagle Cap wilderness had been affected by recreational impacts, and concluded that such impacts were unlikely to pose any danger to the ecosystem. Bratton et al (1978) estimated that camping affected less than 0.06% of the Great Smoky Mountains National Park. Other estimates of impacts relative to the areas of entire national parks range from less than 0.0035% for the Banff National Park (Trottier & Scotter 1975) to approximately 0.1% for an 18 000 hectare park in Europe (Wagar 1975).

B1.3 Impacts as a function of usage

B1.3.1 Nonlinearity

Studies of the relationships between recreational use levels and the resulting biophysical impacts have produced the almost universal result that the usage/impact curve is nonlinear, ie it rises steeply at low levels of usage and flattens out at higher levels.

The level of usage at which the impact curve begins to level out varies widely depending on the type of impact measured and the environment in which the study is undertaken. Bell and Bliss (1973) and Palmer (1979) found that as few as five tramplings can result in direct long-term damage to alpine vegetation. In a study of the impact of trampling on alpine vegetation in the Chilean Andes, Hoffman and Alliende (1982) found that twenty passages produced measurable damage and that two spaced trials each of twenty passages reduced vegetation cover by 50-80%. Cole (1987a) reported that as few as five users per year can exceed the threshold for the establishment of campsites in some areas.

In more resilient environments the usage threshold for long-term impacts may be much higher; for example, in their study of trampling impacts in the Cradle Mt - Lake St Clair National Park Calais and Kirkpatrick (1986) concluded that use thresholds for vegetation loss were as high as 2000 users per year throughout much of the park, and thresholds of up to 1000 have been cited by other researchers (eg Bryan 1977). (For an appraisal of the Calais and Kirkpatrick result see B5.3 (iv).)

While the slope of the usage/impact curve may vary widely its nonlinearity seems fairly universal. This result has been reported for impacts on vegetation (La Page 1967, Willard & Marr 1970, Bell & Bliss 1973, Calais and Kirkpatrick 1986), soils (Jones 1978, Brown, Kalisz & Wright 1977, Kuss 1986), walking tracks (Dale & Weaver 1974, Weaver and Dale 1978) and campsites (Frissell & Duncan 1965, McCool et al 1969, Merriam & Smith 1974, Cole 1982a, Marion & Merriam 1985, Cole & Ranz 1983). It has also been demonstrated for a wide range of indicators - for example, in the case of soils, for soil density and density of macropores (Jones 1978), and organic content, pH and nutrients (Brown, Kalisz & Wright 1977) - and in environments ranging from alpine tundra and subalpine meadows to arid environments and riparian woodlands (Kuss, Graefe & Loomis 1986).

The point at which the gradient of the usage/impact curve decreases rapidly has been termed an inflection point (Cole 1987a). Clearly, restricting usage is likely to have a substantial effect on the level of a particular impact if usage is restricted below the inflexion point but little or no effect otherwise. Hence the determination of inflection-point values may be crucial for determining carrying capacities. However as Cole points out, most studies to date have measured impacts at usage levels exceeding the relevant inflection points.

B1.3.2 Effect of temporal distribution of usage

Some research indicates that for a given amount or rate of use, impacts may vary depending on the temporal distribution of usage - eg on whether the use is predominantly seasonal or is evenly distributed throughout the year. Price (1985a) and Hartley (1976) suggest that the seasonal timing of trampling may affect the severity of damage to vegetation due to seasonal variations in growth rates. Similarly in some climates the amount of soil compaction caused by a given level of usage may vary according to the seasonal rainfall (although this is unlikely to be the case in western Tasmania where monthly rainfalls are moderate to high throughout the year).

Little research has so far been done in this area (Cole 1987a) and the results to date are inconclusive. Ciezlinski and Wagar (1970), Liddle (1973), Rogova (1976) and Cole (1985c) concluded that the distribution of use in time had little influence on impact levels. Singer (1971) and Price (1985b) concluded that for a given number of tramplings, the longer the period, the greater the damage - eg more damage occurred when usage was spread out over two years than when it was concentrated in one year. Landals and Scotter (1973) corroborated this conclusion for high levels of usage but found that at low levels the opposite was true - ie impacts were lower when distributed over longer periods of time. Clearly further research is required and it seems likely that the influence of usage distribution in time will be found to depend on the type of impact measured, the choice of indicator used to measure it and the type of environment in which the study is undertaken. No research into the relationship between impact levels and the distribution of usage in time has yet been undertaken in the western Tasmanian environment.

B1.3.3 Relative importance of usage and site factors

Many recreational-impact studies have produced the result that the influence of usage on impact levels is outweighed by site factors. This result is not surprising in the light of Cole's (1987a) claim that most studies to date have measured impacts at usage levels exceeding the inflection points corresponding to the impact in question (see B1.3.1).

Helgath (1975), Bratton et al (1977), Coleman (1981), and Kuss (1986) concluded that track erosion is more a function of track location and design than of use levels. Some researchers (eg Cole 1983a) have found that while track width tends to increase with increasing usage, track depth is more a function of gradient than of usage. Calais and Kirkpatrick (1986), however, concluded that track width is less dependent on usage levels than on how easy a track is to walk on relative to the adjacent terrain. Aitchison (1976) concluded that site factors and type of use greatly outweigh the effect of use levels on campsite impacts.

Because the susceptibilities of environments to trampling vary so widely some researchers (eg Washburne 1982, Prosser 1986) have concluded that use levels alone are of little value in predicting levels of environmental impacts, and Cole (1982a) concluded that reducing use levels would not substantially improve conditions at medium to high use campsites. More information on the relationship between site variables and track impacts is included in B1.6.2.

B1.4 Impacts on vegetation

B1.4.1 General observations

State-of-knowledge reviews of the impacts of recreational activities on vegetation are included in papers by Price (1985a), Cole (1987a & b), Kuss, Graefe and Loomis (1986) and Kuss, Graefe & Vaske (1990).

It is useful to draw a distinction between vegetation resistance and resilience, the term resistance being used to denote the ability of vegetation to withstand the initial impact of trampling, camping etc, and resilience to denote the capacity of vegetation to recover after impact.

Vegetation types vary widely in both resistance and resilience (Schreiner 1974, Cole 1981a, Holmes & Dobson 1976). For example, the number of foot passes required to reduce original vegetation cover by 50% has been found to vary from as few as 20 to more than 1000 in different plant habitats (Liddle 1975a, Weaver et al 1979). Less productive communities tend to be more resistant (del Moral 1979) but less resilient (Liddle 1975a) - for example the undergrowth in open forests is generally more resilient than that in closed forests because the rate of productivity in open forests is higher. Resilience has been found to be dependent on plant structure, productivity and environmental conditions (Liddle 1975a).

Trampling and camping tend to reduce vegetation productivity (Bayfield 1973), change species composition and reduce species diversity (La Page 1967, Liddle 1973, Dale & Weaver 1974, Calais 1981). Disturbed areas are sometimes colonised by species adapted to change (Kuss, Graefe & Loomis 1986), eg fast-growing annuals (Edwards 1977). Due to colonisation vegetation cover may increase as a result of low levels of usage, but at higher levels of usage vegetation cover is reduced (Liddle 1975b, Cole 1987b). As mentioned in Sec B1.3.2 the seasonality of trampling may influence the severity of vegetation damage (Price 1985a); for example, Hartley (1976) reported that trampling after seasonal maturity retards subsequent plant growth.

Studies by Cole (1978) and Dale and Weaver (1974) indicate that only a narrow band of vegetation on either side of walking tracks is affected by trampling impacts.

B1.4.2 Predictive studies

Some researchers have attempted to predict the susceptibility of vegetation to trampling on the basis of correlations between vegetation characteristics and trampling impacts. For example del Moral (1979) obtained correlations between impacts and vegetation type and derived a set of "resistance indices" which he used for predicting the susceptibility of various vegetation types to future impacts. However he warned that attempts to correlate impacts with habitat factors would be fraught with ecological and statistical difficulties, partly because habitat variables are nonlinearly interrelated.

Price (1981) obtained correlations between impacts and vegetation types as identified from infra-red aerial photographs, and in a subsequent paper (1985b) discussed some of the techniques and limitations of predictive studies of this sort. Calais (1981) classified a number of track types and associated these with habitat types to which he assigned threshold values corresponding to the level of usage at which track impacts exceeded a specified level. However his classification of habitat types was qualitative and somewhat arbitrary, the more so for being based on track characteristics rather than on environmental variables such as soil and vegetation type (see B5).

In a recent paper Kirkpatrick (1990) proposes a simple technique for classifying vegetation synusia (ie structural, morphological, functional and situational types) according to their susceptibility to (or dependence on) fire, resilience to trampling, rarity and reservation status. Each synusia perceptible at the level of study is mapped from colour aerial photographs according to its susceptibility to or dependence on fire, its susceptibility to trampling and so on. Disparate attributes can be combined in a single map, eg a map showing vegetation types which are either highly fire susceptible, highly susceptible to damage, rare or poorly reserved.

Such maps can be a useful aid to managers by providing information about the distribution of vulnerable vegetation types in an easily interpreted form. However this information is relevant only to vegetation and gives no indication of soil erodibility, gradient of terrain and other variables. Moreover the criteria used to classify the vegetation synusia were not derived from specified experimental procedures but from informed judgments based on a broad range of empirical evidence including studies by Calais (1981) and Gibson (1984) (Kirkpatrick, pers. comm. 1991).

B1.5 Impacts on soils

B1.5.1 General observations

Literature reviews on research into recreational impacts on soils include those by Kuss, Graefe and Loomis (1986) and Cole (1987a).

Research has established that trampling affects soil compaction, organic matter content, moisture levels and susceptibility to erosion (Chappell et al 1971, Wall & Wright 1977), the degree of impact generally being related to soil drainage characteristics (Leeson 1979). Soil density increases under trampling (Liddle 1975b); this in turn may decrease soil infiltration for fine textured soils and increase infiltration for coarse textured soils, thereby leading to changes in water holding capacity (Cole 1987a). Where soil compaction reduces infiltration, increased water runoff and erosion may result (Kuss, Graefe and Loomis 1986). It has also been observed that soil water content tends to increase after trampling in dry areas but to decrease in wet areas (Liddle 1975b). Soil compaction may tend to stabilise soils in some circumstances (Kuss 1986, Cole 1987a).

Soil compaction tends to inhibit root growth (Hartley 1876) and germination (Cole 1987a), thereby leading to a reduction in vegetation cover. This in turn may lead to reduced soil aeration and reduced litter cover, and hence to spiralling deterioration culminating in the total loss of vegetation and consequent soil erosion (Manning 1979a). Litter cover can be reduced by low levels of trampling (Manning 1979a, Cole 1981b) but impacts may tend to stabilise as litter is compressed into the A-horizon (Kuss 1986, Cole 1982a).

Once bare soil is exposed natural processes may play a major role in erosion, the primary agent of erosion in many areas being water flow (Root & Knapik 1972, Bratton et al 1979). Other natural erosional factors include wind and wave action and needle ice (Soons 1967).

Chappell et al (1971) found that soil structure in heavily trampled areas of a chalk grassland were substantially less stable than in lightly impacted areas.

In the Tasmanian context Sawyer (1988a) observed that substantial peat compaction and slumping can occur before any damage to vegetation is visually apparent.

B1.5.2 Susceptibility of soils to trampling

As the discussion above indicates, the relationship between soil properties and erodibility is complex. For example an increase in the level of one variable such as silt content may increase or decrease erodibility depending on the levels of other variables such as organic content and moisture levels (Leonard & Plumley 1979). However some general conclusions can be drawn and some researchers (eg Morgan 1985, Ballard 1979) have attempted to construct models to predict soil erodibility on the basis of soil characteristics. Information about the erodibility of soils is contained in numerous publications including those by Montgomery & Edminster (1966), Baver et al (1972), Root and Knapik (1972), Wall and Wright (1977), Bryan (1977), Jones (1978), Parks Canada (1978), Leeson (1979), Leonard and Plumley (1979), and Burde and Renfro (1986). On the basis of this information soil properties can be broadly classified as being conducive to erodibility or stability as follows:

Soil properties conducive to erodibility

- High organic content, especially peat;
- High percentage of fine-grained particles, especially high silt/clay content;
- High percentage of coarse-grained particles, eg sand;
- Homogeneous, stone-free soils;
- Very stony soils;
- Poorly drained soils;
- Shallow soils;
- Infertile soils.

Soil properties conducive to stability

- Mineral soils with high organic content, especially those underlain by well-developed strata;
- Low clay;
- Loams and sandy loams, ie medium texture with a mixture of fine and coarse particles;
- Well drained soils;
- Deep soils;
- Fertile soils.

Root and Knapik (1972) pointed out that soils with high silt content tend to be subject to water erosion, clay soils are poorly drained and sandy soils are unstable.

The above classification was modified by Cole (1987a), who provided the following table:

Table 1: Relationship between soil characteristics and susceptibility to impact.

Soil property	Level of susceptibility		
	Low	Moderate	High
Texture	Medium	Coarse	Homog/fine
Organic content	Moderate	Low	High
Soil moisture	Moderate	Low	High
Fertility	Moderate	High	Low
Depth	None	Deep	Shallow

Soil properties are often indicated by colour, well-drained soils generally being red or yellow while poorly drained or organic soils tend to be dark-bluish or black (Klock & McColley 1979, Proudman & Rajala 1981).

B1.6 Impacts on tracks

B1.6.1 General observations

Some indication of the prevalence of track deterioration, at least in the USA, can be gained from the statement by Cole (1985a) that more money is invested on mitigating track impacts in the USA than on any other form of impact in wilderness areas. Many research papers have been published specifically on the subject of track impacts, and in particular on the way in which indicators such as track width and aerial soil loss vary according to usage and site variables such as altitude, soil type and track gradient.

A common conclusion of such studies has been that track conditions are more dependent on site variables than on use (Helgath 1975, Bratton et al 1977, Weaver, Dale & Hartley 1979, Cole 1983a, Kuss 1986). Indeed, some researchers have concluded that poor siting is the primary cause of track deterioration in the USA, the majority of these tracks never having been designed to withstand long-term or heavy usage - if indeed they were designed at all (Krumpe & Lucas 1987). In this respect there is a close parallel between the situation in the USA and that in the Tasmanian Wilderness World Heritage Area, where the majority of walking tracks have evolved from early bushwalkers' routes.

Some of the results of the abovementioned research into track impacts and site variables are listed below. It should be noted that the results of such studies vary widely; for example the relative importance of usage levels and site variables has been found to vary widely from one study to another.

B1.6.2 Factors contributing to track deterioration

(i) Usage

In some situations track impacts have been found to increase with increasing usage (eg Calais 1981, Coleman 1981, Burde & Renfro 1986), although as mentioned above the significance of usage is often outweighed by site factors and track design. Weaver and Dale (1978) and Cole (1983a) found that track width tends to increase as usage increases, but erosion depth tends to be independent of usage and dependent only on track gradient, at least for higher levels of usage. By contrast Coleman (1981) found that erosion depth tended to increase in proportion to the square root of usage.

(ii) Gradient, drainage and erosion depth

Many researchers have found a high correlation between gradient and erosion (eg Helgath 1975, Cole 1983a), although the threshold at which gradient becomes significant tends to vary between environments (Helgath 1975). Coleman (1981) found that most of the tracks he investigated were stable below about 17°. Water flow is often a major factor in track erosion, especially on steeper tracks, and especially when tracks run close to the fall-line (Root & Knapik 1972, Bryan 1977, Edwards 1977, Bratton et al 1979).

Vegetation damage and mud churning is often worst in poorly drained areas (Edwards 1977, Calais 1981, Gibson 1984). Helgath (1975) observed that in some environments benching can speed erosion by bringing subsurface water to the surface.

(iii) Width

In some types of terrain track width tends to be a function of the roughness of the track surface relative to that of the adjacent terrain, users tending to spread out in areas where the track is more difficult to walk on than the ground on either side (Bayfield 1973, Calais & Kirkpatrick 1986). Width also tends to increase with increasing usage (Cole 1983a, Weaver & Dale 1978).

(iv) Soils and geology

Refer to Sec B1.5 for information about the relationship between soil types and impacts. Calais (1981) found high correlations between geological type and track impacts but these correlations were biased by the fact that the geological types in his study region were strongly correlated with altitude and vegetation type (see B5). Bryan (1977) found that some geomorphological types such as alluvial deposits were particularly susceptible to track impacts. By contrast Helgath (1975) found that the influence of other site variables obscured any correlation between track impacts and soil characteristics.

(v) Aspect

Aspect has failed to prove a significant factor in most impact studies, but there have been exceptions such as the study by Ciezlinski and Wagar (1970). In an unpublished memo to the Dept of Parks, Wildlife & Heritage in 1990, Grant Dixon observed that the majority of severely eroded track sections in the Western Arthur Range were situated on southward facing slopes.

(vi) Altitude

Altitude has been found to be a major contributing factor to track impacts by many researchers, eg Ciezlinski and Wagar 1970, Calais 1981.

(vii) Leaf litter

Kuss (1986) found that leaf litter helped to prevent soil erosion on tracks, and that track impacts in forests varied according to the canopy density.

(viii) Rainfall

Garland (1988) found that several rainfall parameters were highly correlated with soil losses from an experimental footpath in the Drakensberg Mountains.

(ix) Microclimates

Cole (1987a) observed that the clearance of vegetation in the immediate vicinity of tracks can create microclimates, for example by decreasing transpiration. However no research appears to have been done into the ecological effects of creating microclimates or into the relationship between microclimates and track impacts. It is common practice in the Tasmanian Wilderness WHA to clear vegetation away from tracks in lowland areas to allow wind and sunlight to dry out the track surface.

(x) Interactions between causative variables

Many researchers have observed that site variables are often mutually correlated (eg Calais & Kirkpatrick 1986) and in some cases interact strongly with each other in their effect on track impacts. For example Coleman (1981) found that track depth and width increased in approximately linear relation to the square root of usage and the square of the track slope, and that slope and usage interacted strongly - ie high usage and high slope were associated with higher levels of impact than could be attributed to the product of these variables considered independently.
Calais (1981) associated certain types and degrees of track deterioration with particular types of environment in the Cradle Mt-Lake St Clair National Park, although his classification scheme for track types and environments was qualitative and fairly arbitrary.

On the basis of data obtained in her study of track erosion in the Selway-Bitterroot Wilderness, Helgath (1975) suggested that the concept of biophysical units, ie environmental units classified on the basis of vegetation type, soil conditions and the like, showed promise as a tool for predicting track erodibility. A similar approach was used with moderate success by Garland (1990) who used a simple parametric scoring technique to predict track erodibility based on estimates of rainfall, slope and lithology.

Cole (1987a) concluded that more research is needed into the way in which environmental variables and usage interact to influence track impacts.

B1.7 Mechanics of trampling

Some researchers have studied the mechanics of trampling in order to determine whether different footwear or gaits affect the degree of impact. For example Quinn et al (1980) measured the forces exerted by different parts of the feet when walking. However few useful conclusions have been drawn. An analysis by Holmes (1979) of the impacts caused by different types of gait proved inconclusive. Several researchers have investigated the impacts caused by different types of footwear; all concluded that type of footwear has little or no bearing on trampling impacts (Palmer 1972 & 1979, Whittaker 1978, Saunders et al 1980, Kuss 1983 and Kuss and Jenkins 1984).

Sawyer (1993) concluded from qualitative observations that much of the erosion occurring on steep wet tracks is caused by people walking downhill, mainly as a result of the action of boot heels cutting into the track surface to obtain a grip. He suggested that the modern rounded heel design is likely to have appreciably less impact than the old-fashioned squared-off heel, and recommended further research in this area.

Holmes and Dobson (1976) and Saunders et al (1980) arrived at the unsurprising but useful conclusion that walking with a pack has greater impact than walking without one. Weaver and Dale (1978) found that walkers tend to have greater impact when walking downhill than when walking uphill.

B1.8 Campsite impacts

Summaries of research into campsite impacts have been published by Hart (1982) and are included in papers by Manning (1979a), Cole (1987a & b) and in the annotated bibliography by Cole and Schreiner (1981).

B1.8.1 Relationship of usage to impact

As stated in section B1.3.1 the relationship between campsite impacts and usage is nonlinear, low usage causing a disproportionately high degree of impact (Cole 1982a). Because rehabilitation is often very slow (see B1.10.2), campsite rotation is seldom a practical management option because it would lead to the proliferation of impacted sites (Merriam & Smith 1974, Hart 1982, Cole & Ranz 1983).

Several researchers have reported that campsites tend to stabilise after an initial break-in period (McCool et al 1969, Magill 1970, Cole 1987a), the degree of stability being more a function of siting than of use (Bratton et al 1977). Soil compaction may be one of the main factors contributing to campsite stability (Cole 1987a).

Once a comparatively stable state has been reached the main form of change in campsite impacts tends to be an increase in area (Merriam et al 1973, Cole 1986). Large parties have been found to have a greater per capita impact on campsites, particularly in terms of increasing campsite area (Holmes & Dobson 1976, Cole 1987b).

B1.8.2 Types of impacts and site factors

Initial impacts on campsites include changes in species composition, plant productivity and the other types of impact listed in sections B1.4 and B1.5. Longer term impacts may include loss of vigour and dieback in trees and loss of tree reproduction (Hart 1982). Hart has suggested that the vegetation on some developed campsites may reach a dynamic equilibrium and that such sites can be regarded as ecosystems in their own right (ibid).

As is the case with tracks, location and type of environment are often more important than usage in determining how stable a campsite will be (Aitchison 1976, Manning 1979a). Soil surveys and good design should help to minimise campsite impacts (Manning 1979a), but there is a shortage of information about the suitability of different types of environments and locations for campsites (Cole 1985a).

B1.8.3 Campfire impacts

Researchers have found that impacts at campsites in areas where campfires are permitted affect up to nine times the area of fire-free sites, mainly because of the effect of trampling by walkers in search of firewood (Cole & Dalle-Molle 1982). In areas where campfires are prohibited impacts tend to be minimal except in the immediate vicinity of tracks and camping areas (Cole & Dalle-Molle 1982, Cole 1985a)

B1.9 Other biophysical impacts

B1.9.1 Impacts on fauna

Most studies of the impacts of recreation on fauna have been undertaken outside Australia and have little relevance to this report. (For a comprehensive summary see the literature reviews by Ream 1980, Vaske, Graefe and Kuss 1983 and Kuss, Graefe & Vaske 1990a).

Chappell et al (1971) found that in general populations of soil organisms were greatly reduced in trampled areas of a chalk grassland, although some species were most numerous in moderately trampled areas and some seemed unaffected by trampling.

Duffey (1975) found that soil organisms in grassland litter were affected by trampling intensities lower than the levels at which measurable changes in the corresponding vegetation occurred. Different species had different levels of susceptibility to trampling, a fact which he attributed to the alteration of habitat due to compression, fragmentation and increased mud content of trampled litter. Mahoney (1976) reached similar conclusions in relation to the population levels and distribution patterns of soil-dwelling Collembola, changes in which were evident before vegetation damage or soil erosion became apparent.

B1.9.2 Pollution and sanitation

Some research indicates that the cat-hole method for disposing of faecal wastes may create a health hazard in heavily used sites, particularly in alpine areas, because intestinal pathogens can survive in the soil for more than twelve months (Temple et al 1982).

Outbreaks of gastroenteritis have occurred among large numbers of walkers on the Overland Track in recent years (ranger reports), and isolated cases have also been reported in the Western Arthurs (Mead 1991). In a 1990-91 walker survey conducted by the Parks & Wildlife Service twenty respondents (4% of the total surveyed in the WHA) reported contracting gastroenteritis, eleven of them in the Walls of Jerusalem area.

B1.9.3 *Phytophthora cinnamomi*

Another form of recreational impact which is of direct relevant to the issue of walking-track management in the WHA is the spread of *Phytophthora cinnamomi*, an introduced soil fungus which affects a wide range of plant species and has the potential to cause permanent changes to moorland, heathland and dry sclerophyll floristics. The report *Management Plan for* Phytophthora cinnamomi *in the Tasmanian Wilderness World Heritage Area* (Parks and Wildlife Service 1993a) provides the following information:

- Areas suitable for the spread of *Phytophthora cinnamomi* are those where the annual mean temperature exceeds 7.5°C and the annual rainfall exceeds 600mm. In the WHA areas at altitudes greater than 800m (eg the Central Plateau) are considered safe from the disease.
- Plant communities considered highly susceptible to the disease are heathlands, moorlands and the understorey component of dry sclerophyll forests. Closed forests are generally resistant to the disease but may become susceptible following fire.
- The fungus is very difficult to contain; the best known strategy for control is to slow the spread of the disease.
- Human activity is the main long-distance dispersing agent. Groundwater can spread the disease downslope and along watercourses.
- The use of machinery, especially earth-moving equipment, vehicles and the movement of infected soils or gravel, poses the greatest risk of contamination. As far as bushwalking is concerned the fungus is most likely to be spread on boots, tent-pegs and other equipment which can be exposed to soil.
- *P cinnamomi* spores and hyphae can be transported in minute quantities of soil, the risk of infection increasing in proportion to the quantity of soil moved.
- Some rare plant species are considered threatened by the disease.
- *P cinnamomi* has the potential to have an adverse effect on the populations of some birds and animals.

Strategies for managing the spread of *Phytophthora cinnamomi* are summarised in section B4.13.

B1.9.4 Bushfires

Several major fires have been accidentally started by bushwalkers during the past twenty years, usually as a result of escaped campfires. Escaped fires can cause ecological disruption to extensive areas and may cause long-term or even permanent damage (Dept of Parks, Wildlife & Heritage 1991a, Pemberton 1988). Such damage includes the destruction of fire-sensitive communities (Dept of Parks, Wildlife & Heritage 1991a), the loss of organic soils and nutrients, sheet erosion, increased surface runoff, stream siltation, flooding, eutrophication of surface water and damage to faunal habitats (Pemberton 1988).

B1.9.5 Trampling impacts on geomorphological and cultural features

In some instances trampling may cause damage to geomorphological and cultural features such as dune systems and Aboriginal midden sites. While no direct information is available on the effects of human trampling on such features, sand-dune erosion on midden sites in northwest Tasmania has been attributed to trampling by cattle and to the impacts of off-road vehicles (Prince 1989), and track rerouting has been recommended in places where existing walking tracks traverse midden sites (ibid).

B1.9.6 Environmental impacts of track construction and stabilisation

Little research has been done into the ecological impacts of track construction and track stabilisation (Cole 1987b).

However a recent study by Comfort (1992) investigated the environmental effects associated the use of CCA (copper chromium arsenate) treated timber in the western Tasmanian environment. The study, which looked at treated-pine track constructions ranging in age from two to fifteen years, found that minimal leaching of copper, chromium and arsenate occurred and that leaching was confined to the top few centimetres of soil and to the immediate vicinity of tracks on the downhill side.

B1.10 Rehabilitation

B1.10.1 Overview of research

Numerous research papers have been published on the rehabilitation of impacts in wilderness areas, although few have focussed on the rehabilitation of recreational impacts and most of the research to date has been site-specific (Cole 1987b). Detailed summaries of the research in this area to date are contained in a paper by Cole (1987a), and an annotated bibliography is provided by Cole, Schreiner & Edwards (1981). Examples of studies in Australia which have focussed on the rehabilitation of recreational impacts include those by Good (1976), Keane (1979) and Calais (1981), and more general rehabilitation studies are listed in an annotated bibliography by Aust. Alps Nat. Park Co-op. Mgmt (1988).

B1.10.2 Rates of recovery

Most researchers have reported slow rates of recovery in rehabilitation trials, even at low altitudes. For example Cole (1987a) noted that low-altitude campsites may take 20-50 years to recover. Rehabilitation of impacts in alpine areas is generally slow (eg Edwards 1977) and may never occur (Grabherr 1985). Willard & Marr (1971) estimated that alpine tundra may take several hundred to a thousand years to recover after only a few seasons of human activity.

Campsites may recover rapidly after limited use (Cole 1987a) but rehabilitation of more heavily impacted sites is generally slow (Merriam et al 1973, Fay 1975, Cole & Ranz 1983). Where vegetation has been lost rehabilitation may initially take the form of colonisation by fast-growing annuals (Edwards 1977). However, little is known about the processes of plant succession, especially in alpine areas (Brown, Johnston & Johnson 1978).

Soil recovery after compaction is also slow (Jones 1978), and since soil accumulation rates are extremely slow (eg Kirkpatrick and Gibson [1984] report an accumulation rate for peat of 2cm per century in alpine Western Tasmania) the unassisted infill of eroded tracks may take thousands of years or may never occur.

B1.10.3 Assisted rehabilitation

Numerous attempts have been made to assist rehabilitation artificially in wilderness settings but success has generally been limited, not least because of the lack of information about the processes involved (Cole 1987a). Applications of different combinations of seed, fertiliser, mulching and water have been tried (eg Beardsley et al 1974, Keane et al 1979), with varying results; for example Manning (1979a) concluded that fertiliser was unnecessary whereas Brown, Johnston and Johnson (1978) concluded that the application of fertiliser was essential in alpine areas.

Keane et al (1979) found that the installation of cross-drains and subsurface drainage was necessary for the successful rehabilitation of alpine impacts. Palmer (1975) describes a method that has been successfully used to assist the rehabilitation of eroded tracks. Brown, Johnston and Johnson (1978) recommended the use of mulching such as straw or jute netting to prevent frost damage and reduce evaporation.

B2 Use trends, user attitudes/characteristics and social impacts

B2.1 Use trends

Wilderness use data from the USA indicates that there has been a rapid increase in user numbers since the mid 1960s (Krumpe & Lucas 1987). However usage now appears to be levelling off (Spencer et al 1980, Krumpe & Lucas 1987, Lucas & Stankey 1989), is declining in some areas (Roggenbuck & Lucas 1987) and may be declining overall (Dearden & Sewell 1985, Roggenbuck & Lucas 1987). A summary of recent wilderness-use trends in the USA is provided by Roggenbuck and Lucas (1987), who point out that research into usage trends has declined since the late 1960s. Some researchers have endeavoured to predict future usage levels on the basis of current use levels and growth data; for example in 1982 Jungst and Countryman predicted a growth in wilderness use of 2-7% by the year 2020.

Roggenbuck & Lucas (1987) report that the average length of stay in US wilderness areas is decreasing, a typical average being 2-3 days with more than 50% of visitors to many wilderness areas being day trippers.

Recreational use of national parks and wilderness areas continues to grow in many parts of Australia (eg in Victoria - Department of Conservation Forests & Land 1989) and walker-registration statistics show increasing usage of many of the major tracks in the Tasmanian Wilderness WHA (C1.2.2). The adventure-tourism market is considered to be one of the fastest growing markets in Australia (Hepper 1986).

B2.2 User attitudes/characteristics

B2.2.1 General observations

State-of-knowledge summaries of information about the attitudes and characteristics of wilderness-users, including analyses of users by type, socioeconomic background and expectations, are provided by Krumpe and Lucas (1987) and Roggenbuck and Lucas (1987), although these papers are concerned mainly with wilderness users in the USA.

Studies of wilderness-user characteristics and attitudes in Australia include those by Calais (1981), Stankey (1986), Carlington (1988) and Sawyer (1988b), of which the Calais, Carlington and Sawyer studies focus on visitors to specific areas within the Tasmanian Wilderness WHA. Further information on the attitudes and characteristics of wilderness users in the WHA has been derived from walker surveys conducted by the Parks and Wildlife Service since the mid 1980s.

For a summary of the results of the Carlington, Sawyer and Parks & Wildlife surveys see C3.2.

Many researchers including Roggenbuck and Lucas (1987) and Carlington (1988) have pointed out the need for further research in the field of user attitudes and characteristics. For example there is comparatively little documented information about user attitudes to physical impacts such as track erosion. In particular some researchers (eg Watson 1988) have stressed the need for research into how usage patterns and user attitudes and characteristics change over time. However the level of research into social impacts in wilderness areas has declined since the 1960s (Roggenbuck and Lucas 1987).

B2.2.2 User responses to biophysical impacts

As stated in 2.2.1, little is known about user responses to biophysical impacts (Lucas 1985a). Lucas (1979, 1980) found that physical impacts tend to adversely affect user satisfaction more than any other factor including crowding. Hendee & Harris (1970) warned that managers can make false assumptions about user attitudes and preferences - for example users may not necessarily agree with managers that impacts are unacceptable or undesirable, an observation corroborated by Martin et al (1989). Thus managers could be wasting resources by attempting to avoid relatively minor impacts in high-use areas (Shelbey, Vaske and Harris 1988).

Perceptions of impacts and the effect of those perceptions on user satisfaction vary from user to user (Lucas 1964, Bultena et al 1981), although Shelbey, Vaske and Harris (1988) found a high degree of consensus among users in this regard. Users' perceptions of (and responses to) physical impacts also tend to vary according to the location of those impacts, impacts generally being least acceptable in remote areas (Stankey 1973, Shelbey, Vaske and Harris 1988, Martin et al 1989). Lucas (1983b) and Shelbey, Vaske and Harris (1988) report that some users prefer camping at sites with minor impacts to camping on undisturbed sites, possibly because they are unwilling to disturb virgin ground.

In his study of wilderness users in the Tasmanian Wilderness WHA Carlington (1988) found that naturalness was the major contributing factor to bushwalkers' trip satisfaction, a finding corroborated by Sawyer (1988b). Further results of research into the attitudes of visitors to the Tasmanian Wilderness WHA are listed in C3.2.2.

Complaints about the prevalence of degraded tracks are increasing in some parts of the USA (Lucas 1985b) and in Tasmania (Mead 1991).

B2.2.3 Additional comments

Several studies indicate that a significant percentage of wilderness users would be just as happy pursuing recreation activities in nonwilderness areas (Hendee et al 1968, Stankey 1973, Lucas 1978 and Merriam & Knopp 1976).

For information about user responses to management see section B4.3.

B2.3 Social impacts

B2.3.1 General comments

The term social impacts refers to the ways in which the recreational experience of wilderness users is affected by the presence and behaviour of other users, eg the perceived loss of opportunities for solitude. Social impacts are adversely affecting recreational values in nearly half the proclaimed wilderness areas in the USA (Washburne & Cole 1983). While social impacts are probably of less immediate concern in the Western Tasmanian WHA - at least in comparison to physical impacts - there are indications that crowding and other forms of social impact are becoming serious problems in some areas (see C3.2.2)

Papers by Graefe, Vaske and Kuss (1984a & b), Manning (1985) and Watson (1988) provide useful summaries of the research literature into social impacts, although most of this literature has been published outside Australia. Data for social-impact research has been derived mainly from either questionnaires or computer simulations. The latter enable researchers to obtain data on impacts such as encounter rates and average campsite occupancy assuming varying rates of use and management restrictions (such as limits on the number of nights permitted at some campsites). Computer simulations therefore provide a cost-effective way of testing the outcomes of alternative management options, and may show up unexpected trends (see eg Lucas, Schechter & Mordechai 1977, de Bettencourt et al 1978, Rowell 1986).

B2.3.2 Relationship between usage and social impacts

Social-impact research has revealed that it is necessary to draw a distinction between usage levels, encounter rates (ie the number of other users or other parties met in a specified period), perceptions of crowding and reported trip satisfaction, because contrary to what one might expect these variables are often only loosely linked. For example increased usage levels in a given area (or even on a particular track) do not necessarily lead to an increase in the average encounter rate (Colvin and Shelbey 1979, Bultena et al 1981); increased encounters do not necessarily cause increased perceptions of crowding (Colvin and Shelbey 1979); and neither encounter rates nor perceived crowding are necessarily linked to trip satisfaction (Bultena et al 1981, Lucas 1980).

The explanation for these findings lies in the fact that encounters are influenced by use patterns (eg a majority of users may walk along a track in one direction) while crowding and trip satisfaction are subjective quantities which are generally dependent on the background, motivations, preferences, experience and expectations of individual users, and for a given individual may vary over time (Graefe, Vaske & Kuss 1984a).

Use levels may therefore be of little value in predicting social impacts (Washburne 1982) and usage limitations may be ineffective or unnecessary for controlling such impacts (Watson 1988). The most objective means of determining crowding is to study users' contact preferences (Shelbey & Heberlein 1986).

A majority of users in wilderness areas tend to report a high level of trip satisfaction, regardless of increases in social impacts in those areas over time (Graefe, Vaske & Kuss 1984a, Lucas 1985b). Hence user satisfaction is not a reliable indicator of social impact levels (Watson 1988). There is evidence that as social impacts increase, users seeking a higher degree of solitude tend to move on to other areas - a process referred to as recreational displacement (Burch 1969, Anderson & Brown 1984). However this theory has so far been only partially borne out by research (Graefe, Vaske & Kuss 1984a). Graefe et al (1984b) stressed the need for further research in the field of social impacts.

B2.3.3 User background and expectations

For a given number or rate of encounters, perceptions of crowding will vary according to the background, expectations and preferences of each user, sightings of evidence of human impact (eg litter), and the nature and location of the encounters (Badger 1975, Shelbey 1981, Bultena et al 1981, Watson 1988). For example, in a 1991/92 survey conducted by the Parks & Wildlife Service 14% of walkers surveyed on the Overland Track and Frenchmans Cap Track said that encounters with other walkers on tracks had detracted from their enjoyment, 32% said these encounters enhanced their enjoyment and half said they made no difference (see C3.2.2). Ranger staff at Cradle Mountain report that expectations of social counters can be a positive factor affecting some users' choice of walking trips, particularly commercially guided trips.

Some types of users tend to be more tolerant of encounters than others - eg inexperienced users tend to be more tolerant than experienced users (Graefe, Vaske & Kuss 1984a, Manning 1985). Most users are more tolerant of encounters near track starting-points than they are of encounters in remote areas (Stankey 1973), and more tolerant of encounters on tracks than at campsites (Stankey 1973, Bultena et al 1981). In this respect campsites constitute bottlenecks because most wilderness users prefer to camp in isolation (Stankey 1973, Lucas 1980 & 1985b, Manning 1985).

Wilderness users tend to react more negatively to encounters with different types of user (eg encounters between bushwalkers and anglers) than to encounters with users with similar backgrounds and outlooks (Bultena et al 1981, Graefe, Vaske & Kuss 1984b). A majority of users report that encounters with large parties have a major negative impact on their wilderness experience (Lime 1972, Stankey 1973); for example in one study a majority of users reported that they would rather see five small parties during the day than one large party (Stankey 1973).

Results of research into user responses to social impacts in the Tasmanian wilderness WHA are listed in C3.2.2.

B3 Monitoring and inventory techniques

B3.1 Importance of monitoring

The importance of monitoring as an integral part of efficient wilderness management has been stressed by many researchers (eg Price 1985a, Cole 1987b, Merigliano & Krumpe 1988). Only by adequately monitoring environmental and social impacts in wilderness areas can effective management decisions be made and the effectiveness of past and current management policies be adequately assessed (Lucas 1985a). Moreover monitoring programs should be ongoing to ensure that long-term changes are recorded (Merigliano & Krumpe 1988), and should generally be conducted in the context of a range of standards defining acceptable limits for impacts (Cole 1983a).

Until now, however, commitment to monitoring by wilderness managers has generally been poor, and most monitoring has been insufficient, unsystematic (ie lacking goals and outputs) and poorly documented (Cole 1987b, Merigliano & Krumpe 1988). Moreover most monitoring to date has focussed on localised and visible impacts (eg track widening and loss of vegetation); more subtle but critical impacts such as those on aquatic ecosystems and fauna have been largely ignored (Merigliano & Krumpe 1988).

B3.2 Choice of indicators

For monitoring to be useful and effective it must be undertaken in the context of a clear set of management objectives - ie managers must decide what quantities they want to measure and what standards they are trying to maintain. In particular managers must choose a set of indicators which best delineate the biophysical or social impacts of concern, and specify standards which define acceptable limits for these indicators (see eg Stankey, Cole et al 1985). In applying the Limits of Acceptable Change (LAC) approach it may be necessary to reassess one's initial choice of indicators and/or standards of "acceptability" in the light of the results and effectiveness of an ongoing monitoring program (see B4.1.2). In this context it is important to draw a clear distinction between the descriptive and evaluative elements of the management process (Shelbey & Heberlein 1986) - ie between (objective) measurements and the subjective assessment of those measurements.

Merigliano and Krumpe (1988) provide the following list of criteria as a basis for selecting indicators:

(a) Indicators must be quantitatively measurable.

(b) Indicators should be measurable easily, eg with simple equipment.

(c) Measurements should be reliable.

(d) An indicator should reflect the condition of a particular impact.

(e) The values of an indicator should be affected by human activities.

(f) An indicator should be sensitive to changes within one season and/or sensitive to long-term (ie ecologically significant) changes.

(g) Some indicators should reflect changes which affect the recreational value of an area.

(h) Some indicators should serve as early warnings, alerting managers to deteriorating conditions before unacceptable changes have occurred.

Merigliano and Krumpe also provide a list of suggested indicators of which the following are of interest in the context of this report (though not all are necessarily suitable for use in the Tasmanian Wilderness WHA):

(i) Vegetation

- Number and distribution of campsites per unit area
- Percent of ground cover loss on campsites
- Percentage of total area disturbed by campsites
- Vegetation ground cover loss in track corridors
- Exotic plant distributions

(ii) Soil

- Fire-ring density (ie number per unit area)
- Percent or area of exposed soil on campsites
- Number of multiple tracks
- Cross-sectional area of soil loss on tracks
- Number of social tracks associated with campsites
- Length of tracks per unit area
- Percentage of area which is free of tracks

(iii) Use distribution and social impacts

- Number of groups/users encountered at campsites
- Number of groups/users encountered on tracks
- Visitor perceptions of naturalness.

Clearly this list is far from exhaustive, and some of the indicators listed appear to be of dubious value (eg how does one define an "area which is free of tracks"?) Similar lists of indicators can be found in other publications, eg Kuss, Graefe & Vaske (1990b).

Hart (1982) argues that recreational impacts on soils are best monitored by measuring soil density and infiltration, and that fertility and chemical changes are unsuitable indicators because they are less sensitive to human-induced changes.

B3.3 Monitoring priorities

Managers must establish priorities in order to determine how best to use available monitoring resources. Stankey, Cole et al (1985) propose the following list of criteria for determining monitoring priorities:

- Sites where conditions are close to exceeding acceptable standards.
- Sites where rates of change are highest.
- Sites/environments where quality of existing data is poorest.
- Sites where understanding of effects of management is poorest.
- Sites where unanticipated changes have taken place, eg increased ease of access.

In developing a track monitoring system for the Tasmanian Wilderness World Heritage Area these priorities have been modified and revised as follows:

(i) Main priorities

Priority will be given to:

- Environmental damage including impacts on wilderness values. User comfort is generally a lower priority.
- Sites judged to be susceptible to unacceptably high levels of impact.
- Sites where conditions are close to exceeding acceptable levels as specified by the track classification scheme.
- Sites where rates of change are highest or are considered likely to increase rapidly in the near future.
- Sites where recent changes have taken place (eg increased ease of access) which may affect usage or impact levels.

- Sites where new management policies have been implemented, eg a fanout policy.
- The emphasis of the monitoring program will be on unimproved tracks, ie tracks where no major stabilisation works have been undertaken. As an offshoot of the main monitoring program impacts such as erosion will also be monitored on some "hardened" tracks (eg on tracks surfaced with gravel), and systematic techniques for monitoring the condition of track infrastructure such as duckboard may be developed at a later date.

(ii) Secondary priorities:

Priority will also be given to:

- Sites where the quality of existing data is poorest.
- Sites where understanding of the effects of management is poorest.
- Sites where impacts are judged to pose a substantial threat to ecological and other values, eg trampling of rare plant communities and cultural sites.
- Sites representing a broad spectrum of environmental and impact types (including impacts resulting from low usage levels).
- Where practical, preference will be given to sites in relatively accessible locations to facilitate ease of data collection.

B3.4 Track monitoring and track inventories

A summary of techniques for monitoring or inventorying track conditions is included in a paper by Cole (1983a). Cole lists three principle types of survey:

B3.4.1 Replicable measurements

This involves making detailed and accurate measurements at selected sites, eg measurements of aerial soil loss across track transects as described by Leonard and Whitney (1977), Burde and Renfro (1986) and others. Such measurements can detect subtle changes, although Coleman (1981) argued that data on aerial soil loss are difficult to interpret because (a) the statistic does not distinguish between track width and erosion depth, which may be influenced by different variables, and (b) because erosion profiles are dependent on local geomorphology. (As mentioned in Sec B1.6.2 erosion depth tends to be a function mainly of track slope whereas track width tends to depend more on usage.)

B3.4.2 Rapid survey

In this method larger numbers of sites are sampled using simpler, less accurate methods than those used in the method described above; for example estimates may be made of track width and erosion depth at 500m intervals along an entire track system (eg Bratton et al 1977). In the Cradle Mt-Lake St Clair National Park Calais (1981) used a form of this technique to calculate a "track damage index" for sites at 500m intervals (see Sec B5). Root and Knapik (1972) conducted a similar study using sample sites every 150m and taking soil profiles into account.

B3.4.3 Census

Cole uses this term to describe an inventory technique in which percentage estimates are made of impacts such as track erosion over entire sections of track. For example Trottier and Scotter (1975) divided tracks into more or less homogeneous sections (ie sections along which environmental conditions remained roughly constant) and rated these sections qualitatively using a 1-4 ranking for track width, erosion depth, wetness, presence of roots and stones and ease of use. Each section was given an aggregate assessment by adding the individual rankings.

Bratton et al (1979) found that estimates of percentages (eg percentage of a section subject to erosion of a specified depth) were subject to greater error than other measurements, and suggested the alternative of spot sampling using a simple yes/no ranking (eg sampling at every fifty metres, awarding a 1 for "eroded" and 0 for "not eroded" and adding the results every 500m).

Coleman (1977) suggested that approximate measurements at large numbers of sites contain more information and are therefore more likely to be of use to managers than accurate measurements taken at relatively few sites. Cole (1983a) concluded that of the three track-inventory methods the census method gave the best overall picture of track conditions. Cole argued that all monitoring work including census surveys should be conducted by management officers skilled in ecology and soil science, and preferably also skilled in track construction and track-maintenance techniques.

B3.4.4 Other track monitoring techniques

It is worth briefly mentioning some of the other techniques which have been used to measure track impacts.

In an early study in the UK Bayfield (1970) installed fine upright wires across tracks to record the lateral spread of trampling and also to provide a qualitative (and for low usage levels, rough quantitative) assessment of usage levels.

Boorman and Fuller (1977) used aerial photographs to identify track locations, and Coleman (1977) and Sawyer (1988a) have proposed the use of high-resolution aerial photos for determining long-term changes in track width. Sawyer found the scale of existing aerial photographs too small to allow measurements of track deterioration, but found that the Mt Anne Track was far more apparent on (colour) aerial photographs taken in 1984 than on (black & white) photographs taken in 1973. He also found aerial photographs useful for detecting new track developments such as duplications and side-tracks.

Brewer and Berrier (1984) described a range of (non aerial) photographic techniques for monitoring track deterioration at close range. Rinehart et al (1978) described a technique for estimating soil loss using 3D photography, but Cole (1983a) found the transect method (see (i) above) quicker to use and more accurate than 3D photography.

Lance et al (1989) described a study of walking tracks in the Cairngorm area of Scotland in which three indicators (width of bare ground, width of damaged vegetation and total width) were measured at fixed, evenly spaced sites and remeasured after a lapse of time. The total number of sites to be measured on each track was determined on the basis of an assessment of the means and variances of the relevant indicators, the number chosen being the minimum required to ensure detection of a specified change in path width at a specified level of statistical certainty. Pairwise comparison of the measurements made at different times provided a basis for detecting changes with greater sensitivity than would have been possible if variable sample points had been used instead of fixed sample points.

B3.4.5 Track inventories in Tasmania

The only inventories compiled to date of walking tracks in the World Heritage Area have been those by the Tasmanian Interdepartmental Committee on Recreation Use Of State Resources (1980), Calais (1981) and Hepper et al (1986).

The Tasmanian Interdepartmental Committee report contained only a list of walking tracks which was far from complete. The Calais study contained a detailed inventory of track conditions (as measured by spaced transects) but only for major walking tracks in the Cradle Mountain - Lake St Clair National Park (as per its 1981 boundaries).

The Hepper study contained a reasonably comprehensive list of walking tracks and major routes within the (1986) World Heritage Area, together with basic information such as track length, usage levels (generally estimated by local ranger staff), major facilities, recreational attractions and a rudimentary assessment of track conditions (which were classified as "good", "fair", "bad" and "very bad"). The study also classified tracks and routes using a simple four-tiered track classification scheme.

B3.5 Campsite monitoring and inventories

A variety of methods for monitoring and inventorying campsite impacts is described in a paper by Cole (1983b). These methods fall into two general categories: those that list data for numerous separate indicators (eg area of bare ground, number of fire sites, number of mutilations to standing vegetation - see for example the Code-a-site inventory form reproduced in Hendee at al 1976) and those that attempt to combine these data into a single aggregate, such as the Frissell rating (Frissell 1978). Both methods have their pros and cons: the former is more time-consuming and therefore impractical to use in areas where there are numerous scattered campsites (Parsons & MacLeod 1980), but it preserves more useful information than the aggregate method.

Parsons and MacLeod (1980) and Cole (1983b) both advocated the use of simple, visually-based assessments of campsite conditions which Cole claims can yield reproducible results when carried out by trained evaluators. McBride and Leonard (1982) described a system for recording vegetation cover on disturbed sites using vertical (non aerial) photography - a technique which can only be used in areas free of bushes and other tall vegetation.

Since relatively high-use campsites are often "broken in" and stable, at least in the USA, Cole (1983b) advised managers to concentrate their monitoring on lightly used sites where the potential for substantial change is high.

B3.6 Techniques for monitoring usage, user attitudes, user characteristics and social impacts

B3.6.1 Usage levels

In a paper which discussed several aspects of wilderness use and usage trends in the USA Krumpe and Lucas (1987) concluded that accurate and cost-effective methods for monitoring wilderness use are still lacking. Various methods for monitoring usage are described by Leonard and Echelberger (1980) and Roggenbuck and Lucas (1987), including the use of permit-issue data, registration booths, pressure plates, infra-red beams and concealed still or movie cameras.

Each of these methods has its limitations, including mandatory permits (because not all visitors will obtain permits and not everyone who obtains a permit will undertake the trip they get the permit for). However mandatory permits appear to be the most reliable source of user data (Hendee & Lucas 1973, Leonard & Echelberger 1980). Self-registration tends to be inadequate as an indicator of use levels (Hendee & Lucas 1973, Lucas & Kovalicki 1981) although Petersen (1985) found that the percentage of users who signed themselves in at registration booths increased if the booths were located a few kilometres in from the start of a track. Roggenbuck and Lucas (1987) stressed the importance of protecting user privacy if photographic monitoring methods are used, particularly at campsites.

Most of the information currently available on usage levels in the WHA has been derived from registration data (where available), hut logbooks and reports from ranger staff and walkers (see C1.1). Of these, registration data are considered to be the most reliable but they are still far from 100% accurate because many walkers fail to register at trailheads and many walkers fail to complete the walk for which they register (Sawyer 93). The introduction of a mandatory permit system for the Cradle Mt - Lake St Clair National Park has provided a reasonably accurate source of data on use levels on the Overland Track and other major tracks in the park.

Pedestrian counters have been trialled in some areas, with varying success (eg see Sawyer 1988b). Pressure-type counters (modelled on sheep counters) are currently considered within the Parks & Wildlife Service to be the most reliable type of pedestrian counters for use in Western Tasmanian conditions.

B3.6.2 User characteristics and attitudes

Assessments of user characteristic, user attitudes and social impacts are generally carried out by means of questionnaires (see for example Hendee et al 1968, Lucas 1980, Carlington 1988). However it appears that little research has been done into the methodology of such assessments and some of the methodology may need refining. For example Shelbey and Colvin (1982) discovered discrepancies between actual and reported numbers of encounters. Some researchers have conducted "simulated wilderness experience" experiments to assess user responses to hypothetical social-impact situations or management actions (eg Ellis & Williams 1989).

B4 Planning frameworks, management principles and management strategies

B4.1 Planning frameworks

Numerous papers have been published on the subject of wilderness management philosophy and the various planning frameworks which can be used to identify problems, define objectives and determine strategies for achieving those objectives. McCool and Cole (1988) proposed a list of attributes which they considered desirable in any planning framework - in particular the requirement that objectives should be specific, quantifiable and achievable. Discussions of the pros and cons of various the "rival" frameworks are included in many publications, for example Prosser (1986) and Tyson (1989).

B4.1.1 Carrying capacity

The concept of carrying capacity originated in the field of wildlife population studies and was transplanted into the field of recreational management in the 1960s (Wagar 1964). However while the idea of determining upper limits for recreational-usage sounded plausible and even fairly straightforward, twenty years of research failed to make much progress towards that end. Indeed researchers began to realise that the problem was not as clear-cut as was first assumed, for several reasons:

(a) The concept of carrying capacity is vacuous unless it is defined in the context of a specified range of "acceptable" impact levels and a clearly defined program of management strategies;

(b) Biophysical impacts are dependent on other factors besides usage levels, eg type of use, user behaviour and usage distribution (see B1 and Washburne 1982); and

(c) Social impacts are often only weakly linked to usage levels (see B2.3.2 and Washburne 1982).

The concept of carrying capacity has now fallen into disrepute with many researchers. For example, Hendee Stankey and Lucas (1978) criticised the carrying-capacity approach because it fails to emphasise factors other than usage levels, and Krumpe (1988) went so far as to dismiss the whole concept of carrying capacity as "mythical". With regard to social carrying capacity Stankey (1980) concluded that "significant conceptual and methodological problems remain", while Burch (1981) suggested that "the research methodology, theory and findings still remain at a primitive level".

Nevertheless some researchers continue to promote the carrying capacity concept, though in a modified form which in many ways is scarcely distinguishable from the Limits of Acceptable Change concept (see 4.1.2). Shelbey and Heberlein (1986) emphasised that carrying capacity is ultimately a value judgment based on decisions about the types of ecological and recreational settings one wishes to conserve or provide, and the types of indicators and standards chosen to define acceptable limits to recreational impacts. They defined carrying capacity as “a level of use beyond which selected impact parameters exceed acceptable values specified by evaluative standards” - hence it defines a range of values corresponding to a range of specified management requirements.

An example of a practical application of the carrying capacity approach was described by van Wagtendonk (1986) in which the author estimates the carrying capacities of various parts of the Yosemite National Park based on calculations of area, track length and the ecological vulnerability of the areas in question.

B4.1.2 Limits of Acceptable Change (LAC)

The LAC system, which has been proposed as an alternative to the carrying capacity approach (eg by Stankey, Cole et al 1985), lays emphasis on impacts rather than usage levels. The LAC system involves selecting indicators, defining acceptable limits for those indicators and implementing management strategies which maintain the values of the indicators within those limits. (See B3.2 for a list of suggested criteria for selecting indicators.)

Besides avoiding many of the pitfalls of the carrying capacity approach, the LAC system can be better from the point of view of public relations because usage limits defined in terms of carrying capacity might be seen as arbitrary by some users. Monitoring plays a central role in LAC management, and in the course of implementing a management program based on LAC principles the selection of indicators and “acceptable” values may have to be modified and fine-tuned (Krumpe 1988). For further discussion of the LAC system see Graefe, Vaske & Kuss (1984b).

Sawyer (1990) pointed out that different “acceptable limits” may be appropriate in different situations. For example in trackless areas the acceptable limit may be defined in terms of the development of visibly trampled pads, whereas on existing tracks the acceptable limit may be defined in terms of specified levels of track erosion, campsite area or social impacts.

B4.1.3 Recreational Opportunity Spectrum (ROS)

The ROS concept has been defined as a system for inventorying, planning and managing recreational resources on the basis of user experiences and for providing a range of “recreational opportunity settings”. The latter are defined as “the combination of social, physical, biological and managerial conditions that give value to a place” (Clark & Stankey 1979, Stankey & Wood 1982). The ROS approach recognises that there is a demand for a range of recreational experiences, and gives priority to satisfying that demand.

The ROS approach typically involves zoning. Examples of ROS classes ranging from primitive to urban are listed in Buist & Hoots (1982), and a similar list is provided in the USDA Management Plan for the Great Bear Scapegoat Wilderness (USDA 1987).

The ROS concept has been criticised on the grounds that it tends to emphasise recreational (ie anthropocentric) values at the expense of ecological values, and may be seen as promoting a consumer ethic (see eg van Oosterzee 1984). The publication of a paper which compares national parks to department stores (Robertson & Wood 1982) suggests that there are valid grounds for such criticism.

B4.1.4 Other management frameworks

Other management frameworks have also been proposed, of which the most publicised is probably Visitor Impact Management (VIM) - see eg Graefe Vaske and Kuss (1983) and Graefe, Kuss and Loomis (1987). The VIM approach does not appear to be essentially different from the LAC approach; indeed, recent publications on carrying capacity, LAC and VIM all seem to be saying more or less the same thing but with varying emphasis on details. Readers wishing to investigate this question further are advised to consult the publications cited above.

B4.1.5 Comment: A shortcoming of the CC and LAC frameworks

A major shortcoming of the carrying capacity and LAC approaches is that they emphasise reactive rather than predictive indicators (Sawyer 1990), and consequently fail to emphasise the importance of being able to predict the *potential* for future deterioration. In particular they fail to address the possibility that ultimately "unacceptably" damaging processes may be set in train long before "acceptable" levels of impact are reached, and in some cases even before impacts are noticeable to the casual eye. For example in some cases the loss of vegetation cover on a track may be sufficient to initiate severe erosion regardless of subsequent usage levels.

The LAC concept can be modified to take future deterioration into account if acceptable limits are defined in terms of projected as well as existing impacts. This can only be done if adequate research and monitoring are undertaken to facilitate the prediction of future impact trends - a point which receives attention in some of the VIM literature (eg Graefe, Vaske & Kuss 1983).

B4.2 Management principles

This section summarises some of the key management principles proposed and discussed in the wilderness-management literature, with the exception of the management frameworks outlined in B4.1. A landmark publication on the subject was the book *Wilderness Management* by Hendee, Stankey and Lucas (1978), which remains one of the few comprehensive summaries of the subject.

B4.2.1 Managing wilderness implies managing use

Managing wilderness implies managing wilderness use (Lucas 1973, Manning 1979b); hence wilderness managers need social, behavioural and communication skills as well as scientific and financial expertise (Manning 1979b). Researchers have stressed the need for managers to assess the attitudes and norms both of wilderness users and of the wider public (Vaske, Shelbey et al 1986, Smith & Moore 1990), and to encourage public involvement in the decision-making process (ibid), while avoiding the trap of promoting a consumer ethic (Stankey, Cole et al 1985, van Oosterzee 1984).

B4.2.2 Nonregulatory actions are preferable

Indirect, nonregulatory management actions are preferable to regulations, not only because they are more acceptable to users (Anderson & Manfredo 1986) but also because they are more compatible with the concept of wilderness recreation and the maintenance of wilderness values (Hendee, Stankey & Lucas 1978, Lucas 1982, 1983a). Proposals to introduce regulations such as mandatory permits have attracted stiff opposition from some quarters - eg Behan (1974) who argued that mandatory permits are an infringement of civil rights. Hendee and Lucas (1974) countered by arguing that mandatory permits are both necessary and widely accepted, and Dustin and McAvoy (1984) went so far as to argue that regulations protect individual rights and freedoms (such as the freedom to experience solitude). Most researchers agree that regulations should be avoided where possible, although managers tend to think that regulations are more effective than indirect management methods (Bury & Fish 1980).

B4.2.3 Management guidelines

Lucas (1982, 1985a) has been critical of wilderness management in the USA and in particular has made the following criticisms:

(a) many of the management policies in place in the USA reflect an ignorance of impact processes, user behaviour and user attitudes;

(b) some management strategies currently in place are unnecessarily authoritarian; and

(c) managers tend to adopt techniques such as usage restrictions because they are "in vogue" or comparatively easy to implement, without adequately assessing whether restrictions are necessary and whether alternative strategies are available.

To counter these trends he proposed a set of guidelines for applying regulations (Lucas 1983a).

Other principles of wilderness management which have been emphasised in the literature include:

- The importance of specifying precise management objectives; for example "to protect the resource and provide a range of recreational experiences" may be fine as a statement of general policy but it is useless as a guide for day-to-day resource management (Watson 1988).
- The importance of research and monitoring (see B3).
- The importance of considering, as far as possible, all the ramifications of proposed management actions (Manning 1979b) - for example the imposition of hut fees may lead to increased campsite impacts (Devlin & O'Connor 1988).
- The importance of informing visitors about the need for management actions (Anderson & Manfredo 1986).

B4.3 Visitor attitudes to management

B4.3.1 General comments

A recent state-of-knowledge summary of this topic is provided by Stankey and Schreyer (1987). In general, wilderness users tend to support management actions which maintain the quality and character of the wilderness resource and recreation experience, and oppose other sorts of management actions (Anderson & Manfredo 1986). They prefer indirect to direct management (ie they prefer persuasion to regulation), but tend to support direct management when it is explained to them that such management is necessary, especially when the problem is overuse (Krumpe 1988).

Hendee *et al* (1968) reported a high degree of acceptance among users for access restrictions, a finding which has been corroborated by numerous other researchers (Stankey & Schreyer 1987). Indeed, providing the need is adequately explained acceptance of use rationing is high even among users who are unable to obtain a permit and are turned away (Stankey 1979), and even in situations where the process of obtaining permits is time-consuming and inconvenient (Fazio & Gilbert 1974).

While users tend to support access restrictions most oppose fixed itineraries, presumably because they perceive fixed itineraries as a major restriction on their freedom (Stankey 1973, Lucas 1980). Most users oppose the development of facilities with the exception of surfaced tracks, signposts and bridges (Hendee et al 1978, Lucas 1980, Lucas 1985b, Stankey & Schreyer 1987).

B4.3.2 Tasmanian findings

In his survey of wilderness users in the Cradle Mt-Lake St Clair National Park Calais (1981) reported that few users opposed access restrictions and that most were neutral on the issue. He also found widespread support for the closure of damaged tracks and for restrictions on party size.

A more recent survey by Carlington (1988) found a high degree of support for access restrictions. More than 60% of bushwalkers surveyed by Carlington supported further track hardening and roughly a quarter supported the idea of closing areas showing signs of overuse. There was strong rejection of a proposal for further facilities or road access, and 8.6% of bushwalkers surveyed expressed the view that management currently provides excessive comforts and conveniences in the WHA. Interestingly, however, Carlington found few links between the values expressed by users and their views on future management directions.

In a small survey of Tasmanian wilderness users, wilderness managers and scientific staff in the Tasmanian Dept of Parks, Wildlife & Heritage Bond (1990) obtained the following results:

- most respondents felt that usage restrictions were unnecessary in Recreation Zones and that track hardening was appropriate in these zones;
- most respondents supported the imposition of usage restrictions in Self-Reliant Recreation Zones, with minimal track hardening for environmental purposes only;
- Managers and scientists tended to support usage restrictions for Wilderness Zones but the majority of wilderness users considered such restrictions unnecessary.

Ted Mead, who worked as a track ranger for the Parks & Wildlife Service in the summer of 1990/91, reported a high degree of concern among walkers in the Western Arthur Range about crowding and the condition of tracks in that area (Mead 1991). Support for access restrictions among walkers in the Western Arthur Range increased from 66% in 1989/90 to 95% in 1990/91 (ibid).

For further information on visitor attitudes to management in the WHA see C3.2.2.

B4.4 Management strategies - overview

Summaries of key management strategies are contained in papers by Cole, Petersen & Lucas (1987), Manning (1979b) and Graefe, Vaske & Kuss (1983). Cole *et al* provides a comprehensive list of strategies with notes on the pros and cons of each, a list of which problems are addressed by which strategy, and references to publications citing examples of applications of particular strategies where such publications exist.

Manning (1979b) lists management strategies hierarchically and emphasises that a wide variety of management options exist - the choice is not simply between hardening surfaces or reducing usage. From these and other sources a fairly comprehensive list of management options has been complied and is included in appendix F of this report. Both Cole et al and Manning list increasing the resource (eg by extending national park boundaries) and increasing remoteness (eg by closing roads) as legitimate management options.

B4.5 User education

The value of educating wilderness users as a means of modifying user behaviour has been discussed by several researchers (eg Bradley 1979, Roggenbuck & Berrier 1982, O'Loughlin 1989), and a summary of the pros and cons of various education techniques is provided by Cole (1989). O'Loughlin (1989) describes the MIB campaign which the Parks & Wildlife Service has conducted in Tasmania, and reports on the relative effectiveness of various educational media such as pamphlets, audiovisuals and posters. In a walker survey conducted by the Parks & Wildlife Service during the 1990-91 season more than 90% of respondents said that they were aware of the Service's MIB campaign.

Many researchers (eg Anderson 1986) have emphasised the importance of informing users about the need for management actions, particularly those involving restrictions on user freedom. For example, users tend to accept the imposition of entry fees if they are told that these are necessary for financing the upkeep of a park (Reiling & Criner 1988). The supply of information to users can also enhance their recreational experience (Lime & Lucas 1977), for example by directing users to less crowded areas (Krumpe & Brown 1982). However, Lucas (1981) pointed out that in some circumstances the supply of information can reduce the opportunity for discovery which is an important component of the wilderness experience.

Researchers have experimented with various ways of educating wilderness users, with varying results. For example Roggenbuck & Berrier (1982) compared the results of supplying leaflets to campers with and without personal contact between users and managers; the supply of leaflets with personal contact proved to be a slightly more effective strategy but the difference was not as great as had been expected. The same study also revealed that it is more difficult to communicate information to large groups than to small groups or individuals. Lucas (1981) found that walkers who receive information about alternative routes before they get to the start of a track are more likely to take an alternative route than walkers who receive the same information at the trailhead. Fazio & Gilbert (1974) pointed out the value of permits as a means of issuing educational material. Some education campaigns have met with little success (Thornburgh 1986).

In his assessment of wilderness-user education Cole (1985a) observed that a great deal is being spent on educational campaigns but little research is being done on finding out what should be getting taught. Similarly, Krumpe & Lucas (1987) concluded that more research is needed in the field of user education and that there is scope for developing more effective education campaigns.

B4.6 Use rationing and permit systems

B4.6.1 Overview

Mandatory permits and use rationing have been used extensively in US wilderness areas for at least twenty years, and mandatory permits are currently required by most national parks and more than a third of National Forest units in the US (Krumpe & Lucas 1987). In a survey of US wilderness managers Washburne & Cole (1983) found that 15% of wilderness managers rationed use and more than half rationed length of stay. Most restrictions on user numbers applied to overnight campers rather than day visitors. In some North American national parks entry quotas are determined by the availability of campsites (Smith 1991).

As stated in B4.3, acceptance for use rationing among wilderness users is generally high and appears to be increasing; and as stated in B3.6.1 permit systems have the added benefit of providing accurate usage data and an effective means of providing wilderness users with educational material and other information.

B4.6.2 Methods for use rationing

Methods for issuing permits and rationing use are described and evaluated in various publications including Hendee & Lucas (1973), Stankey & Baden (1977), Hendee, Stankey & Lucas (1978), Stankey, Cole et al (1985), Shelbey and Heberlein (1986) and McCool & Cole (1988). These methods include lotteries, first-come-first-served (ie on-the-day) issue, advanced booking, tests of skill, requirements for particular types of equipment and the imposition of fees (including differential fees). Most US wilderness areas where permits are issued use more than one of these methods (Washburne & Cole 1983), and the common experience has been that a combination of methods is best to avoid discriminating against any particular type of user - for example people with full-time employment may prefer to book ahead whereas casual workers and tourists may prefer to apply for on-the-day permits (Stankey & Baden 1977). However permit-issue systems vary widely between different US national parks (Saunders 1991).

Users generally tend to prefer advanced bookings and first-come-first-served permits to lotteries, fees and tests of skill (Stankey & Schreyer 1986). Fixed itineraries are unacceptable to most users and difficult to police (Stankey 1973, Hendee, Stankey & Lucas 1978, Lucas 1985a). The problem which occurs most frequently in managing permit systems is lack of prior knowledge of the system by some users (Stankey 1979).

As stated above, some 50% of US wilderness areas restrict length of stay and about 30% restrict length of stay throughout the entire wilderness area (Washburne & Cole 1983). However the length-of-stay limit is generally fairly long, ie in the region of 15-25 days (Cole 1985a), and few parties actually stay that long (Lucas 1985a). Consequently existing length-of-stay limits have little impact on overall usage but tend to discriminate against a small minority of users who wish to undertake a grand wilderness adventure - the opportunity for which is arguably an important aspect of the cultural value of wilderness (Lucas 1985a).

B4.7 Fees

The practicality and desirability of charging entry fees for wilderness areas have been discussed by various researchers, eg Wellman (1987), Leuschner et al (1987) and Reiling et al (1988). Leuschner et al claimed that the imposition of fees does not alter the socioeconomic makeup of user populations, nor does it cause users to alter their choice of routes and destinations - and so cannot be used to influence usage patterns. They concluded that fees do not generate significant income and that rigorous (and costly) enforcement of payment is therefore impractical; nevertheless they found a high level of compliance among users despite low levels of enforcement. They also found that users generally supported fees if they were persuaded that fees were necessary for the protection of wilderness areas (although this seems contradictory to the authors' finding that fees contribute no significant income), and concluded that having to pay a fee neither adds to nor detracts from a user's recreational experience. The validity of these conclusions presumably depends on the size of fee levied.

Bamford, Manning et al (1988) agreed that fees do not generate significant income but found that fees did influence usage patterns, discriminating against and reducing the proportion of low income earners. Reiling et al (1988) corroborated the finding of Leuschner et al (1987) that users tend to accept fees if they know they are necessary for protecting the wilderness resource. By contrast, Devlin and O'Connor (1988) cite a case where the imposition of hut fees in a New Zealand national park caused an undesirable increase in campsite impacts - and conclude that the "user pays" approach is both bad economics and bad ecology.

Thus the question of whether proposed fees will be equitable, whether they will generate significant income and whether they will assist or impair management objectives will in general depend on what the fees are being charged for, how much is being charged, and in the case of differential pricing, how big a difference exists in the scale of fees.

All this begs the question as to whether it is morally and culturally desirable to charge fees for what some would argue is a public resource - a question which however was not raised by any of the authors cited in this literature search.

According to Smith (1991) park entrance fees are levied at a majority of major national parks in the USA and Canada and at several national parks in South America. The level of fees levied varies from country to country but is always fairly modest - for example in the USA the going rate is $2 per walker and $5 per car. Special annual passes are available for each park, as are passes allowing entry to all parks in the country.

By contrast park entrance fees in African national parks are often exorbitant, especially in relation to local currency rates (eg $US 20 per day), because the income from international park visitors often constitutes a major source of government revenue in the countries concerned (G. Dixon, *pers. comm.*).

B4.8 Redistribution of usage

Usage distribution may take the form of either concentrating or dispersing usage, and usage can be dispersed either within a particular wilderness area or to other (possibly nonwilderness) areas (Krumpe & Lucas 1987). Because low usage often causes disproportionately high levels of impact (B1.3.1) and because rehabilitation is often extremely slow (B1.10.2), track or campsite rotation is seldom an appropriate management option in wilderness areas (Merriam & Smith 1974, Cole 1985a).

Usage dispersal within a wilderness area can be an effective strategy for minimising impacts in low-use, resilient areas (Landals & Scotter 1973, Cole 1985a), although Cole (1982b) and Lucas (1983b) observed that campers tend to choose worn campsites in preference to pristine sites (see B4.11). In high-use areas it is generally better to concentrate usage on existing tracks and campsites (Archer 1985, Cole 1987b); however, in some cases this may lead to unacceptable levels of impact, either biophysical or social (Cole 1987b). Some researchers (eg McEwen & Tocher 1976) have argued that usage - particularly camping - should be concentrated by installing facilities, although Cole (1987b) points out that facilities are generally inappropriate in wilderness areas. Krumpe & Brown (1982) suggest that overuse of some major tracks may be due to lack of user knowledge of alternatives.

According to the 1983 Washburne-Cole survey of wilderness managers in the United States, management authorities have attempted to redistribute use in about half the wilderness areas in the US, either by imposing regulations or by providing information to users. In about half of these cases managers have attempted to disperse usage to other areas. The results of such attempts have been highly variable. Some research has been done into the effectiveness of various strategies for redistributing use, eg the issue of information in pamphlet form with or without personal contact between managers and users (Krumpe & Brown 1982, Roggenbuck & Berrier 1982), and some conclusions can be drawn: for example, the nature of the information and the timing of its issue may be critical if the strategy is to be effective (Lime & Lucas 1977, Lucas 1981).

Differential pricing and the provision to users of information about potential crowding have also been employed as strategies for redistributing use, with moderate success (Manning & Powers 1984). Lucas (1980) and Krumpe & Lucas (1987) recommended the development of recreational opportunities in nonwilderness areas to take some of the pressure off wilderness areas. Further research in the area of use redistribution is clearly necessary.

B4.9 Track relocation, siting, design and construction

B4.9.1 Relocation

Track relocation has been recommended as a key management option by many researchers, eg Root & Knapik (1972), Helgath (1975), Calais (1981) and Cole (1987b). As in western Tasmania, the majority of walking tracks in US wilderness areas were never designed for heavy or long-term usage - many were simply never designed - and so are poorly sited from the point of view of both stability and user enjoyment (Lucas 1985a, Krumpe & Lucas 1987). Moreover poor siting is the primary cause of track deterioration in US wilderness areas (Krumpe & Lucas 1987). Thus Krumpe & Lucas (1987) recommended a program of major rerouting for the entire US wilderness track system; similarly Cole (1983a, 1987b) concluded that the majority of problems associated with track deterioration in the US could be solved by rerouting tracks, without the need for extensive research.

The “golden rule” regarding track relocation is to ensure that the alternative route is better than the original route and that the original route can be rehabilitated (Proudman & Rajala 1981).

For additional comments and information on track relocation see 8.3.2 and 9.8.

B4.9.2 Track siting and design

Detailed guidelines for track siting and track design are included in manuals such as those by Parks Canada (1978), Proudman & Rajala (1981) and Blamey (1987), and various recommendations are scattered throughout the recreational-impact literature - eg in Root & Knapik (1972). Key recommendations include:

- avoid sites with steep or zero gradient (Proudman & Rajala 1981);
- avoid persistent wet areas (Gibson 1984);

- site tracks along contours or obliquely up slopes (Coleman 1981);
- site tracks on terrain where lateral spread is restricted (Coleman 1981);
- install switchbacks where appropriate (Cole 1985a); and
- consult earth scientists when planning tracks (Root & Knapik 1972).

Detailed advice on switchback design is included in the publication by Proudman & Rajala (1981), which describes the use of grade dips as an alternative to water-bars on sections of track which run obliquely up slopes.

B4.9.3 Track stabilisation

Track stabilisation (eg surface hardening and drainage improvement) has been recommended as an alternative to rerouting by Root & Knapik (1972), Gibson (1984), Cole (1985a) and others, although Washburne & Cole (1983) reported that track hardening was rare in the US. Detailed information on techniques for track stabilisation are included in manuals such as those by Parks Canada (1978) and Proudman & Rajala (1981). The use of local rock for track stabilisation is described in Archer (1985) and the use of mobile rock crushers is described in the paper by USDA (1975).

A wide range of methods of track hardening appropriate for Tasmanian conditions are described in detail by Blamey (1987), and this manual is currently being updated by the Parks & Wildlife Service. A similar track manual has been published in New Zealand (Dept of Land & Survey (NZ) 1979). The use of various types of industrial plastic and rubber matting have also been trialled for track surfacing in the Kosciusko National Park (Jacobs 1992).

Drawbacks of track stabilisation, and in particular of surface hardening, include the fact that it is generally expensive (Leaman & Eden 1990), may be incompatible with area zoning and management objectives (Dept of Parks, Wildlife & Heritage 1991), may lead to zonal creep, and tends to isolate the user from the environment. For further discussion of these points see 8.2.

A recent study by Comfort (1992) investigated environmental and occupational health aspects associated with the use of CCA treated timber for track construction in the Tasmanian Wilderness WHA. Key findings of the report were:

- Minimal leaching of copper, chromium and arsenate occurs and leaching is confined to the top few centimetres of soil and to the immediate vicinity of tracks on the downhill side.
- Only the handling of freshly treated (ie wet) timber constitutes a significant health hazard to workers.
- The report recommended that existing practices in the Parks & Wildlife Service be modified to avoid the handling of freshly treated CCA timber.

B4.10 Track classification schemes

By the mid 1980s a simple three-tiered track classification scheme ("walk", "track" and "route") had been developed by the New Zealand Walkways Commission and adopted by the NSW National Parks and Wildlife Service and by park management agencies in New Zealand (Hepper, Marriott & Associates 1986). A similar classification system with four broadly defined categories was proposed in the 1978 Australian Standard for track-markers (Standards Association 1978).

The Hepper Report (ibid) adopted a modified version of this system, the categories "walk", "track", "route+" and "route" being broadly defined in terms of length, construction standards and ease of use. This classification scheme was used to summarise existing conditions but could also be used as a guide to track management. The Hepper Report recommended the adoption of a more detailed track classification scheme specifying a range of standards for design, construction and maintenance.

The *Walking Track Management Manual* (Blamey 1987) adopted the “walk-track-route” system, defining these in terms of construction standards, facilities and (in very broad terms) usage levels. This scheme is cited in the *Tasmanian Wilderness World Heritage Area Management Plan* (Department of Parks, Wildlife & Heritage 1992) and is used to classify tracks and routes in some of the Service’s regional track management plans (eg Department of Parks, Wildlife & Heritage 1989).

Similar broad track classification schemes have been adopted by park management authorities elsewhere in Australia. For example the management plan for the Wilsons Promontory National Park includes a five-tiered track classification scheme which classifies tracks according to construction standards (including drainage, surfacing and track width) and levels of management input (Department of Conservation, Forests & Lands 1987). Unlike the classification scheme proposed in this report the Wilsons Promontory scheme does not include explicit specifications with regard to track gradient, facilities or usage levels, although track gradients are specified by guidelines which apply to tracks throughout the national park.

The track management plan for the Overland Track side-tracks (Department of Parks, Wildlife & Heritage 1991e) includes a more detailed version of the Blamey scheme in which each of the four track classifications are subdivided according to relative levels of usage. However the value of this scheme is questionable because usage levels are not quantified.

B4.11 Management of campsite impacts

Strategies for managing campsite impacts include dispersal or concentration of use, site rotation, permanent closure, site stabilisation/hardening, the installation, upgrading or removal of facilities, user education, and limits on usage including limits on party size and limits on length of stay.

Several researchers (eg Cole & Ranz 1983) have argued that site rotation is seldom a viable option because impact thresholds are generally low and rehabilitation is generally slow; hence site rotation will generally cause a proliferation of impacts. Cole (1985a) advocates concentrating camping in high-use areas and dispersing it in low-use areas; in other words, users should be directed to camp either on pristine sites in low-use areas or on moderately impacted sites which are unlikely to deteriorate further. In low-use areas a camping-dispersal policy would encourage campers to avoid lightly impacted sites, since these are likely to deteriorate rapidly (Cole & Benedict 1983). However Lucas (1983b) and Cole (1982b) observed that campers tend to choose worn sites, possibly because they are loath to damage pristine areas.

The single most effective way of minimising campsite impacts, and in particular the area of campsites, is to ban campfires, since trampling for firewood collection contributes to most of the impacts in areas where fires are permitted (Cole & Dalle-Molle 1982, Krumpe 1988). Campsite impacts can also be minimised by restricting party size (Cole 1985a); however unless usage is restricted overall this may result in the development of new campsites (Cole 1987a).

It appears that little research has been done to date into techniques for stabilising and hardening campsites; one exception is the study by Beardsley & Wagar (1971).

B4.12 Employment of voluntary labour and non-governmental funding

Smith (1991) reports that the employment of voluntary labour and the use of non-governmental funding is common in North American national parks, both in the USA and Canada. International and local volunteers are employed in wildlife research, general park maintenance and construction activities, and periods of voluntary work are seen as useful - indeed almost essential - prerequisites for employment in national parks.

An important supplementary source of funding for US and Canadian national parks comes from voluntary groups known as “cooperating organisations”. Groups such as Friends of the Banff National Park and the Yellowstone Association collectively raise millions of dollars each year for park publications, interpretative services, research projects and other management needs.

B4.13 Management of *Phytophthora cinnamomi*

The following strategies for minimising the spread of *Phytophthora cinnamomi* (see B1.9.3) are proposed in the *Management Plan for* Phytophthora cinnamomi *in the Tasmanian Wilderness World Heritage Area* (Parks and Wildlife Service 1993a) and in the Phytophthora cinnamomi *hygiene manual* (Parks and Wildlife Service 1993b). For further details the reader is advised to refer to these documents.

(i) The best known strategy for control of *Phytophthora cinnamomi* is to slow the rate of infection.

(ii) A zoning scheme has been drawn up classifying areas in the WHA according to whether they are infected, uninfected (and at risk), alpine or forest. Alpine zones are considered not to be at risk, and forest zones to be at risk only if they are subject to major disturbance such as fire.

(iii) The risk of transportation of infected soil or gravel from infected to uninfected zones is to be minimised by a number of measures, including hygiene procedures for machinery and walkers. The washing of infected soil into the catchments of uninfected areas is to be avoided.

(iv) Where tracks cross between an infected and uninfected area, walkers are to be encouraged (where practical) to walk in the direction which leads from the uninfected area into the infected area.

(v) Washdown points are to be installed on walking tracks where walkers are likely to cross from infected into uninfected areas. These are points where walkers will be encouraged to wash their boots and gaiters, the run-off going into the catchment of the infected zone. Tracks will be hardened for some distance beyond a washdown point into the uninfected zone, the length of hardened track varying from 50m to several hundred metres depending on the terrain.

Sites identified for track hardening and/or the installation of washdown points are listed on pages 25-26 of the Phytophthora cinnamomi *management plan.*

(vi) Tracks should not be placed on ridges between catchments, especially if the track would border an uninfected area.

(vii) Tracks should not approach or be sited above highly susceptible or rare plants or communities.

(viii) Creek crossings and waterlogged areas should be avoided where possible. Tracks should be sited where possible on well-drained soil.

(ix) No new tracks to be developed in susceptible or uninfected areas.

(x) Any evolving new tracks which cross from infected zones into uninfected zones to be managed from an early stage to minimise the spread of the infection. Closure should be considered if practical, and if the track is to remain in use rerouting should be considered if this can avoid the problem. Otherwise washdown points should be installed, together with the associated track hardening (see (v) above). The risk of encouraging greater use by local track hardening or of diverting track-maintenance funds from other areas is considered to be outweighed by the risk of spreading the infection to new areas.

(xi) The walker-education program to be widened to encourage walkers to:

- stay on established tracks wherever possible;
- plan routes which stay in uninfected zones and zones where vegetation types are not susceptible to the fungus;
- learn to recognise *P cinnamomi* infection;
- avoid crossing into uninfected areas except at washdown points;
- if leaving an established track, to do so in an uninfected zone; otherwise to choose a route that will provide points for washing down on leaving infected areas;
- if crossing from an infected zone, to wash down at the break of slope on leaving the area.
- wash boots, gaiters, tentpegs, tent floors etc before entering uninfected areas.

  To this end the Parks & Wildlife Service has recently published a pamphlet and a poster with information about *P cinnamomi* and ways in which users can minimise the risk of spreading it.

B5 Summary and critique of Calais (1981) study

This section has been included for several reasons:

(i) The Calais study (as detailed in Calais 1981 and summarised in Calais & Kirkpatrick 1986) was the only detailed and extensive study of recreational impacts conducted in western Tasmania prior to the commencement of track monitoring by the Parks & Wildlife Service in 1992;

(ii) Several of Calais' results and conclusions are of direct relevance to this report; and

(iii) Owing to idiosyncrasies in Calais' data and analysis techniques which are not adequately emphasised in the 1981 and 1986 publications, some of Calais' conclusions are potentially misleading.

It is not the intention here to provide a full summary of the Calais study but rather to list aspects of the study which are relevant to his report. Readers who want more information are advised to consult Calais & Kirkpatrick (1986) or the original 1981 thesis.

B5.1 Overview of the study

Calais' study focussed on usage and impacts in the Cradle Mt-Lake St Clair National Park and covered five main areas of investigation:

(i) A survey of use levels and user characteristics.

(ii) A survey of track damage on major tracks throughout the national park.

(iii) A study of the relationship between track damage, usage levels and site variables such as altitude and vegetation. Track damage was measured by calculating a "track damage index" (TDI) based on measurements taken at uniformly spaced transects, and the results were correlated with each of the measured site variables.

For specified categories of each siting variable (eg dolerite bedrock, altitude >1200m) an estimate was made of the level of usage corresponding to a specified "acceptable" level of track damage - ie a value of the TDI which corresponded to a narrow, lightly impacted pad. The resilience of different categories of vegetation, geology etc were then compared by comparing the corresponding threshold usage levels.

(iv) A classification of tracks based on the type and severity of deterioration that has occurred.

(v) Trampling studies on two previously untrampled sites and rehabilitation studies on closed tracks.

B5.2 Findings of the study

B5.2.1 Usage, user characteristics and user attitudes

Calais collected data on user numbers and the age, profession and other background details of users, and surveyed user attitudes to management options such as usage restrictions and track closure. Overnight usage in the park remained fairly stable in the period 1976-80 but there was a steady increase in the number of day walkers in this period. Users generally supported proposals to limit party size, close damage tracks and introduce fuel-stove-only restrictions. Most users were neutral on the question of restricting overall usage, with few opposing and few actively supporting the idea.

B5.2.2 Track damage survey

The study found that the value of the TDI was significantly correlated with use levels, vegetation type, geology and altitude, but not with aspect, slope of the terrain or track slope. The following findings were made for each of the site variables and usage:

Geology Based on calculations of the levels of usage corresponding to an "acceptable" level of the TDI, the geological categories were ranked in order of increasing susceptibility to trampling as follows: schist, mudstone, sandstone, conglomerate, till, dolerite, quartzite. (See B5.3 for a discussion of this result.)

Vegetation Track impacts were found to be greatest in low vegetation such as heath and sedgeland and least in forest. Of the taller vegetation habitats closed forest was found to be the most susceptible to trampling.

Slope A slightly significant negative correlation was found between track damage and track slope, bad sections of track generally occurring on flat, poorly drained sites. Few steep sites were measured and track gradients were only recorded up to 25°. The most stable category for track slope was found to be >14°.

Altitude Track impacts were found to increase with increasing altitude.

Use Use was found to be positively correlated with impact, but Calais concluded that track location may be of greater significance than usage in determining track stability.

Width The width of tracks was found to differ in different environments; tracks tended to be wide in low, open vegetation and narrow in more confined vegetation such as in forests. In particular, track width was found to be strongly dependent on the ease of use of the track surface relative to that of the adjacent terrain.

Depth Erosion depth was not taken into account in calculating the track damage index. Calais noted that most sites with low values of TDI had shallow erosion, and that erosion depth appeared to be more a function of track slope and water flow than of usage.

B5.2.3 Track types

Calais identified eight broad categories of track based on their characteristic erosion profiles. These categories were ranked in order of resilience to trampling (as measured by the usage level corresponding to the specified acceptable value of the TDI), and the type of environment in which each track category generally occurs was identified.

B5.2.4 Trampling and regeneration study

Key findings of the trampling/regeneration study included:

- different types of vegetation were found to have different susceptibilities to trampling;

- initial vegetation loss occurred rapidly;
- unassisted recovery after the cessation of trampling was slow;
- soil erosion was worse on steeper slopes, especially in the initial phase of trampling; and
- significant soil erosion continued after the cessation of trampling and despite recolonisation of all but the most severely eroded track sections.

B5.2.5 General conclusions

The following major conclusions of the study are relevant to this report:

- No vegetation in the park can survive trampling of more than 2000 passes per year.
- Since most of the tracks studied receive usage in excess of 2000 passes per year, the main factor governing impacts is the ease of use and relative confinement of tracks. (Users will tend to spread out and widen tracks on sections of track which are more difficult to walk on than the surrounding terrain.)
- Trampling on new ground causes rapid vegetation loss and recovery is slow; hence track rotation is not a viable management option.
- If usage is not to be reduced (and Calais ruled out usage restrictions as contrary to the aims of the park), and since track rotation is not practical, Calais concluded that track stabilisation and upgrading were the only viable management options for the park, with some rerouting where appropriate.

B5.3 Limitations of the study

Three major limitations of this study, and potential sources of misunderstanding, are as follows:

(i) Limitations of the track damage index

The track damage index is essentially a measure of track width (defined in terms of vegetation loss) and does not take erosion depths into account. Thus, for example, the TDI for a given site could remain the same over a period of time even if the depth of erosion at that site drastically increased during the same period of time. Hence statements about the susceptibility of environments to trampling, as measured by the TDI, provide information only about the susceptibility of those environments to sustain vegetation loss and track widening under trampling, not about their susceptibility to erosion.

This observation helps to explain why the authors found a negative correlation between track slope and impact: high values of the TDI correspond to wide or badly braided tracks which tend to occur on flat, poorly drained sites, whereas erosion is generally associated with steeper tracks.

This shortcoming of the TDI was noted by Sawyer (1988a) who felt that the index “gave too much weight to relatively minor damage and too little to more severe problems”, and suggested that the TDI be modified to take depths of mud and erosion into account. Sawyer also found that the TDI failed to provide an accurate picture of track impacts at sites where parallel tracks have evolved, where outcrops of unmodified rock occur or where a track has been artificially stabilised.

(ii) Correlations between explanatory variables

Many of the site variables in the study area were strongly interrelated - a fact which is illustrated in a correlation diagram in the Calais-Kirkpatrick paper. However the authors made no attempt to neutralise the effect of these correlations in their analysis. For example they observed that more than 95% of the sites where quartzite or dolerite were recorded occurred above 900m, an altitude range in which 83% of the “very bad” sites (ie those sites with TDIs at the upper end of the range) also occurred. Hence the conclusion that sites underlain by quartzite and dolerite are among the most susceptible to trampling is highly misleading; the result was almost certainly a reflection of the fact that most of these sites happened to occur at high altitudes where vegetation is more susceptible to trampling. The conclusion that sites underlain by schists and mudstone tend to be resilient to trampling is similarly misleading. Once vegetation cover has been lost sites underlain by schists and mudstones are probably among the most erosion-prone whereas sites underlain by dolerite and till tend to be resistant to erosion (see 3.3.5).

(iii) Lack of predictive capacity

A third major drawback of the study, and one which receives little attention in the published report, is the fact that the survey of track conditions was a "once-off" assessment which did not take into account the susceptibility of tracks to further deterioration.

The authors acknowledge that "the results [of calculations of the TDI] are used indicatively rather than predictively". Hence their statement: "We assume that [the impact of trampling] is acceptable where it results in tracks with damage indices less than 1200" is potentially misleading. The fact that a particular track had a TDI of less than 1200 at the time the study was conducted was no guarantee that it would remain less than 1200 indefinitely if usage levels remained constant. On the contrary, the results of the WHA track inventory suggest that only a minority of existing tracks in the WHA are stable (3.4.2).

(iv) Evaluation of threshold for vegetation loss

On the basis of an analysis of the relationship between usage levels and track impacts (as measured by the TDI) Calais and Kirkpatrick concluded that the usage threshold for vegetation loss in the Cradle Mountain - Lake St Clair National Park is around 2000. This figure may have been biased by the following factors:

(a) The fact that accurate usage statistics were unavailable for most of the tracks surveyed;

(b) The fact that a low value of TDI does not necessarily imply track stability in the long term; and

(c) The nonlinearity of the use/impact curve at lower levels of usage.

The figure of 2000 would appear to be far too high. The WHA track inventory (3.3) found that the majority of tracks in the Cradle Mountain - Lake St Clair National Park that are subject to usage in excess of 200 per year are largely free of vegetation, or are likely to become so in the long term.

(v) Additional limitations

Two further criticisms can be levelled at the Calais study:

(a) Calais' classification of tracks by type (based on erosion profiles) is qualitative and of dubious value; and

(b) Calais' recommendation for hardening the majority of tracks in the Cradle Mt-Lake St Clair National Park takes no account of the likelihood that this strategy would lead to zonal creep unless usage restrictions are also introduced.

C1 WHA usage: levels and trends

C1.1 Day visitors (non-walkers)

C1.1.1 Annual visitation data

Notes:

(i) Data were obtained from internal Parks & Wildlife Service sources and are valid for the period 1990-91 or later except where otherwise stated.

(ii) Data for annual visitation is often incomplete even at major centres like Cradle Mountain.

(iii) Where road-counters have been used to record vehicle numbers a multiplier of 2.7 has been used to calculate visitor numbers.

(a) Hartz Mountains

10 500.
Source: road-counter / *Forestry Commission Visitor Manual* (Forestry Commission 1992/93). Recent annual visitation appears to be fairly constant.

(b) Gordon River Road

30 000 - 40 000 (Dept of Parks, Wildlife & Heritage 1991b)
This figure is based on a record of the number of non-service vehicles which passed through the Maydena toll gate during office hours during the period November 1990 to June 1991. Because data for recent years is incomplete trends cannot be stated with certainty. However annual visitation appears to have remained fairly static and may have decreased slightly over the last few years.

(c) Gordon River

69 000 (Dept of Parks, Wildlife & Heritage 1991b)
Usage was estimated at 20-30 000 in the early 1980s, but increased dramatically during and for about three years after the Franklin dam controversy. Since the mid 1980s usage has levelled off and may have decreased slightly. Only one company is currently operating commercial launch trips on the lower Gordon River.

(d) Lake St Clair

131 000
Lake St Clair is the third most popular park visitor-centre in the state after Mt Field and Cradle Mountain. However visitation has remained fairly static over the last four years and there was a 4.5% decrease in visitation between 1989/90 and 1990/91.

(e) Cradle Mt area

147 000
Visitation trends at Cradle Mountain cannot be stated with certainty because data collection has been sporadic over the past seven years. However it appears that total visitation to the Cradle Mountain area

roughly trebled in the ten-year period between 1976/77 and 1986/87 and almost doubled again in the period 1986/87 - 1990/91. Cradle Mountain is therefore the fastest growing park visitor centre in Tasmania, and the second most popular after Mount Field National Park. This rapid growth can be attributed in part to the construction of the Cradle Mountain Link Road and the upgrading of the access road from Daisy Dell.

A survey conducted in the late 1970s suggested that nearly 50% of visitors to the Cradle Mountain area undertook a walk of some description while they were there (Dutton 1979).

(f) Central Plateau

Local ranger estimates put total annual visitation to the Central Plateau Conservation Area at around 25 000. A large proportion of these visitors are either day-tourists or anglers. Usage data for some of the tracks in the area are listed in appendix A5.

The Inland Fisheries Commission estimates that approximately 5500 anglers spent a total of 17 000 person-days fishing in the Western Lakes region of the Central Plateau (ie west of the Great Lake) during each of the 1989-90 and 1990-91 seasons. The level of usage has nearly tripled over the last five years.

(g) Liffey area

Liffey Forest Reserve: 10 000

Liffey State Reserve: 1500

Usage of the Liffey Forest Reserve increased 15% in the period 1992-93.

Source: road-counters and vehicle counters; *Forestry Commission Visitor Manual* (Forestry Commission 1992/93).

C1.1.2 Seasonality

Visitation to the WHA is highly seasonal, with about half of all visits being undertaken during the period December-March (Dept of Parks, Wildlife & Heritage 1991b; Forestry Commission 1992/93). Summer visitation levels at Lake St Clair are four to five times the level of visitation in the three winter months.

C1.1.3 Comparison with other WHAs in Australia

Note: Figures are for the year 1990/91.

WHA	Annual visitors (thousands)	Avg stay (days)
Kakadu	238	3.6
Uluru	250	1.8
Qld Wet Tropics	2700	?
Tas. Wilderness	597	0.5*

* Educated guess only.

Note that the data for total visitation to the Tasmanian Wilderness WHA would count some visitors twice because some people visit more than one park centre during their stay in the WHA.

C1.1.4 Visitation trends in other WHAs in Australia

Number of annual visitors in thousands.

Year	Kakadu	Uluru
1982	46	
1983	58	
1984	75	
1985	101	
1986	131	141
1987	185	189
1988	220	191
1989	230	181
1990	238	250

Comments

(a) Kakadu experienced a steep growth in usage in the mid 1980s due to the publicity generated by the "Crocodile Dundee" films and the controversy over the park's conservation status. However the rate of increase in usage has become less pronounced in recent years. This trend is comparable to the trend in visits to the Gordon River, which increased dramatically in the early 1980s but flattened off about three years after the Gordon below Franklin hydroelectric scheme was stopped.

(b) The fall in visitation to Uluru in 1989 and the slowdown in growth at Kakadu during the same period can be attributed to the protracted pilots' strike which occurred at that time.

(c) Usage of the 32km Thorsborne Trail, the major wilderness walking track on Hinchinbrook Island, increased fourfold during the period 1985-91. 1287 people used the trail in 1991/92 (Prociv 1993).

C1.1.5 Summary and conclusions

(a) Usage continues to increase rapidly at Cradle Mountain and in the Western Lakes area of the Central Plateau but has levelled off or decreased slightly at the Hartz Mountains and Lake St Clair and on the Gordon River and Gordon Road.

(b) Usage is highly seasonal with most visitation occurring during the summer months at all visitor centres for which seasonal data is available.

C1.2 Walkers and rafters

C1.2.1 Sources of data

The following data are taken from internal Parks & Wildlife Service records except where otherwise stated. The data in question were obtained from a variety of sources including registration booths, logbooks and reports from track rangers and commercial operators. In many cases the estimates amount to little more than an informed guess by the author or by ranger staff, based on personal experience and whatever other information is available.

In recent years the Parks & Wildlife Service has progressively installed walker-registration booths at major trail-heads throughout the WHA. During the past two years the registration system has been modified to allow walkers to indicate their intended route by means of a coding system. Initial trials of the system indicate a high degree of user compliance, at least in some areas. The accuracy of data from some registration booths may be biased by low user compliance, although this bias may be partially offset by the fact that some users fail to complete the trip for which they register (Sawyer 1990).

Anecdotal evidence suggests that a substantial percentage of users do not use logbooks; hence data obtained from logbooks tend to substantially underestimate usage levels. Some usage data are available from pedestrian counters, which have been trialled on a few tracks with varying success.

In many cases little or nothing is known about the distribution of usage on different routes within a particular area or track-system. For example whereas the number of people currently visiting the Western Arthurs can probably be estimated to within 20%, virtually no information is available on the number of people using Moraines E and K and the Lake Rosanne Track.

The usage data below refer to the number of passes along any point on the track in question - ie users who double back are counted twice.

C1.2.2 Annual usage data

- **Southwest Cape circuit**

  1990/91: 150 (walker registration, Melaleuca).
  Source: *Tasmanian Wilderness WHA. Resources and Issues.* (Dept of Parks, Wildlife & Heritage 1991b).
  Note: Anecdotal evidence suggests that usage of the circuit has increased dramatically during the past five years and may currently be in the range 200-400. The bulk of this usage appears to be on the New Harbour - SW Cape section with users doubling back rather than continuing to Windowpane Bay.

- **Port Davey Track: Moraine A turnoff - Melaleuca**

  1990/91: 200 (rough estimate based on entries in Junction Ck logbook).
  Source: *Tasmanian Wilderness WHA Resources and Issues.* (Dept of Parks, Wildlife & Heritage 1991b).

- **South Coast Track**

Year	Total reg'ns: Cockle Ck	Cockle Ck - Melaleuca
74/75	396	396
85/86	>921	-
86/87	1147	690
87/88	1211	-
88/89	2410	820
89/90	Not avail	-
90/91	4810	752

Notes:

(i) Data incomplete for the years 85/86 and 89/90.

(ii) The data in the column headed "Total registrations: Cockle Creek" records total entries in the registration book at Cockle Creek, including walkers doing return trips of one or two days' duration to South Cape Bay. The number of such walkers has risen dramatically since the rerouting and upgrading of the Blowhole Valley Track in 1990, and currently accounts for around 60% of total registrations at Cockle Creek.

(iii) Data in the right-hand column, which is reproduced from the document Tasmanian Wilderness WHA Resources and Issues (Dept of Parks, Wildlife & Heritage 1991b), records entries in the logbook at Cockle Creek by walkers intending to walk to Melaleuca. Observations by ranger staff suggest that more walkers travel in the other direction (ie Melaleuca to Cockle Creek), although no reliable statistics are available for walkers starting at Melaleuca.

- **Southern Ranges**

1990/91: 390 (approx - from registration booth).
Source: *Tasmanian Wilderness WHA. Resources and Issues.* (Dept of Parks, Wildlife & Heritage 1991b).
This figure is based on walker registrations at the Lune River quarry and includes all visitors to the Southern Ranges regardless of destination or length of stay. Due to some overlap with registrations by visitors to Exit Cave this figure must be regarded as a rough guide only.

- **Western Arthurs traverse**

Year	Total reg'ns
74/75	91
86/87	218
88/89	410
90/91*	638

* July 1990 - Feb 1991.

Notes:

(i) Data obtained from logbook registrations at Junction Creek by walkers intending to undertake full traverse, ie a walk which includes at least the section between Moraines E and K. This figure is approximate because not all walkers register and not all those who intend to traverse the range complete the traverse.

(ii) Total visitation to the range (ie including short trips such as return visits to Lake Cygnus via Moraine A) is in excess of 1000 per year.

(iii) Note rapid rise in usage during past few years.

- **Eastern Arthurs**

Year	Total reg'ns
74/75	42
85/86	296
88/89	259

Note:

Data obtained from logbook registrations at Cracroft Crossing. Actual usage likely to be substantially higher owing to nonregistration and large numbers of users doing return trips to Federation Peak via Moss Ridge.

- **Mt Anne track**

Year	Total reg'ns
74/75	445
86/87	420
88/89	899
90/91*	840

* July 1990 - Feb 1991.

Note:

Data from logbook entries at Memorial Hut.

Using data obtained from logbooks, pedestrian counters and a user survey Sawyer (1988b) estimated that about 1500 people visited the Anne Range during the twelve-month period ending 25 April 1988 and spent about 3000 person-days in the area. Roughly two-thirds of these visitors were probably Tasmanian residents. Sawyer's data suggest that about 250 people used the Lake Judd Track and more than 150 used the Northeast Ridge track from Gelignite Creek during that period.

- **Frenchmans Cap Track**

Year	Total reg'ns
84/85	501
85/86	493
86/87	641
87/88	765
88/89	772
89/90	736
90/91	667

Notes:

(i) Data obtained from registration book at Franklin River.

(ii) Apparent recent decline in usage may be due to declining use of registration book. Anecdotal evidence suggests usage may still be increasing.

(iii) In 1990/91 63% of walkers visited the area in January and February.

- **Franklin River**

Year	Total reg'ns	% private users
85/86	490	44
86/87	519	48
87/88	564	36
88/89	758	34
89/90	495	31
90/91	374	33

Source: *Tasmanian Wilderness WHA Resources and Issues* (Dept of Parks, Wildlife & Heritage 1991b). Data obtained from registration book at Collingwood River.

Notes:

(i) The term "private users" refers to rafters who did not travel with a commercially guided party.

(ii) In recent years substantial numbers of rafters have accessed the lower Franklin via Mt McCall. Actual usage on the river below Mt McCall is therefore higher than is indicated by the above data.

- **Lake St Clair daywalks (including overnight walks returning via Lk St Clair)**

1989 (calendar year): 6660

Source: Walker registration - cited in the document *Tasmanian Wilderness WHA Resources and Issues* (Dept of Parks, Wildlife & Heritage 1991b).

- **Overland Track**

Year	N-S reg'ns	S-N reg'ns	% S-N reg'ns	Total
84/85	2021	436	18	2457
85/86	2333	412	15	2745
86/87	1943	>259*	>12	>2202
87/88	2583	434	14	3017
88/89	2630	419	14	3049
89/90	3088	473	13	3561
90/91	3571**	725	17	4296

* S-N walkers recorded at Cradle Mt; insufficient data recorded at Lake St Clair.

** includes data from Lake St Clair for months when no data recorded at Cradle Mt.

Notes:

(i) N-S walkers were recorded at Cradle Mt and S-N walkers were recorded at Lake St Clair except where indicated.

(ii) All data were obtained from registration books.

(iii) Usage levels appeared to reach a plateau in the mid 1980s. The apparent rapid increase in usage in the last two years may be due in part to the introduction of compulsory permits, as a result of which a higher percentage of walkers are now being registered.

(iv) Use of the Overland Track, like most bushwalking in the WHA, is highly seasonal. Roughly half of all Overland Track walkers undertake the trip in January or February. In January 1989 840 walkers started out from Cradle Mountain to Lake St Clair whereas only nine registered in July. Walker traffic from Cradle Mountain to Lake St Clair in the six-month peak season Nov 88 - April 89 was 2802 compared to only 195 in the following six-month period. (Source: Dept of Parks, Wildlife & Heritage 1991b.)

- **Cradle Daywalks**

Year	Total reg'ns
84/85	7415
85/86	8216
86/87	8996
87/88	10885*
88/89	13434
89/90	13132§
90/91	13455†
*	30 days unrecorded
§	11 days unrecorded
†	61 days unrecorded

- **Walls of Jerusalem**

  Registration booth statistics for the years 1991/92 and 92/93 indicate a total of just under visitors and an annual visitation of over 10,000 visitor days. A slight decline was evident in the latter twelve months. Allowing for a percentage of walkers who do not register, total visitation could be as high as 15,000 visitor days.

  A breakdown of approximate usage levels by route and area, adjusted to take into account nonregistration and walkers doubling back, is included in C2.

C1.2.3 Seasonality

Usage levels on tracks in the WHA tend to be highly seasonal. For example more than half of all Overland Track and Frenchmans Cap Track walkers undertake the trip in January or February, and half the visitor-days spent in the Walls of Jerusalem occur in the period December-February.

C1.2.4 Summary and conclusions

(a) In recent years usage appears to have levelled off or declined slightly on the Mt Anne Track, Frenchmans Cap Track, Franklin River and in the Walls of Jerusalem area but continues to increase steadily on the Overland Track and has increased dramatically in the Eastern and Western Arthurs, on the Blowhole Valley Track, in the Cradle daywalks area and probably also on the New Harbour-SW Cape section of the Southwest Cape circuit.

(b) Usage levels are highly seasonal with more than half of all usage on major tracks occurring during the summer months.

C2 Estimated usage levels on specific tracks

Notes:

(i) Data sources

Data sources in decreasing order of reliability are indicated as follows:

Permit — Permits issued for walkers in the Cradle Mt - Lake St Clair National Park during the period 1991-93. Permit statistics for tracks in the Cradle Mt - Lake St Clair National Park other than the Overland Track have been extrapolated from data collected during the period 1.12.91-12.8.92.

T/C — Track counter.

FC T/C — Forestry Commission track counter; data quoted from the *Forestry Commission Visitor Manual* (Forestry Commission 1992/93).

Sawyer — Survey of users in the Mt Anne area conducted by Sawyer in 1987/88 (Sawyer 1988b). Statistics based on track counters.

Reg — Registration books, usually located at or near the start of the track in question or the main trail-head which provides access to the track in question. Statistics quoted are recent (ie 90/91 or later) unless otherwise stated. Note: Estimates have been extrapolated from registration data by multiplying by approximately 1.5 to allow for walkers who do not register.

Ranger — Estimate provided by local ranger staff based on user enquiries at ranger office, information from user groups (eg walking clubs and commercial operators), personal observations and similar sources. Some of this data was obtained by means of a questionnaire circulated to district ranger staff at park centres in and adjacent to the WHA.

Guides — Information based on first-hand estimates and/or business records of commercial guides.

Log — Data obtained from logbooks, usually located in huts or on mountain summits. Note: Logbook data usually underestimate usage levels because many walkers abstain from writing in logbooks.

Hepper — Information obtained from the WHA track inventory conducted by Hepper (1986). Hepper's information was based mainly on ranger estimates and is likely to be substantially out of date.

IG — Informed guess by the author of this report based on anecdotal information and observations of track conditions.

(ii) Double trampling

Usage data refer to the annual number of visitors. Where the majority of these visitors double back along a track this fact is indicated by "x 2".

(iii) Unavailable data

Tracks for which no usage information is available - not even enough to make an informed guess - have been omitted from the following list.

Area	Usage	Source

Southwest

Bathurst Harbour

Mt Rugby - southern route	<100x2	Ranger
Balmoral Hill (from Horseshoe Inlet)	<100x2	IG

Southwest Cape

New Harbour - SW Cape	(250-500)x2	Reg/IG
Mt Karamu - Noyhener Beach	100-200	IG
Stephens Bay - Spain Bay	<100x2	IG
Other routes	<100	IG

Old River

Old River route	<100	IG

Southwest Coast

Low Rocky Point - Port Davey	<100	IG

Port Davey Track

Port Davey Track (Scotts Pk - Junction Ck)	(1000-1500)x2	Reg/IG
Port Davey Track (Junction Ck - Melaleuca)	200-300	Reg
White Monoliths	<100	IG

South Coast

Sth Coast Track: Melaleuca - Sth Cape Bay	1000-2000	Reg/IG (See C1.2.2)

Southeast

Southern Ranges

Lune River - Pindars Pk	(300-500)x2	Reg/IG (See C1.2.2)
Pindars Pk - Precipitous Bluff	200-400	IG
Precipitous Bluff - Prion Beach	(300-500)x2	IG
Vanishing Falls	<100	IG

Adamsons-Esperance

Adamsons Peak Track	±930	FC T/C
Adamsons Falls	±680	FC T/C
Duckhole Lake Track	±590	FC T/C
Adamsons Peak - Moores Garden	<100	IG

Hartz Mts		
Hartz Lake	<100x2	IG
Kermandie Track	<100	IG
Hartz Pk - Adamsons Pk	<100	IG
Bobs-Boomerang		
Lake Sydney Track	<100x2	IG
Other routes	<100	IG
Picton Valley/Huon Valley		
Picton R (downstream of Farmhouse Ck)	1000-2500	Guides
Western Arthurs		
Moraine A - Lk Oberon	600-800	Reg (See C1.2.2)
Total visitation to range	800-1000	Reg (See C1.2.2)
Picton Range		
South Pictons traverse	<100	IG
Eastern Arthurs		
Eastern access	400-500	IG
Northern access	250-400	Reg
Forest Chute/Rock Chute	<100	IG
Lower Weld - Mt Weld		
Dozer track	<100x2	IG
Mt Weld track	<100x2	IG
Riverside Track (up Weld River)	<100	IG
Cavers tracks	<100	IG
Upper Weld - Styx		
Weld arch route	<100x2	IG
Mt Mueller	<100x2	IG
Old Port Davey Track	<100	IG
Mt Bowes from Old Port Davey Track	<100x2	IG
Snowy Range		
Nevada Peak track	<100x2	IG
Snowy North	<100	IG
Snowys traverse	<100	IG
Frankland Range		
Traverse (Frankland Pk - Mt Sprent)	<100	IG

Anne Range

Mt Anne Track	(1000-1500)x2	Reg (See C1.2.2)
Lake Judd Track	250x2	Sawyer
Lake Timk	<100x2	IG

Schnells Ridge

Various routes	<100	IG

Gordon Road

Tim Shea	<100x2	IG
Needles	<100x2	IG
Adamsfield Track	<100	Reg
Creepy Crawly NT	500-1000	T/C
Sentinels	<100x2	IG
Old Lake Pedder Track	<100x2	IG

Gordon-Franklin

Rasselas-Denisons-Spires

Timbs Track (to Florentine R)	(300-500)x2	Reg/IG
Rasselas Track (to Gordonvale)	(200-300)x2	IG
Gordon Range access routes	(200-300)x2	IG
Rasselas Track (Gordonvale to Lk Rhona)	(400-600)x2	IG
Thumbs	<100	IG
Mt Wright	<100	IG
Lk Rhona - Reeds Pk	100-500	IG
Denison Range - Lk Curly	<100	Reg/IG
Lk Curly - Spires	<100	Reg/IG
Spires traverse	<100	IG
Spires - Gell River	<100	IG
Prince of Wales Range	<100	IG

Upper Gordon-King Williams

Wylds Craig track	<100x2	IG
§ Darkes Pk	<100	IG
Mt King William 1	<100x2	Reg
Other routes in King Williams	<100	IG
Gell River dozer track	<100	IG

Hamiltons-Splits

Eastern ascent of Hamilton Range	<100x2	IG
Splits Track	<100x2	IG
Truchanas Pine Reserve	<100x2	IG

Frenchmans-Raglans

Frenchmans Cap Track	(1000-1500)x2	Reg (See C1.2.2)
North Col - Irenabyss	(300-500)x2	Hepper
Irenabyss - Lyell Hwy	<100	Ranger
Fincham Track	<100x2	IG
Jane River Track	<100	IG
Franklin River (Collingwood - Mt McCall)	350-400	Reg (See C1.2.2)
Franklin River (Mt McCall - Gordon)	500-600	Guides

Lyell Highway

Franklin River NT	>5000	Ranger
Nelson Falls	>10 000	T/C
Donaghys Hill NT	>5000	T/C
Donaghys Hill - Franklin/C'wood junction	<100	Ranger

Lower Gordon-Macquarie Harbour

Perched Lake	<100x2	Ranger / IG
Eagle Creek Track	<100	Ranger / IG
Sir John Falls walkway	>5000x2	Ranger
Angel Cliffs Track	<100	Ranger
Heritage Landing Track	>5000	Gordon River cruises
Sarah Island (main track)	1000-2500	Gordon River cruises
Bird River Track: (vehicles)	100-500	Ranger / IG
Kelly Basin walking track	(100-500)x2	Ranger / IG

West Coast

West Coast Range

Mts Jukes, Huxley Darwin	<100	IG

Tyndall Range

Mt Geike	<100	IG
Lake Huntley	<100	IG

Eldons-Rocky Hill

Traverse (Eldon R - Pidgeon House Hill)	<100	IG
Other routes	<100	IG

Reserve-Plateau-Tiers

Rufus-Hugel-Cuvier-Lake St Clair

Watersmeet NT	(4-5000)x2	Reg
Lakeside Track	1-2000	Reg
Lk Oenone Track	<100	IG
Cuvier Valley Track	200-250	Permit
Mt Byron	<100	IG
Gingerbread Track	1-200	Reg
Shadow Lake Track	(3-4000)x2	Reg
Rufus circuit (ex Shadow Lk Tk)	1-2000	Reg
Forgotten Lake	1000x2	Reg
Little Hugel Track	(750-1000)x2	Reg
Hugel Range traverse	<100	IG
Mts Manfred, Cuvier	<100	Reg

Upper Franklin-Cheyne

Hugel Range - Lake Hermione	<100	Ranger
Lake Hermione - Lake Petrarch	100-200	Reg
Cheyne Range routes	<100	Reg
Lake Dixon Track	(50-100)x2	Reg
Lake Dixon - Lake Undine	<100	Ranger
Goulds SL - Pyramid Mt	<100	IG

Du Canes area

Overland Track (Narcissus - Kia Ora)	4-5000	Reg (See C1.2.2)
Pine Valley Track	(2500-3000)x2	Permit
Labyrinth: Pine Valley - Pool of Memories	±750x2	Permit
Labyrinth: Pool of Memories - Geryon Ridge	<100	IG
Southern Spur	<100x2	
Geryon Campsite Track	100-150	Reg
Geryon Campsite - Pool of Memories	<100	IG
Mt Acropolis	±750x2	Permit
Kia Ora - Mt Massif	<100	IG
Du Cane traverse (Geryon Ridge - Du Cane Gap)	<100	IG

Gould Plateau Track	100-500	IG
Lake Marion	(<100)x2	Reg
Mersey Falls (Fergusson Falls, Hartnett Falls etc)	1500x2	Permit
Hartnett Falls - Fergusson Falls	<100	Ranger
Du Cane Gap - Traveller Range	<100	IG

Pelion area

Overland Track (Kia Ora - Windermere)	4-5000	Reg (See C1.2.2)
Arm River Track	250-500	Reg
Reedy Lake Track	<100	Ranger
Lees Paddocks - Kia Ora	<100	Ranger
Forth Valley Track (Road - Old Pelion)	500-1000	Ranger
Old Pelion Hut side-track	1000-2500	Ranger/Log
Mt Ossa	(2500-5000)x2	Ranger/Log
Pelion East	±250x2	Permit
Mt Oakleigh	(1000-2500)x2	Ranger/Log
Mt Pelion West	<100x2	Ranger/Log
Pelion traverse	<100	IG
Thetis Track (OT - Paddys Nut/Ossa saddle)	<100	IG
Pelion Falls Track	(1000-2500)x2	Ranger
Forth River	<100	IG

Cradle Mt area

Overland Track (Waldheim - Windermere)	>5000	Reg (see C1.2.2)
Waldheim NT	>5000	Ranger
Maryland Track	1000-2500	Ranger
Hounslow Heath	1000-2500	Ranger
Lake Dove: Boat Shed, suicide rock	>30,000x2	Ranger/Reg
Ballroom Forest	>5000x2	Ranger/Reg
Truganini Track	>5000x2	Ranger/Reg
Lake Wilks Track	>5000	Ranger/Reg
Lake Lilla	>5000	Ranger/Reg
Wombat Pool	2500-5000	Ranger/Reg
Marions Lookout	10-20,000	Ranger/Reg
Face Track	5-10,000	Ranger/Reg
Cradle Mt summit	(5-10,000)x2	Ranger/Reg
Weindorfers Tower	<100x2	IG
Little Horn	(2500-5000)x2	Ranger

Hansons Peak traverse	5-10,000	Ranger/Reg
Mt Campbell	(1000-2500)x2	Ranger/Reg
Twisted Lakes	2500-5000	Ranger/Reg
Riggs Pass	<100	Ranger
Kitchen Hut/Horse Track	2500-5000	Ranger
Crater Falls	>5000	Ranger/Reg
Crater Lake Track	>5000	Ranger/Reg
Suttons Tarn	(100-500)x2	Ranger/Reg
Rodway Track: Ranger Hut - Lk Rodway	5-10,000	Ranger/Reg
Rodway Track: Lk Rodway - Cradle Cirque	500-1000	Ranger/Reg
Barn Bluff	(1000-2500)x2	Ranger/Reg
Waterfall Valley Falls track	(1000-2500)x2	Ranger/
Lake Will	(1000-2500)x2	Ranger/Reg
Info Centre rainforest walk	>50,000	T/C, Ranger
Reynolds Falls	(100-500)x2	Ranger
Dove Canyon Track: Knyvet Falls	(>5000)x2	Ranger/Reg
Dove Canyon Track: circuit	2500-5000	Ranger/Reg
Enchanted Nature Walk	>5000	Ranger/Reg
Waratah Track	<100	Ranger
Pencil Pine Track	1000-2500	Ranger, P&O staff

Walls of Jerusalem

Main access (Trappers to Solomons)	(3500-5000)x2	Reg
Herods Gate and Amphitheatre	>3500	Reg
Lake Ball - Lake Adelaide circuit	1500-2000	Reg
Trappers Hut - George Howes Lake	200-500	Log/IG

Upper Mersey

Moses Creek Track	250-500	IG
Jacksons Creek Track	100-250	IG
Lake Myrtle Track (Road - Lk Meston)	250-500	
Junction Lake Track (Lk Adelaide - Junction Lk)	250-500	IG
Never Never route	500-1000	Reg/IG

Plateau-Tiers

Clumner Bluff route	<100x2	IG
Zion Gate - Lake Fanny	<100	IG
Split Rock Track	±1420	FC T/C
Meander Falls Track	±1180x2	FC T/C

Old Powerline Track	<100	IG
Liffey Bluff Track	<500	IG
Liffey Falls (from top picnic area)	± 6250	FC T/C
Drys Bluff	±400x2	Bob Brown
Pillans Lakes / Lake Field: walkers	±500	Ranger
Pillans Lakes / Lake Field: vehicles	±700	Ranger
Lake Ada - Christys Creek: walkers	5-10,000	Ranger
Lake Ada - Christys Creek: vehicles	±300	Ranger
Lake Ina: walkers	<100	IG
Travellers Rest Lagoon: walkers	<100	Reg
Travellers Rest Lagoon: vehicles	0	Ranger (NB: bridge is unusable)
Clarence Lagoon: walkers	100-200	Ranger
Clarence Lagoon: vehicles	100-200	Ranger

C3 User characteristics, behaviour and attitudes: results of visitor surveys

C3.1 Overall visitation

Visitor surveys undertaken by the Parks & Wildlife Service over the 1987-88 summer season provided the following statistics concerning the origin of visitors to Cradle Mountain and Lake St Clair:

	Tasmania	Interstate	Overseas
Cradle Mt	34%	57%	9%
Lake St Clair	15%	74%	11%

In a survey of park users carried out in July 1993 57% of visitors to Cradle Mountain listed daywalks as their main activity the park. However this figure may not be representative of usage trends throughout the year.

C3.2 Bushwalkers

C3.2.1 Bushwalker characteristics and behaviour

The following information is based on three sources: the Carlington (1988) survey, a survey of visitors to the Anne Range conducted by Sawyer in 1987/88 (Sawyer 1988b), and visitor surveys conducted by the Parks & Wildlife Service during the 1990-91 and 1991-92 seasons.

The Parks & Wildlife Service surveys (indicated in the list below by "P&W") sampled the attitudes and characteristics of walkers on major tracks such as the Overland Track, Frenchmans Cap Track, South Coast Track and Western Arthurs traverse, as well as some areas outside the WHA. Half the people surveyed in the WHA were walkers on the Overland Track and the sample sizes in most of the other areas were fairly small. For these reasons the results of these surveys are unlikely to be representative of walkers in all parts of the WHA.

Although the Parks & Wildlife surveys included visitors to the Freycinet National Park and Maria Island, the following information relates only to walkers in the WHA.

Place of origin

- Places of origin indicated by the P&W 1991/92 survey were as follows: Tas 26%, Vic 22%, NSW 23%, SA 3%, other states 9%, overseas 14%. Two thirds of overseas visitors were from Europe, 10% from Canada and 13% from New Zealand. (The sample size of overseas visitors was too small to justify more detailed analysis.)
- Carlington (1988) found that more than 60% of bushwalkers in the WHA are from interstate.
- In the Sawyer survey 55% of visitors to the Anne Range were residents of Tasmania. This suggests that the percentage of local visitors may vary widely in different parts of the WHA, with the major "prestige" tracks receiving the highest proportion of non-Tasmanian users.

Experience

- The following table indicates the percentages of respondents who described themselves as "novice", "moderately experienced" and "very experienced" bushwalkers in the 1990/91 P&W survey. These terms were defined in the questionnaire as follows: novice - never been on an overnight bushwalk before; moderately experienced - less than six overnight bushwalks; very experienced - six or more overnight bushwalks. The right-hand column-headings refer to areas in which walkers were surveyed as follows:

Arthurs Eastern and Western Arthurs
Low SW The Port Davey Track, South Coast Track and Southwest Cape circuit.
OT/FC Overland Track and Frenchmans Cap Track.
Walls Walls of Jerusalem.

Experience	Arthurs	Low SW	OT/FC	Walls
Novice	0	0	11	8
Moderate	17	16	39	26
Very exp'd	83	84	50	66

- In the 91/92 survey two-thirds of walkers surveyed on the Overland Track and Frenchmans Cap Track rated themselves as "very experienced" and most of the rest as "experienced".

Return visits

- The P&W 1991/92 survey found that 75% of walkers on the Overland Track and Frenchmans Cap Track were first-time visitors to the area.
- Roughly half of the bushwalkers in the WHA are return visitors (to the WHA), and nearly 60% of walkers participating in walks of more than three days' duration are return visitors (Carlington 1988).

Age

- Roughly two-thirds of walkers are aged between 16 and 35 (P&W).

Education

- Bushwalkers tend to be well educated, 60% of them having completed tertiary education (Carlington, P&W). Three quarters of walkers over twenty years of age had tertiary education (P&W).

Sex

- 60% of walkers are male (P&W). (Note: in the Sawyer survey 69% of respondents were male.)

Party size

- The most common party size is two. 84% of respondents travel in parties of 1-6 people (P&W).

Trip length

- The most common trip length is six days. 92.5% of trips are between 2 and 10 days in length (P&W).

MIB practices

- More than eighty percent of walkers carry out their litter (P&W) and 96% carry fuelstoves.

Use of guidebooks

- In the Sawyer survey (1988b) 55% of visitors to the Anne Range listed guidebooks as their main source of information about the area.
- A survey of wilderness walkers conducted by the Service in the summer of 1986/87 indicated that more than 50% of walkers on major tracks in the WHA carry guidebooks, the Chapman (1983) and Chapman/Siseman (1984) books being the two most commonly used guidebooks at the time.

Axes

- In the Sawyer survey five walkers (2% of those surveyed) said they were carrying axes.

Summary

- 60% of walkers on major tracks in the WHA come from interstate and 14% come from overseas.
- More than 90% of walkers on major tracks in the WHA have done at least one overnight bushwalk before and more than two-thirds have done at least six.
- More than half of visitors to the WHA are return visitors, but the percentage of first-time visitors is higher on major tracks such as the Overland Track.
- Two-thirds of walkers are aged between 16 and 35, and roughly two-thirds are male.
- Walkers tend to be well educated, three quarters of adult walkers having completed tertiary education.
- More than 90% of walkers travel in groups of 1-6 people.
- More than 50% of walkers on major tracks carry guidebooks.

C3.2.2 Bushwalker attitudes

For a summary of the findings of overseas research into the attitudes of wilderness users see sections B2.2 and B4.3.

The following information about the attitudes of visitors to the Tasmanian Wilderness WHA is derived from the 1990-91 and 91/92 wilderness walker surveys referred to in C3.2.1 except where otherwise indicated. The term "Sawyer survey" refers to the survey of visitors to the Anne Range conducted by Sawyer in 1987/88 (Sawyer 1988b).

Attitudes to track conditions

- 86% of walkers in the Eastern and Western Arthurs and more than a third of walkers on the Overland Track and Frenchmans Cap Track described the tracks as either "deteriorating" or "heavily damaged".
- 52% of walkers on lowland Southwest tracks described the tracks as deteriorating but only 7% described them as heavily damaged.
- In the Sawyer survey one third of respondents considered the tracks to be either deteriorating or heavily damaged. The majority of walkers surveyed on the Overland Track, Frenchmans Cap Track and in the Walls of Jerusalem area described the tracks as either "acceptable" or reasonable".
- Overall, 40% of respondents said that they had noticed deteriorating track conditions but that this had not detracted from their enjoyment, and 36% said that track conditions had detracted mildly from their enjoyment. However in the Western and Eastern Arthurs 37% said track conditions had detracted mildly from their enjoyment and 43% said track conditions had detracted greatly from their enjoyment. In lowland areas of the Southwest (ie the South Coast Track, Port Davey Track and Southwest Cape circuit) these percentages were 52% and 26% respectively
- In the Sawyer survey 50% of respondents said that degraded tracks detracted mildly from the natural qualities of the area and 32% said they detracted greatly. Experienced walkers were more concerned about degraded tracks than inexperienced walkers.
- In the Sawyer survey 31% of respondents said that the existence of tracks in the Anne Range area detracted mildly from the natural qualities of the area and 4% said the tracks detracted greatly. Similar percentages were obtained in response to a question about whether users felt that track construction and maintenance detracted from the naturalness of the area.

Awareness of MIB

- 90% of respondents were aware of the Service's MIB program.

Attitude to encounters

- In the 1991/92 survey 14% of walkers surveyed on the Overland Track and Frenchmans Cap Track said that encounters with other walkers on tracks had detracted from their enjoyment, 32% said these encounters enhanced their enjoyment and half said they made no difference.
- In the same survey 32% of walkers surveyed on the Overland Track and Frenchmans Cap Track said that encounters with other walkers at campsites had detracted from their enjoyment, 31% said these encounters enhanced their enjoyment and 37% said they made no difference. 40% of walkers surveyed in the Walls of Jerusalem area stated that encounters at campsites had detracted from their enjoyment.
- 23% of walkers reported that encounters with large parties detracted mildly from their enjoyment and 12% said they detracted greatly from their enjoyment.

The Sawyer survey (1988b) found:

- 21% of visitors to the Anne Range listed social interaction as one of the motives for undertaking their trip to the area.
- Fewer than 10% of walkers expressed concern about crowding on tracks.
- 15% of walkers expressed concern about crowding at the Mt Eliza hut or at campsites.

Usage restrictions

- 50% of walkers said that they would support restrictions on usage levels on the track they had walked on in order to reduce or avoid congestion and crowding, while 32% disagreed. Agreement was uniformly high but was highest in the Western and Eastern Arthurs where 77% agreed.
- 70% of walkers said that they would support restrictions on usage levels on the track they had walked on in order to limit environmental damage, while only 18% disagreed. Agreement was uniformly high but was highest in the Western and Eastern Arthurs where 89% agreed.
- 60% of walkers said they would support a limit on the number of people in trackless areas to minimise the development of new tracks.

Party size restrictions

- In the 91/92 survey 100% of walkers surveyed in the WHA (excluding the Central Plateau) supported party size restrictions. 41% of walkers on the Overland Track and Frenchmans Cap Track favoured party sizes of no more than six and 63% favoured party sizes of no more than eight. Among walkers surveyed in Southwest highland areas these figures were 62% and 89% respectively.

Track closures

- 66% of walkers were in favour of closing tracks and campsites for management purposes. Only 17% were not in favour and 18% were undecided. The percentages in favour were fairly even in all areas.

Restrictions on camping and campfires

- In the Sawyer survey 71% of walkers supported restrictions on camping and 67% supported bans on campfires. In the P&W survey 65% of walkers supported a ban on campfires throughout the area in which they were surveyed, roughly 30% supported the declaration of Fuel Stove Only Areas (as an alternative to a total ban on campfires) and fewer than five percent favoured no restrictions on campfires.

Track upgrading vs usage restrictions

- In the Sawyer survey 38% of walkers on the Anne circuit favoured substantial track upgrading without restrictions on usage whereas 62% favoured usage restrictions and minor upgrading. Walkers on other tracks in the area (most of whom were walking the Mt Anne Track) were evenly divided on this question.

Permit system

- Assuming user numbers are to be limited, 75% of walkers favoured limiting numbers using a permit system together with an entry fee, while 25% favoured a free permit system. Support for the permit system-entry fee package was uniformly high in all areas.
- 90% of walkers favoured an advanced-booking system for allocating permits while only 10% favoured first-come-first-served allocation. Support for the advanced-booking system was uniformly high in all areas. Note however that respondents were not offered the option of a combination of these systems.

Summary

- Track degradation draws more criticism from walkers and has the greatest negative impact on walker enjoyment in the Eastern and Western Arthurs than in any other area surveyed in the WHA.
- Experienced walkers tend to be more sensitive to and intolerant of biophysical and social impacts than inexperienced walkers.
- Most walkers are aware of the Service’s MIB campaign.
- A relatively small percentage (14%) of walkers on major tracks report that encounters with other walkers on tracks detract from their enjoyment, but a third of all walkers report that encounters with other walkers at campsites detract from their enjoyment.
- 50% of walkers support usage restrictions to limit crowding and 70% support usage restrictions to limit environmental damage. 60% support a limit on the number of people in trackless areas to minimise the development of new tracks.
- At least three-quarters of walkers support restrictions on party size. Two-thirds of walkers on the Overland Track and Frenchmans Cap Track support restricting party sizes to less than eight, and more than half the walkers in other areas support restricting party sizes to less than six.
- Two-thirds of walkers support the closure of tracks and campsites for management purposes.
- Two-thirds of walkers on the Anne circuit preferred a policy of usage restrictions combined with minor track repair to a policy of major track upgrading with no usage restrictions.
- Two thirds of walkers support a total ban on campfires in the area where they were surveyed, and fewer than five percent favoured no restrictions on campfires.

C4 Social impacts

Information about user attitudes to social impacts such as encounters with other users is summarised in C3.2.2.

This information indicates a lower user tolerance to encounters at campsites than to encounters on tracks, a finding which is consistent with the results of most other social-impact research (see B2.3). They also indicate that current levels of social impacts on tracks are not a problem for the majority of walkers on the major tracks in the WHA.

However these results must be interpreted with caution. As pointed out in B2.3 it has been found that a majority of users in most wilderness areas tend to report a high level of trip satisfaction, regardless of increases in social impacts in those areas over time (Graefe, Vaske & Kuss 1984a, Lucas 1985b). Hence user satisfaction is not a reliable indicator of social impact levels (Watson 1988).

There is also evidence that as social impacts increase, users seeking a higher degree of solitude tend to move on to other areas - a process referred to as recreational displacement (Burch 1969, Anderson & Brown 1984). Moreover the Parks & Wildlife surveys focussed on walkers using well-known and relatively high-use tracks in the WHA. It may be that as social impacts on major tracks in the WHA increase a shift in user expectations is occurring while walkers less tolerant of high levels of social impact are being displaced to other areas. Clearly further research is needed including a study of use levels and social impacts in medium to low use areas in the WHA.

The information in C3.2.2 indicates that a third of all walkers on major tracks in the WHA are concerned about crowding at campsites, and this figure is as high as 40% in some areas. Verbal reports of more than a hundred walkers traversing the Western Arthur Range at the same time, and of more than thirty tents pitched at Hanging Lake in the Eastern Arthurs, suggest that some degree of use restriction is already required in some parts of the WHA.

The survey results listed in C3.2.2 indicate that a majority of walkers would support the restriction of usage levels in order to reduce or avoid congestion and crowding, and that support for such restrictions is as high as 80% in some areas.

Summary and conclusions

- Social impacts do not appear to be a major problem on most of the major tracks in the WHA, although campsite crowding is a significant problem in many areas.
- A majority of walkers would support the introduction of usage restrictions to minimise environmental impacts and crowding on major tracks in the WHA.
- There is a need for research into social impacts and user attitudes in low-use areas in and adjacent to the WHA.

Notes

(i) Overview

In this section the tracks, routes and major recreational rivers listed in section 11 have been reordered so as to indicate the recreation opportunity spectrum that will exist for walking and rafting trips in different parts of the WHA once the recommendations of the Strategy are implemented. An infinite number of recreational opportunities are possible; the intention here is to identify recreational units (ie trips) which are generally recognised by wilderness users and managers, particularly those which involve the use of existing or proposed walking tracks.

(ii) Regional divisions

The WHA and adjacent natural areas have been divided into regions which identify the *main point or area of access* to the tracks and routes in question. Note that this classification of regions is slightly different from the geographical classification used in section 11 and appendix A1.

(iii) Trip lengths

Trip length refers to the length of time (in hours or days) typically required to undertake a trip and return to "civilisation" or (in the case of Melaleuca and Cox Bight) to one's starting-point.

Within each region tracks, routes and some rivers have been listed according to the length of walking or rafting trips which (a) can be undertaken from the indicated point or area of access and (b) would generally involve walking or rafting along that track, route or river.

Extended and medium-length camping trips include "A to B" type traverses (eg from Melaleuca to Scotts Peak), return trips to particular destinations (eg the return trip to Federation Peak via Moss Ridge) and trips involving a combination of "A to B" type journeys or return trips and shorter side-trips (eg a 4-day trip to the Pelions area with visits to Mt Ossa, Pelion East etc).

Where trips begin and end in more than one region they are listed under one regional heading and listed in square brackets under the other(s).

Circular trips are indicated with the symbol °.

(iv) Subsidiary tracks/routes

Tracks and routes in remoter areas which may be walked as part of longer trips are listed under the heading "subsidiary tracks/routes", eg the Mt Ossa Track is listed in the Pelions/Upper Mersey/Walls of Jerusalem region as a subsidiary track under the heading "Short to medium camping trips (1-4 nights)".

Subsidiary tracks and routes are usually listed under only one heading although technically they may belong under more than one. For example the Louisa Bay track is listed under "Short to medium camping trips (1-4 nights)" for the "Port Davey/Southwest Cape" region but not under "Extended camping trips (5-9 nights)" for the same region, despite the fact that it is potentially a side-trip of a trip from Melaleuca to Lune River via the South Coast Track and Southern Ranges.

(v) Track classifications

Tracks, routes and rivers are listed in each trip-length category in order of decreasing track classification as defined by the specifications in section 10. Where the trip in question includes tracks or routes with different classifications, the track is listed according to the lowest classification. Some tracks are listed which are currently open but are classified X, ie recommended for closure.

The term “Short low-grade walks” refers to walks of T2 standard or lower and less than 3 hours’ duration.

The term “Short high-grade walks” refers to walks of T1 standard or higher. and less than 3 hours’ duration.

(vi) Primary attractions of nature trails and other short high-grade walks

The primary attraction(s) (eg rainforest, scenic views) of nature trails and other short high-grade walks are indicated.

(vii) Summary

The results are summarised in section 5 of Volume 1.

D1 Port Davey - Southwest Cape

Main access:

Melaleuca and Cox Bight, accessed on foot via the Port Davey Track or South Coast Track, by plane or by boat.

(a) Expeditions (≥ 10 nights)

Old River route	R
[Port Davey - Low Rocky Point]	R
Several other routes - low usage	R

(b) Extended camping trips (5-9 nights)

SW Cape circuit°	T3+T4+(X or R), *T3*
[South Coast Track / Southern Ranges]	T2-R
Other routes - low usage	R

Subsidiary tracks/routes

Noyhener Beach - Spain Bay	T4+R
SW Cape	T4

(c) Short to medium camping trips (1-4 nights)

South Coast Tk: Melaleuca - Cockle Ck	T2
[Port Davey Track]	T3
New Harbour - SW Cape	T3+T4

Subsidiary tracks/routes

Louisa Bay	T4
Summit of Ironbound Range	T4
Rocky Boat Inlet	R
Osmiridium Beach	T4

	New Falls	T4

(d) 0.5-1 day trips

Melaleuca - Cox Bight	T2
Melaleuca - Narrows	T3
Melaleuca - New Harbour	T3
Spain Bay - Stephens Bay (boat based)	T4
Mt Rugby (boat based)	T4

(e) Short low-grade walks (≤3 hrs, ≤T2)

Balmoral Hill (from Horseshoe Inlet)	T4

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

None.

D2 Huon - Esperance

Main access:

Huon-Esperance area.

(a) Expeditions (≥ 10 nights)

[South Coast Track + Port Davey Track]	T2+T3
Vanishing Falls°	R
[E & W Arthurs traverse]	T3
Southern Ranges - Sth Coast Tk - Port Davey Tk	T2-R
Other routes - low usage	R

(b) Extended camping trips (5-9 nights)

Southern Ranges traverse/South Coast Track (to Cockle Ck or Melaleuca)	T2-T4
Precipitous Bluff return (via Sthn Ranges)	T3+T4
[W Arthurs traverse]	T3
[E Arthurs traverse]	T3
Other routes - low usage	R

(c) Short to medium camping trips (1-4 nights)

[Cockle Ck - Melaleuca]	T2
South Cape Bay return	T2
Granite Beach / Prion beach return	T2
Federation Peak (via Moss Ridge)	T3
Huon Track [+ Arthur Plains Track]	T3
Southern Ranges	T3+T4
Mt Picton (from Blakes Opening)	T4
Mt Picton (from Picton forestry roads)	T4
Mt Weld	T4
Lake Sydney Track/Mt Bobs	T4+R
Adamsons Peak - Moores Garden	R
Hartz Pk - Adamsons Pk	R
South Pictons	R
Snowy Range routes	R
South Pictons	R

Subsidiary tracks/routes

Hipp•	R
Reservoir Lakes	T4
Arndell Falls	R
Mt La Perouse	T3
Pindars Pk	T3
Wargata Mina (from E. Arthurs Track)	T4

(d) 0.5-1 day trips

Hartz Peak	T1+T2
South Cape Bay	T2
Hill 1	T3
Adamsons Peak Track	T3
Hartz Lake	T1+T3
Lake Skinner Track / Snowy Sth	T3+T4
Nevada Peak/Woolleys Tarn	T4+R
Kermandie Track (aka Hartz Track)	T4, *T2*
Lower Weld karst features	T4
Adamsons Falls-Creekton Falls-Duck Hole Lk circ.°	T2+(X, *T2)*
Picton River (below Farmhouse Ck)	Riv 1
Huon River (below Tahune bridge)	Riv 1

(e) Short low-grade walks (≤3 hrs, ≤T2)

Adamsons Falls Track	T2
Duck Hole Lake Track	T2

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

Track	Main attraction	Class'n
Hastings Cave Track	Mixed forest	W1
Hot Springs NT	Rainforest, thermal springs	W2
Waratah Lookout	Extensive views of nonwilderness	W2
Keoghs Pimple	Extensive views	W2
Lake Osborne	Alpine lake	W2
Arve Falls	Waterfall	*W2*
Devils Backbone LO (proposed)	Extensive views of WHA	*W2*
Ladies Tarn / Lake Esperance	Alpine lake	T1

Also relevant:

The Forestry Commission has constructed more than nature trails and other short walks in the Huon-Esperance area, mostly of W2 or T1 standard.

D3 Gordon River Rd - Scotts Peak Rd

Main access:

Gordon River Road, Scotts Peak Rd, ANM forestry roads.

(a) Expeditions (≥ 10 nights)

Port Davey Track + South Coast Track	T3+T2
W & E Arthurs traverse	T3
Spires region traverse	R
Other routes - low usage	R

(b) Extended camping trips (5-9 nights)

W Arthurs traverse	T3
E Arthurs traverse	T3
Franklands traverse	R
Lk Curly/Spires	R
Other routes - low usage	R

(c) Short to medium camping trips (1-4 nights)

Lk Judd	T2
Anne Circuit (Mt Anne - Lk Judd)	T3
Arthur Plains Track [+ Huon Track]	T3
W Arthurs - partial traverses	T3
Rasselas Track (to Lk Rhona)	T3
Wylds Craig track	T3
NE Ridge track (Gelignite Ck - Mt Anne)	T4
Lk Timk (from NE Ridge track)	T4
Hamilton Range	T4
Gordon Range access routes to Denison Range	T4+T4*+T3
Mt Mueller	T4+R
Splits Track	T4+R
Truchanas Pine Reserve	R
[Snowys traverse]	R
Schnells Ridge	R
Mt Wright	R
Other routes - low usage	R
Weld arch route	X, R

Subsidiary tracks/routes

Lake Picone - Lots Wife	T4

(d) 0.5-1 day trips

Mt Eliza/Mt Anne	T2
Timbs Track (to Florentine R)	T2
Mt Wedge	T3, *T1*
Mt Sprent	T3
Old Port Davey Track (+ Mt Bowes)	(T4,*T2)* (+X, R)
Snowy North	T4
Tim Shea	T4
Needles	T4
Thumbs	R
Adamsfield Track	T4, *T1*
Sentinels	X, (R or T4)
Old Lake Pedder Track	T4, R

(e) Short low-grade walks (≤3 hrs, ≤T2)

Boyd NT°	X

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

Track	Main attraction	Class'n
Creepy Crawly NT°	Rainforest	W2
Geological walk (Gordon Rd)	Geological features	*W2**
Wedge NT°	Mixed forest	T1**

* Proposed track bordering Gordon River Rd approximately 20km east of Strathgordon.

** A proposal is being considered to construct a walk of W1 standard at this location.

The following nature trails at the Mt Field National Park and in the ANM forestry concession are also relevant:

Track	Main attraction	Class'n
Russell Falls Track	Mixed forest, waterfall	W1
Tall Trees NT (Mt Field)°	Tall forest	W2
Lyrebird Tk	Mixed forest	W2
Pandani Grove Tk (Lk Dobson)	Subalpine forest	W2
Lawrences Ck NT (ANM)	Tall forest	T1
Big Tree walk (ANM)	Tall forest	T1

D4 Lyell Highway (excl. Lk St Clair)

Main access:

Lyell Highway.

(a) Expeditions (≥ 10 nights)

Franklin River	Riv 2
Prince of Wales Range	R
[Spires region traverse]	R
Other routes - low usage	R

(b) Extended camping trips (5-9 nights)

[Eldons traverse]	R
Other routes - low usage	R
Prince of Wales Range via Jane River Track	X+R
Franklin River (to Fincham or McCall)	Riv 2

(c) Short to medium camping trips (1-4 nights)

Frenchmans Cap Track	T2
Frenchmans - Raglans traverse	T2+T4+R
High Dome (via Pidgeon House Hill)	R
King William Range (except KW 1)	R
Jane River Track	T4, R

(d) 0.5-1 day trips

Wayatinah Tall Trees (proposed)	*T1?*
Mt King William 1	VT+T4
Collingwood R - Franklin R junction - Donaghys Hill	Riv 2 + T4

(e) Short low-grade walks (≤3 hrs, ≤T2)

None

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

Track	Main attraction	Class'n
Franklin River NT°	Rainforest	W1
Nelson Falls	Mixed forest, waterfall	W2
Frenchmans Tk (to Franklin R)	River, Rainforest	W2
Donaghys Hill NT	Mixed forest, views	W2
Wayatinah NT (proposed)	Tall forest	*W2?*

D5 West Coast

Main access:

Queenstown area, South Queenstown Road, Strahan, Macquarie Harbour, lower Gordon and Franklin Rivers.

(a) Expeditions (≥ 10 nights)

Low Rocky Point - Port Davey	R

(b) Extended camping trips (5-9 nights)

Eldons traverse	R

(c) Short to medium camping trips (1-4 nights)

Kelly Basin Track	T2+T4
Fincham Track	T4
Eagle Creek Track + Lower Franklin	T4 + Riv 2
Lower Gordon River (below Seal Rapid)	Riv 2
Eldon Peak	R
Tyndall Range	R

(d) 0.5-1 day trips

Darwin Crater Track	T3
Mt Geikie (from Basin Lake)	T4
Lk Huntley (from north)	R
Mt McCall Rd	VT; *T4, R*

(e) Short low-grade walks (≤3 hrs, ≤T2)

Perched Lake	T4

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

Track	Main attraction	Class'n
Heritage Landing Track	Rainforest	W1
Sir John Falls walkway	Rainforest, waterfall	W2
Sarah Island	Historic site	W2

D6 Lake St Clair area

Main access:

Cynthia Bay, Narcissus, vicinity of Derwent Bridge on Lyell Highway.

(a) Expeditions (≥ 10 nights)

[Overland Track plus side-trips]	T1 + various

The region north of the Lyell Highway provides little scope for extended “A to B” type expeditions except those which include routes in wilderness areas in the upper Murchison and Mackintosh catchments.

(b) Extended camping trips (5-9 nights)

[Overland Track plus side-trips]	T1 + various
Return or through trips to Pelion area, Plateau	Various
Gould SL - High Dome [+ Eldons traverse]	R

(c) Short to medium camping trips (1-4 nights)

[Overland Track]	T1
Pine Valley	T1
Cuvier Valley Track	T2
Lake Marion	T3
Labyrinth, Walled Mt	T3+T4
Gould Plateau	T4
Lake Oenone/Mt Olympus	R
Hugel traverse	R
Mts Manfred, Cuvier, Gould SL	
Hugel Range - Lake Hermione - Lake Petrarch	R
Cheyne Range/upper Franklin	R
Traveller Range	R

Subsidiary tracks/routes

Hartnett Falls	T2
Fergusson Falls, Cathedral Falls	T3
Mt Acropolis	T3
Geryon Campsite Track	T4
Mt Gould	R
Gould plateau - Labyrinth	R
Mts Eros, Hyperion	R
Du Cane traverse	R

Mt Byron	R
Mt Geryon peaks	R

(d) 0.5-1 day trips

Lakeside Track	T1
Shadow Lake Track	T1
Rufus circuit°	T2
Forgotten Lake	T2
Little Hugel Track	T3
Gingerbread Track	T3
Lake Dixon Track	T4
Proposed loop track	*T1?*

(e) Short low-grade walks (≤3 hrs, ≤T2)

None.

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

Track	Main attraction	Class'n
Watersmeet NT	Sclerophyll forest	W1

D7 Pelions - Upper Mersey - Walls of Jerusalem

Main access:

Mersey Forest Road, Lemonthyme Road.

(a) Expeditions (≥ 10 nights)

The region north of the Lyell Highway provides little scope for extended "A to B" type expeditions except those which include routes in wilderness areas in the upper Murchison and Mackintosh catchments.

(b) Extended camping trips (5-9 nights)

Through trips to Cradle Mt plus side-trips	Various
Extended trips to Plateau, Pelions etc	Various

(c) Short to medium camping trips (1-4 nights)

Walls of Jerusalem: main access	T1
Walls of Jerusalem: Dixons Kingdom	T2
Lake Myrtle Track (to Lk Meston)	T3
Junction Lake Track	T3
Arm River Track	T3
Lees Paddocks Track (Mersey Rd - Lees P.)	T3
Reedy Lake Track	T3
Forth Valley Track	T3
Moses Creek Track	T3
Jacksons Creek Track	T4
Trappers Hut - George Howes Lake	T4
Little Fisher Track	T4
Walls/Upper Mersey - L St Clair via Never Never	T4
Lees Paddocks - Kia Ora	T4
Walls/Upper Mersey - L St Clair via Orion Lks	R
Lake Ball - Lake Adelaide circuit	T1-R
Forth River	Riv 1

Subsidiary tracks/routes

Mt Ossa	T2
Pelion Falls track	T3
Pelion East	T3
Mt Oakleigh	T3
Mt Jerusalem route	T3

Mt Pillinger	T3
Solomons Throne	T4
Mt Pelion West	T4
Junction Lake - Lake Artemis	T4
Thetis Track	X, R
Pelion traverse	R
Other Walls routes	T4, T4* & R

(d) 0.5-1 day trips

Trappers Hut, Solomons Jewels	T1
Clumner Bluff route	R

Several of the tracks listed in (c) also lend themselves to day walks

(e) Short low-grade walks (≤3 hrs, ≤T2)

None.

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

None.

D8 Cradle Mt area

Main access:

Cradle Valley Road.

(a) Expeditions (≥ 10 nights)

The region north of the Lyell Highway provides little scope for extended "A to B" type expeditions except those which include routes in wilderness areas in the upper Murchison and Mackintosh catchments.

(b) Extended camping trips (5-9 nights)

Return trips to Pelion, Du Cane area	T1 + various
Overland Track plus side-trips	T1 + various
Cradle - Overland Tk - Central Plateau	T1 + various

(c) Short to medium camping trips (1-4 nights)

Overland Track	T1
Rodway Track	T2+T3
Barn Bluff	T3
Reynolds Falls	T4, *T3*

Subsidiary tracks/routes

Suttons Tarn	T3
Lake Will	T3
Waterfall Valley Falls track	T4

(d) 0.5-1 day trips

Dove Lk loop track	W2
Kitchen Hut/Horse Track	T1
Crater Lake Track	T1
Speeler Track (incl King Billy Track)	T1
Pencil Pine Track	T2
Cradle Mt summit	T2
Face Track	T2
Dove Canyon circuit	T1+T2
Marions Lookout	T2
Lake Wilks Track	T3
Maryland Track / Hounslow Heath	T4 or X
Twisted Lakes/Hansons Pk	T2+T4

Subsidiary tracks/routes

Mt Campbell	T2
Little Horn	T4
Weindorfers Tower	X, R
Riggs Pass	X, R

(e) Short low-grade walks (≤3 hrs, ≤T2)

Maryland Track	T4

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

Track	Main attraction	Class'n
Info Centre rainforest walk°	Rainforest	W1
Boathouse, Suicide Rock	Views, subalpine moorland	W1
Waldheim NT°	Rainforest	W2
Enchanted Nature Walk°	Rainforest, some sedgeland	W2
Ballroom Forest	Views, moorland, rainforest	W2
Lake Lilla	Lakes, moorland	T1
Wombat Pool	Lakes, moorland	T1
Crater Falls	Waterfall, rainforest	W2
Campground Track	Primarily an access track	T1

D9 Plateau - Tiers

Main access:

Mole Creek, Meander, Lake Highway, Liffey, Marlborough Highway, private vehicular tracks north of Lyell Highway.

(a) Expeditions (≥ 10 nights)

The region north of the Lyell Highway provides little scope for extended "A to B" type expeditions except those which include routes in wilderness areas in the upper Murchison and Mackintosh catchments.

(b) Extended camping trips (5-9 nights)

Tiers or lakes - Lake St Clair (numerous routes)	Various
Extended trips on Plateau and to Pelions etc	Various

(c) Short to medium camping trips (1-4 nights)

Blue Peaks Track	T3
Higgs Track (to Lake Nameless)	T3+T4
Lake Fanny	VT+T4
Lake Antimony	T4
Pillans Lakes / Lake Field	VT
Pine River	VT
Olive Lagoon	VT
Lake Ina	X
Travellers Rest Lagoon	VT
Ritters Track (Lk Nameless - Lk Fanny)	R
Zion Gate - Lake Fanny (SE end)	R
Numerous other routes	R

(d) 0.5-1 day trips

Liffey Falls (from lower picnic area)	T1
Meander Falls Track	T3, *T1*
Liffey River Track	T3, *T1*
900 metre contour track (proposed)	*T3*
Explorer Creek Track	T3
Parsons Track	T3+T4
Western Creek Track	T3
Mother Cummings Peak (from M.C. Rivt)	T3
Dixons Track	T3

Projection Bluff Track	T3
Mt Ironstone (Smoko Ck) Track	T3+T4
Chasm Falls (Mt Ironstone Track)	T3
Syds Track	T4
Dell Track	X+T4
Stone Hut Track	T3+T4
Split Rock Track	T3+X
Western Bluff Track	T4
Mother Cummings Peak (from Westrope Rd)	T4
Scotts Tk (Mother Cummings Peak from Scotts Rd)	T4
Staggs Track	T4
Liffey Bluff Track	T4
Drys Bluff Track	T4, *T3*
Clarence Lagoon	VT
Warners Track	T4 + (X, R)
Yeates Track (a.k.a. South Mole Creek Track)	VT
Johnstone's Track	X
Old Powerline Track	X
Pine Lake vehicular track	X

Subsidiary tracks/routes

Split Rock Falls	T3
Croft Track	T3?
Bastion Bluff Track	T4
Bastion Cascades Track	X

(e) Short low-grade walks (≤3 hrs, ≤T2)

None.

(f) Nature trails and other short high-grade walks (≤3 hours, ≥T1)

Track	Main attraction	Class'n
Pine Lake NT	Alpine moorland and native pines	W1
Devils Gullet LO track	Views, cliffs	W2
Marakoopa Forest Walk°	Rainforest	W2
Meander Picnic Ground NT°	Rainforest	W2
Liffey Falls (from top)	Rainforest, waterfalls	W2
Marakoopa karst walk (prop)	Surface karst features	*T1 or W2?*
Liffey Falls (upper to lower picnic area)	Mixed forest	T1

E Inventory of recreational impacts in the WHA

The following inventory has been included as a checklist of the main types of recreational impacts that are occurring in the WHA.

E1 Biophysical impacts

E1.1 Impacts on vegetation

- Crushing, breakage etc
- Exposure of roots, bruising/removal of bark
- Loss of biomass
- Change in species composition
- Grazing by horses
- Clearance for campsites or track construction
- Removal of dead or live vegetation for firewood, facilities, track construction
- Scorching caused by campfires
- Blazing of trees/disfiguring of trees caused by track markers
- Direct and indirect impacts of escaped fires

E1.2 Impacts on soils and geomorphological features

- Soil compaction and slumping
- Alteration of physical and chemical composition of soil
- Loss or compaction of organic horizon
- Change in organic content of soil
- Downward movement of loose materials
- Soil churning and formation of mudbowls
- Erosion: channelling (often assisted by water flow), gouging, breakage and crushing of friable subsoils and bedrock
- Disturbance of sand dunes leading to wind erosion and blowouts.
- Stream-bank erosion exacerbated by trampling
- Scorching of soils and burning of peat caused by campfires
- Peat loss and sheet erosion caused by escaped fires
- Disturbances caused by track/campsite construction and maintenance
- Damage to exposed rock formations such as micro-erosional features

E1.3 Changes to track and campsite conditions

- Development of new tracks, pads and campsites
- Deterioration of tracks and campsites (eg mud, erosion)

- Track widening, increase in area of campsites
- Hardening/stabilisation of tracks and campsites
- Installation of facilities, eg toilets, bridges, signposts
- Obstruction of tracks by regrowth vegetation and fallen debris

E1.4 Other biophysical impacts

- Introduction and spread of exotic species and pathogens such as *Phytophthora cinnamomi*
- Pollution eg of soils and surface water near campsites
- Physical damage to cultural sites, eg Aboriginal midden sites
- Litter
- Disturbance to drainage patterns
- Siltation and associated changes in flow patterns (eg susceptibility to flash flooding in streams silted by sheet erosion caused by escaped fires)
- Disturbance to fauna, eg disturbance to nesting or feeding sites, taming of animals at campsites, impacts of trampling, erosion and pollution on soil and aquatic flora.
- Vandalism, eg carved graffiti on trees or rocks.

E2 Social impacts

- Encounters between similar users/groups
- Encounters between different types of users, eg encounters between bushwalkers and hunters
- Perceived crowding, loss of opportunities for solitude
- Noise and visual intrusion of use, eg visual impact of coloured tents
- Impact of management on users, eg restrictions on access and length of stay, policing of permits

E3 Impacts on cultural, aesthetic and recreational values

- Aesthetic impact of biophysical changes, eg visual scarring, loss of appearance of naturalness
- Cultural impact of damage to unique or outstanding natural features
- Change in ease of use of tracks
- Change (usually decrease) in opportunity for challenge and adventure
- Change (usually decrease) in wilderness values, ie loss of naturalness and remoteness
- Zonal creep
- Increased hazards to user safety, eg loss of handholds on cliffs
- Hazards to user health resulting from pollution of drinking water, contamination of food by flies etc

- Loss of sense of mystery due to publicity of wilderness areas. (Note: includes publicity of routeguides and descriptions of trips in wilderness areas, naming of wilderness features and inclusion of wilderness areas on large-scale maps)

F Inventory of management options

The following is an inventory of management strategies which may be considered as options for the management of walking tracks and non-mechanised wilderness recreation in the WHA. This inventory has been compiled from various sources including papers by Cole, Petersen & Lucas (1987), Manning (1979b) and Graefe, Vaske & Kuss (1983). Cole *et al* provide a comprehensive list of strategies with notes on the pros and cons of each, a list of which problems are addressed by which strategy, and references to publications citing examples of applications of particular strategies where such publications exist. Manning lists management strategies hierarchically and emphasises that a wide variety of management options exist - for example the choice is not simply between hardening surfaces or reducing usage.

In the context of this inventory the term "primary strategies" is used to refer to management strategies likely to have a direct effect on the extent, severity or rate of change of recreational impacts (eg reducing usage). The term "secondary strategies" refers to ways in which primary strategies can be achieved (eg access restrictions, education).

Strategies listed are accompanied by a statement about the current and/or proposed status of the strategy in question in the context of managing recreational impacts in the WHA. Where relevant the likely effectiveness and/or limitations of the strategy in question are also noted.

F1 Primary strategies

(i) Increase supply of recreational resource

(a) Extend the area of the WHA

The Parks & Wildlife Service is required to make recommendations to the Tasmanian government concerning suitable extensions to the state's national park system, and has released a report canvassing potential extensions to the WHA (Department of Parks, Wildlife & Heritage 1990d). It is beyond the scope of this report to make recommendations concerning extensions to the WHA. However it should be noted that developments outside the WHA, particularly those involving road construction, may degrade wilderness values and substantially alter recreational opportunities in some areas within the WHA (see the *WHA Management Plan* section 6.6)

(b) Increase the wilderness resource by closing and rehabilitating roads and other major intrusions

The closure of some vehicular tracks is proposed in the *World Heritage Area Management Plan* (Department of Parks, Wildlife & Heritage 1992).

(c) Provide and promote recreational tracks and destinations outside the WHA

Further investigation of this option is proposed in this report - see 9.7 (vii).

(d) Develop new tracks or campsites in the WHA

Appendix A1 includes proposals for investigating further track development in the WHA, although the developments in question are usually seen as a low priority given the urgency and scale of the task of managing impacts on the existing track system.

Appendix A1 also includes proposals for the development of new campsites in some areas (eg at Wild Dog Creek in the Walls of Jerusalem area).

(ii) Modify use

(a) Dispersal

- **In time, eg redirect a proportion of summer usage to shoulder season; restrict number of walkers who start out on a given day.**

  Restricting daily numbers can alleviate "pile-ups" at campsites, especially those caused by hold-ups due to bad weather (Sawyer 1993).

- **In place:**

- **Within the WHA, eg redirect some usage in alpine areas to lowland areas, encourage walkers to fan out**

  Distribution of usage will be determined largely by the proposed track classification scheme (see 9.4). Fanning out will be encouraged in many areas, subject to the findings of monitoring and research into the effectiveness of a fan-out policy (see 9.11 (iii) (b), 9.13 (ii) (a) and 9.13 (iv)).

- **To other areas, eg encourage some tourists to do a cycle tour of the east coast**

  See 9.7 (vii).

- **Limit party size**

  Social-impact research consistently indicates that large parties result in higher levels of social impacts than dispersed smaller parties. There is also evidence that large parties have greater per-capita impact on campsites than smaller parties, particularly in terms of increasing campsite area (Holmes & Dobson 1976). Recommended party size limits are included in the track classification scheme (see 9.4 and 10).

(b) Segregation

- **In time, ie allow some types of usage (eg fishing, large parties) at particular times of year only**

  The fishing season is restricted by licence conditions. No other such restrictions for nonmechanised recreation are currently in force and none are recommended in this report.

- **In place, ie confine some types of use to particular areas, eg by zoning**

  The existing zoning scheme effectively segregates different types of recreational activities, for example by confining facilities such as major bridges to Recreation Zones and excluding them from Self-Reliant Recreation Zones and Wilderness Zones. In a similar way the proposed track classification scheme (see 9.4 and 10) would segregate different types of usage by creating a hierarchy of recreational opportunities within the track system. Inexperienced walkers will be encouraged to walk on relatively high-grade and high-use tracks - see 9.11 (i): (j) and (k).

(c) Concentrate use

Examples:

- **Encourage/require walkers to stay on formed tracks and campsites or on relatively stable vegetation/terrain**

  Walkers are already encouraged (eg by the MIB pamphlet) to stay on formed tracks and to camp on stable sites.

- **Encourage/require walkers to follow a track in one direction only**

  Implementation of the guidelines of the track classification scheme will restrict social impacts on some tracks by minimising the average number of daily encounters with other parties. It may also be necessary to encourage walkers to walk in one direction to minimise the spread of *Phytophthora cinnamomi* in some areas (see B4.13 (iv)).
  Existing routeguides and map notes already encourage walkers to follow some tracks in a particular direction, eg to walk the Overland Track from Cradle Mountain to Lake St Clair. Further encouragement of this nature may be required but no specific recommendations are made at this stage.

(d) Modify user behaviour

Examples:

- **Discourage/ban campfires**

  Campfires are already banned in many parts of the WHA and their use is discouraged throughout the WHA. Extensions to existing Fuel Stove Only Areas are proposed (see 9.14).

- **Other MIB rules**

  Some additions to the existing MIB rules are proposed - see 9.11 (iii).

(e) Ban some types of activity

- **Eg ban horseriding**

  Horseriding is permitted only in designated areas within the Central Plateau Protected Area.

(iii) Reduce/limit use

In areas where trampling occurs away from formed tracks, usage restrictions may be necessary to prevent the unplanned formation of pads and tracks, the development of tracks from existing pads and other forms of biophysical damage.

On existing tracks and campsites usage restrictions may be necessary to slow the rate of track deterioration or maintain impacts at a stable level (subject to occasional maintenance). Alternatively they may be required to limit social impacts which may otherwise degrade the recreational opportunity and lead to recreational displacement.

(a) In place

- **Entire WHA**

  No overall usage limit is proposed for the WHA although usage restrictions for particular tracks and areas may effectively impose an overall limit for all parts of the WHA inaccessible by mechanised transport.

- **Particular tracks and areas**

  The proposed track classification scheme sets guidelines for annual usage on each category of track and route in the WHA (see 9.4 and 10). However usage limits will generally have to be determined on a case by case basis (see 9.7 (ii)).

(b) In time

- **Entire year**

- **Particular times, eg on weekends, during summer months**

  See 9.7 (ii).

(c) Limit length of stay:

- **In WHA**

- **In particular areas**

- **On/at particular tracks, routes, campsites**

  Restrictions on overall length of stay, either in the WHA or within specified areas, are generally not recommended for the reasons given in 9.7 (iii). However such restrictions may be necessary in some heavily used areas and limits may have to be set for the number of nights walkers are allowed to stay at some campsites - see 9.7 (ii).

(d) Restrict itineraries

Generally not recommended for the reason given in 9.7 (iv). However some exceptions may be necessary, and restrictions on length of stay in particular areas and at particular campsites will have the effect of imposing some restrictions on overall itinerary.

(e) Close particular areas, tracks, routes or campsites, either temporarily or permanently.

Some tracks are proposed for closure in appendix A1.
In general temporary closures are not recommended because of fast rates of deterioration and slow recovery times of vegetation and soils. However it is recommended that some tracks be closed and the routes in question reopened with “route” status.

(iv) Modify user expectations

- **Eg promote Overland Track as a place for “bush socialising”**

  Proposed - see 9.11 (i): (j).

(v) Relocate/stabilise tracks, pads and campsites

Substantial track stabilisation and some rerouting has already been undertaken in the WHA (see 1.1.4, 7.2 and 7.3). This report proposes a program of stabilisation and/or rerouting for tracks throughout the WHA (see appendix A1) consistent with the track classification scheme (section 10).

F2 Secondary strategies

(i) Education/publicity

(a) Encourage/discourage specific types and patterns of use:

- **WHA wide, eg don't cut switchbacks**

  Existing MIB code contains a range of rules applicable to all areas.

- **In specific areas, eg avoid trampling on dunes**

  Some rules in the existing MIB code apply to specific areas, eg no campfires in alpine areas. This report proposes expanding the MIB code by adding several rules applicable throughout the WHA (see 9.11 (iii)), and publishing user notes with rules applicable to local conditions (see 9.11 (ii)).

(b) Modify content of and user demand for routeguides

Proposed - see 9.12.

(c) Explain need for management measures such as usage restrictions

Proposed - see 9.11 (i) (c).

(ii) Regulations

(a) Mandatory permits: restrictions on user numbers, length of stay, itinerary

The introduction of a mandatory permit system is proposed - see 9.6. Restrictions on user numbers are recommended (9.7) and are implicit in the track classification scheme (9.4 and 10). It is recommended that restrictions on itinerary and overall length of stay be avoided wherever possible (9.7 (iii) and (iv)).

(b) Fees:

- **Uniform, eg $10 per day anywhere in WHA**

  This report makes no recommendation concerning fees because the question of raising revenue for management of the WHA is beyond the scope of this report. Fees for entry into national parks in Tasmania were introduced in 1993.

- **Differential, eg higher fees in Dec-Feb period.**

  Not recommended at present.

(c) Require certain skills or equipment for entry into some areas or use of some grades of track/route.

This option has been avoided to date because of the problem of policing restrictions and the legal ramifications if users who are allowed entry subsequently get into difficulties. This report recommends that more effort be made to educate visitors about the sort of equipment and the levels of experience and fitness that are required for trips on the various classifications of tracks and routes in the WHA (see 9.11 (i): (j)).

(d) Ban some items of equipment, eg axes and machetes

Proposed - see 9.16.

(e) Ban some types of activity eg unauthorised track cutting

Unauthorised track cutting and track marking, including building cairns and blazing trees, are already prohibited in the WHA.
It is proposed that this fact be publicised with greater emphasis (9.11 (iii) (a)).

(iii) Modify ease of access

(a) Increase remoteness, eg:

- **close and rehabilitate roads**

The closure of several roads and vehicular tracks is recommended in the *1991 Draft Management Plan.*

- **ban or limit vehicular access**

Management specifications for vehicular access in the WHA is broadly defined by the zoning scheme in the *1991 Draft Management Plan.*

- **allow some sections of track to become overgrown or muddy**

In some cases the Service's policy of allowing tracks to remain in a muddy or overgrown condition has been and will be based not only on the lack of resources required to improve them and on the fact that from an ecological point of view the improvement of such tracks must be seen as a low priority, but also on the fact that the condition of these tracks serves as a deterrent to some inexperienced walkers and consequently tends to limit visitation to sensitive areas, trackless areas or areas of high wilderness value. In addition the "poor" condition of some tracks may be regarded as a contributing factor to the recreational experience of walking on those tracks - eg few walkers would insist on being able to traverse the Western Arthurs without encountering moderate scrub on some sections.
This report endorses the policy of allowing some tracks to become muddy providing the resulting track conditions are compatible with relevant the track classification and providing the tracks in question do not wash out and erode in the long term (see 10.2.1 (iii)).
The track classification scheme includes the specification that higher grade tracks be kept largely free of scrub but that scrub clearance on low-grade tracks and routes be minimal.

(b) Improve access to alternative areas within or outside the WHA.

No new construction of roads or vehicle tracks is recommended, but the construction and upgrading of walking tracks will effectively improve access to some areas. Recommendations for such development within the WHA are included in appendix A1.

(iv) Modify facilities

(a) Install facilities, eg huts and bridges

Specifications for facilities are included in the track classification scheme (section 10). The installation of washdown points may be necessary to reduce the spread of *Phytophthora cinnamomi* (see 9.9 (xi)).

(b) Establish new tracks and campsites

Proposals concerning the construction of new tracks and campsites are included in appendix A1.

(c) Allow some tracks to deteriorate as a deterrent to use

See (iii) (a) above.

(d) Remove facilities

Specifications for facilities are included in the track classification scheme (section 10).

(e) Make better use of existing facilities, eg relocate and/or upgrade tracks, redesign huts

This report proposes relocating tracks where appropriate to improve track stability and/or enhance opportunities for rewarding recreational experiences (see 9.2 and 9.8).

F3 Management options for specific problems and impacts

In this section the strategies listed in F1 and F2 are re-ordered by matching them to specific management problems and impacts. Only those problems and impacts which relate to walking tracks or non-mechanised wilderness recreation, and which are currently prevalent in the WHA, are listed in this section. Impacts are indicated in italics and comments are included where relevant.

(i) Deterioration of existing tracks, pads and campsites

(a) Modify usage

- **Reduce annual usage, eg restrict issue of permits, encourage use of alternative areas, close tracks or areas.**
  On existing tracks and campsites usage restrictions may be necessary to slow the rate of track deterioration or maintain impacts at a stable level (with occasional maintenance).
- **Redistribute use in time**
  May reduce severity of impact in some circumstances, eg temporary closure or prevention of heavy use in peak season may assist vegetation survival and recovery.
- **Change type of use, eg:**
  - **Encourage day-use of track only**
    May reducing impacts due to carrying of packs.
  - **Encourage walkers to walk along centre of track**
  - **Ban campfires**
  - **Ban horseriding**
  - **Ban vehicular access**
- **Limit party size**
  May prevent spread of campsites.
- **Temporary closure**
  Unlikely to be effective in the WHA due to slow rehabilitation rates.
- **Permanent closure**

(b) Other strategies

- **Stabilise/harden track or site**
  Note: includes installation of bridges to prevent streambank erosion and installation of huts to avoid campsite impacts.

- **Relocate track or site**

(ii) ***Formation of new tracks, pads and campsites***

(a) Modify usage

- **Encourage fan-out policy in trackless areas**

  Can be effective only in areas where dispersed usage levels remain below the thresholds at which irreversible vegetation damage and pad formation will occur.

- **Concentrate usage on existing tracks, pads and campsites or on relatively stable vegetation/terrain**

- **Reduce overall usage below level at which new pads or campsites will form**

- **Redistribute use in time**

  May reduce impacts on some types of vegetation or terrain.

- **Limit party size**

  May minimise formation of new pads and campsites.

- **Limit length of stay in some areas or at particular sites**
- **Ban unauthorised track marking**
- **Discourage or ban carrying of axes, machetes and saws**
- **Discourage/ban campfires and other high-impact camping activities**
- **Ban horseriding and use of vehicles**
- **Prohibit access to some areas**

(b) Other strategies

- **Discourage publicity of some routes and areas including in routeguides**
- **Pre-empt formation of pad or campsite by marking new pad or establishing new campsite in optimum location**
- **Remove facilities eg huts**

(iii) Damage to vegetation and soils (other than that caused by trampling and camping)

- **Discourage/ban disturbance of vegetation**
- **Discourage or ban campfires**
- **Ban unauthorised track marking**
- **Discourage or ban carrying of axes, machetes and saws.**

(iv) Pollution/introduction of exotic species and pathogens

- **Reduce/redistribute use**
- **Modify user practices, eg discourage use of soap**
- **Encourage walkers to wash boots, tent-pegs etc where practical**
- **Install facilities, eg toilets, water supply pipe, washdown points**

(v) Crowding

- **Reduce usage overall**

  May be either unnecessary or ineffective - see B2.3.2.

- **Segregate usage**

  In particular, encourage inexperienced walkers to visit high-use areas since such walkers tend to be less concerned about encounters with other users.

- **Redistribute use in space/time**
- **Modify user behaviour, eg discourage noise at campsites, discourage use of brightly coloured tents.**
- **Limit party size**
- **Encourage/require use of track in one direction only**
- **Increase number of tracks and campsites**
- **Encourage fan-out policy in trackless areas**
- **Segregate different types of user, eg confine large parties to particular times or places**
- **Restrict itineraries**
- **Modify user expectations**

G Track management plans

Note:
For notes on the format of track management plans see 9.18.

G1 Amendments and additions to existing plans

Notes:

(a) The purpose of this section is to indicate additional areas, tracks and routes to be incorporated in existing track management plans.

(b) As stated in section 9.18, existing (draft) track management plans should be revised so as to:

- conform to the format indicated in 9.18;
- assess management options and recommend management strategies consistent with the track classification scheme and the track classifications listed in section 11; and
- incorporate the proposed management actions listed in appendix A1.

(c) The management prescriptions contained in existing plans to be updated as a matter of **high priority**.

G1.1 Southwest Cape Plan

Include the Bathurst Channel region and specifically the track on Balmoral Hill.

G1.2 Port Davey Track Plan

Include Mt Rugby.

G1.3 South Coast Track Plan

Include sidetracks to Louisa Bay, summit of Ironbound Range, Rocky Boat Inlet and Osmiridium Beach.

G1.4 Anne Range

Include Schnells Ridge.

G1.5 Frenchmans Cap Track Plan

Include the North Col - Irenabyss route, Irenabyss - Raglan Range route, Raglan Range tracks, Irenabyss loop track (proposed), the Jane River Track and the Fincham Track.

G1.6 Overland Track Plan

No additions required.

G1.7 Overland Track side-tracks plan

Include pad west of Little Hugel, Walled Mountain Track and the track from Du Cane Gap to the Traveller Range.

G1.8 Cradle Mountain daywalks plan

No additions required.

G1.9 Walls of Jerusalem

Include all tracks and routes within the Walls of Jerusalem National Park.

The plan should also include specific recommendations for the management of trackless areas in the National Park.

G2 Additional track management plans required

Notes:

(a) It is recommended that track management plans be prepared for the following regions (items G2.1-G2.11) encompassing the areas, tracks and routes indicated. As stated in 9.18 a track management plan encompassing a particular region (as opposed to a plan for a single track like the Overland Track) should contain a resource/management assessment for the entire region, not just for existing tracks within that region.

(b) Areas and tracks partially or wholly under the jurisdiction of other management agencies are indicated by the symbols (¥) and ¥ respectively. Track management plans for these areas and tracks should be prepared in collaboration with the agencies in question.

(c) All plans to be produced as a matter of high priority except where indicated.

(d) The management of areas not yet covered by track management plans should conform to the recommendations of the WHA Track Strategy until regional track management plans are prepared.

G2.1 Southern Ranges

Area:

Southern Ranges.

Tracks and routes (all under or mostly under P&W jurisdiction):

Lune River - Pindars Pk

Hippo

Hill 4 - Reservoir Lakes

Pigsty Ponds - Reservoir Lakes

Arndell Falls

Mt La Perouse

Pindars Pk - Precipitous Bluff

Precipitous Bluff summit track

Prion Beach - Precipitous Bluff

G2.2 Adamsons-Esperance-Hartz

Areas:

Adamsons Peak, Hartz Mountains and eastern slopes of the Adamsons-Esperance-Hartz range.

Tracks and routes under or mostly under P&W jurisdiction:

Hastings Cave Track

Hot Springs NT

(¥) Adamsons Peak Track

Waratah Lookout

Keoghs Pimple

Arve Falls

Lake Osborne Track

Lake Osborne - Devils Backbone lookout (proposed)

Hartz Peak Track

Hartz Lake

(¥) Kermandie Track (aka Hartz Track)

Hartz Pk - Adamsons Pk

Other tracks and routes

¥ Adamsons Falls-Creekton Falls-Duck Hole Lake circuit:

Adamsons Falls Track

- Duck Hole Lake Track
- Adamsons Falls to Duck Hole Lake via Creekton Falls

G2.3 Picton-Huon (medium priority)

Areas:

Picton & Bobs ranges (excluding Farmhouse Creek - Eastern Arthurs Track), Huon Valley, Picton Valley.

Tracks and routes under or mostly under P&W jurisdiction:

Lake Sydney Track

(¥) Huon Track

Mt Picton (from Blakes Opening)

(¥) Mt Picton (from Picton forestry roads)

South Pictons

Wargata Mina (from E. Arthurs Track)

Other tracks and routes

¥ Picton River (below Farmhouse Ck)

¥ Huon River (below Tahune bridge)

G2.4 Arthur Ranges

Areas:

Western and Eastern Arthurs.

Tracks and routes (all under P&W jurisdiction):

Western Arthurs traverse (Moraine A - Lk Rosanne Tk)

Moraine E

Moraine K

Eastern Arthurs traverse (Farmhouse Ck - Cracroft Crossing)

Hanging Lake Track

Rock Chute/Forest Chute

Note: As a matter of very high priority, a plan to be produced assessing management options for short-term stabilisation works. As a high priority, a more detailed plan to be prepared containing a detailed assessment of options for rerouting and/or stabilising tracks in these areas.

G2.5 Lower Weld-Snowys (medium priority)

Areas:
Lower Weld Valley, Mt Weld, Snowy Range (excluding Snowy North).

Tracks and routes under or mostly under P&W jurisdiction:
Mt Weld Track

Riverside track (up Weld River)

Cavers tracks (lower Weld)

(¥) Lake Skinner Track

Lk Skinner - Snowy South

(¥) Nevada Peak track (to scrubline)

Woolleys Tarn route

Nevada Peak traverse

Other tracks and routes
¥ Dozer track (lower Weld)

G2.6 Gordon River Road-Scotts Pk Road

Areas:
Environs of Gordon River and Scotts Peak Roads excluding Anne Range, Arthur Ranges, Timbs Track and Rasselas Track. Includes upper Weld Valley and Snowy North.

Tracks and routes under or mostly under P&W jurisdiction:
Needles track

(¥) Adamsfield Track

Creepy Crawly NT

Sentinels

Old Lake Pedder Track

Weld arch route

Mt Mueller track

Old Port Davey Track

Mt Bowes from Old Port Davey Track

(¥) Snowy North track

Mt Sprent track

Franklands traverse (Frankland Pk - Mt Sprent)

Eastern ascent of Hamilton Range

Splits Track

Truchanas Pine Reserve route

Other tracks and routes
¥ Tim Shea track

¥ Boyd NT

¥ Wedge NT

¥ Mt Wedge track

G2.7 Rasselas-Denisons-Spires-Upper Gordon

Areas:
Rasselas Valley, Gordon Range, Thumbs, Mt Wright, Stepped Hills, Clear Hill, Denison Range, Mt Curly-Spires region, Denison River, Prince of Wales Range, King William Range, Wylds Craig, Wayatinah Tall Trees area, Mt Hobhouse, Beech Creek-Counsel River area.

Tracks and routes under or mostly under P&W jurisdiction:
Rasselas Track (to Lk Rhona)

Gordon Range access routes

Thumbs

Mt Wright

Bombadier trail to Gordon Gorge

Lk Rhona - Reeds Pk

Denison Range - Lk Curly

Lk Curly - Spires

Spires traverse

Outlet creek of Font - crest of Spires

Spires - Gell River

(¥) Wylds Craig track

Darkes Pk

Mt King William 1 track

Other tracks and routes in King Williams

(¥) Gell River dozer track

Wayatinah Tall Trees track (proposed)

Other tracks and routes
¥ Timbs Track (to Florentine R)

G2.8 Lyell Highway – West Coast (medium priority)

Areas:
Areas adjacent to the Lyell Highway (except the Frenchmans-Raglans area) and accessible from the Queenstown-Strahan area.

Tracks and routes (all under or mostly under P&W jurisdiction):
Franklin River NT

Alma-Collingwood junction track

Nelson Falls NT*

Donaghys Hill NT

Donaghys Hill - Franklin/C'wood junction

Perched Lake

Eagle Creek Track

Sir John Falls walkway

Angel Cliffs track

Heritage Landing Track

Sarah Island

Darwin Crater Track

Kelly Basin Track

Mt McCall Rd south of Bird River turnoff

Franklin River

Collingwood River (Lyell Highway - Franklin junction)

Lower Gordon River (below Seal Rapid)

Eldons traverse (Eldon River - Pidgeon House Hill)

*Note: The Nelson Falls nature trail lies outside the WHA on unallocated crown land, but has traditionally been managed by the Parks & Wildlife Service.

G2.9 Plateau-Tiers Pt 1

Areas:

Western Tiers between Little Fisher Valley and Mother Cummings Peak; Central Plateau northwest of a line between Ironstone Mt and Mt Jerusalem.

Tracks and routes under or mostly under P&W jurisdiction:

Western Bluff track

Devils Gullet lookout track

Blue Peaks Track

Explorer Creek Track

Yeates Track (on plateau)

Parsons Track (on plateau)

Marakoopa Forest Walk

Marakoopa karst walk (proposed)

Higgs Track (ascent)

Ritters Track (Lk Nameless - Lk Fanny)

Zion Gate - Lake Fanny (SE end)

Syds Track (on plateau)

Mother Cummings Peak (nthn peak from Westrope Rd) - traverse to summit.

Other tracks and routes

¥ Yeates Track (ascent)

¥ Parsons Track (ascent)

¥ Sentinel Rock Track

¥ Hills Hut to plateau

¥ Higgs Track (traverse of plateau to Lake Nameless)

¥ Western Creek Track

¥ Syds Track (ascent)

¥ Mother Cummings Peak (nthn peak from Westrope Rd) - ascent

¥ Scotts Track (Mother Cummings Peak from Scotts Rd)

G2.10 Plateau-Tiers Pt 2

Areas:
Western Tiers between Mother Cummings Peak and Drys Bluff (including Meander and Liffey Forest Reserves), and adjacent strip of Central Plateau.

Tracks and routes under or mostly under P&W jurisdiction:
Meander Falls to Lk Meander (traverse of plateau)

Pine Lake vehicular track

Pine Lake nature trail

Liffey Falls (from top picnic area)

Other tracks and routes
¥ Mother Cummings Peak (from M.C. Rivt)

¥ Mt Ironstone (Smoko Ck) Track

¥ Dell Track

¥ Bastion Bluff Track

¥ Stone Hut Track

¥ Bastion Cascades Track

¥ Croft Track

¥ Split Rock Track

¥ Meander Falls Track

¥ Meander Falls to Lk Meander (ascent)

¥ 900 metre contour track (proposed)

¥ Dixons Track

¥ Meander Picnic Ground Nature Trail

¥ Staggs Track

¥ Johnstone's Track

¥ Old Powerline Track

¥ Warners Track

¥ Projection Bluff Track

¥ Liffey River Track

¥ Liffey Bluff Track

¥ Liffey Falls to lower picnic area

¥ Drys Bluff Track

G2.11 Plateau-Tiers Pt 3

Areas:
Eastern and southern areas of the Central Plateau west of the Lake Highway.

Tracks and routes (all under or mostly under P&W jurisdiction):
Pillans Lakes / Lake Field vehicular track

Lake Fanny VT

Lake Antimony track

Pine River VT

Olive Lagoon VT

Lake Ina VT

Travellers Rest Lagoon VT

Clarence Lagoon VT

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