NSW National Parks & Wildlife Service
Office of Environment & Heritage

# Horse Riding in Wilderness Trial Monitoring Program

## Final report

**Cover photograph:**

Horse riding in Kosciuszko National Park (Photo: S Vivers/ OEH)

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# Executive summary

The two-year horse riding in wilderness trial commenced in 2014, allowing horse riding on five designated tracks and trails in wilderness areas across NSW.

To ensure that wilderness values were adequately protected from potential impacts during the horse riding trial, a monitoring program was developed to detect and mitigate impacts to the key values of these areas.

Independent experts from the University of Melbourne facilitated a process in which stakeholders, scientific experts and operational staff worked together to develop the overarching monitoring framework to be applied to the trial.

To develop the specific monitoring plan for each track and trail the University of Melbourne also led local workshops attended by stakeholders, scientific and operational experts. These workshops identified the indicators to be monitored on each track and trail, the parameters to be measured and the thresholds to be set that would trigger management interventions to ensure the wilderness values were not irreversibly compromised during the trial.

In summary, there were very few horse riders utilising the tracks and trails during the trial. The majority of agreed thresholds were rarely exceeded, all exceedances were referred to management to consider whether interventions were needed and management interventions were successful when enacted.

The primary objective of the monitoring program, to protect wilderness values from being irreversibly compromised during the horse riding trial, was met. Monitoring of the social impacts of horse riding did not disclose significant issues in terms of numbers of complaints or negative interactions between horse riders and other users of tracks and trails.

Monitoring revealed a variety of authorised and unauthorised users on the subject tracks and trails. Apart from horse riders, other authorised users included bushwalkers, cyclists, management vehicles and management personnel.

Unauthorised users were mostly people on motorbikes. Evidence of feral animals using tracks and trails was also observed. Unauthorised users and feral animals, or a combination of these, may also contribute to changing track condition and may impact on wilderness values.

This trial was not able to predict the potential impact prolonged use of tracks and trails by horse riders or an increase in horse rider numbers might have on wilderness values. Some tracks and trails monitored in this trial are routinely used for management purposes. These tracks and trails may regularly be regraded to maintain accessibility. Doing so may affect some parameters measured in this trial and consequently, if horse riding in wilderness continues, it will not be possible to model long-term trends of these indicators over time as they will regularly be restored to reference condition.

If horse riding is to continue on **current** tracks and trails, the following recommendations should be considered:

1. The data from this trial should be aggregated to become the new baseline for comparison to future monitoring.
2. The current approach should be adapted to focus on measures that are most meaningful, consistent and readily measured. For example, track/trail usage monitoring should continue and potentially be expanded to include more cameras or more frequent usage data collection.
3. Social impact monitoring should continue and focus on on-track/trail interactions.
4. Usage thresholds, if required, should be defined, with reference to technical advisors and stakeholders, as appropriate.

5. More intensive monitoring and potentially usage restrictions should be capable of being activated if defined usage thresholds are exceeded.
6. Monitoring data should continue to be made available to the public on a regular basis.
7. Monitoring results and analysis should be peer reviewed triennially.

If horse riding is to be considered on **additiona**l tracks and trails in wilderness, the following recommendations should be considered:

1. Utilise and adapt the current adaptive management monitoring framework, including identifying park specific values and impacts. Values may be garnered from plans of management, stakeholders, technical experts, area staff and others, and are likely to be driven by local considerations such as cultural assets and environmental systems.
2. Baseline data about key values and attributes at each track or trail should be gathered well before horse riding commences and when seasonal conditions are optimal to do so. This should include a basic weeds survey that is repeated at appropriate and meaningful intervals.
3. Monitoring indicators, usage thresholds and management interventions should be defined with reference to relevant technical advisors and stakeholders, as appropriate.
4. Track/trail usage and impact monitoring should maximise the use of cameras and photo points and include a minimum set of quantitative attributes that are best monitored using this approach.
5. Social impact monitoring should be included and focus on on-track/trail interactions.
6. More intensive monitoring and potentially usage restrictions should be capable of being activated if defined thresholds are exceeded without an effective or timely mitigation response.
7. Monitoring data should be made available to the public on a regular basis.
8. Monitoring results and analysis should be peer reviewed triennially.

If horse riding in wilderness is to continue, the monitoring methods and framework should be reviewed periodically as data becomes available, to ensure the approach continues to be pragmatic and fit for purpose.

# 1. Introduction

## 1.1 Background

In November 2012 the NSW Government released the *Strategic directions for horse riding in NSW national parks* (OEH 2012), which committed to providing horse riding opportunities in parks, including the implementation of a two-year trial of horse riding in wilderness.

The Horse Riding in Wilderness Trial Monitoring Program was developed to monitor the horse riding trial and protect the key natural, cultural and social values associated with the wilderness areas. A *Monitoring framework for wilderness horse riding trial* (OEH 2015a) was prepared which detailed the aims of the monitoring and the process that would be undertaken. It adopted an adaptive approach, specifying management interventions to bring any detected impacts to within acceptable limits. Horse riding commenced in April 2014 at five of the six nominated trial locations.

## 1.2 Objectives

The monitoring program was designed to monitor and manage the tracks and trails involved in the trial so that their wilderness values were not compromised.

The aims of the monitoring program were to:

- detect impacts that may occur to key values as a result of horse riding on the pilot wilderness tracks/trails within the two year trial period
- define thresholds for implementing management interventions to protect key values from irreversible damage and inform park managers of any threshold triggers
- detect whether interventions are successful in ensuring key values are protected from irreversible damage and inform when interventions should cease.

The key considerations guiding design development were:

1. the ability to **adequately detect change** including ensuring that techniques were:
   a. ***targeted*** to the value and to the activity being monitored
   b. ***sensitive*** enough to detect impacts within the timeframe of the trial
2. that the design is at the **appropriate scale**
3. that it is **flexible** enough to respond to unanticipated usage or impacts.

## 1.3 Scope

The monitoring was committed to managing the horse riding trials using an adaptive management approach (Section 2.1). The trial was not designed to identify what impacts are associated with horse riding in natural landscapes as these have been well documented (Newsome et al. 2008, Pickering 2008). Rather, it was designed to detect and manage impacts to prevent the degradation of wilderness values throughout the horse riding trial.

Comparisons cannot be made between locations, as each varies greatly in its environmental characteristics. Further, while future monitoring may benefit from the lessons learnt in this program, the trial should not be used to draw direct comparisons with other locations, which are also likely to vary greatly in environmental characteristics and values. The merits of pairing treatment sites with control sites (on wilderness tracks/trails with no horse riding) was considered, but was deemed unfeasible due to limited options for suitable paired sites. Consequently, changes associated with the introduction of horse riding were gauged by comparison to a baseline dataset. The baseline data was collected before the trial began and gives an indication of the sum impacts of users and management activities prior to the introduction of horse riding.

## 1.4 Trial locations

Horse riding wilderness trials were nominated at six locations across NSW (Figure 1 and Appendix 4). Horse riding commenced in April 2014 at all locations except Curracabundi National Park (Curracabundi Wilderness Area). The track/trails nominated were unique and varied with regard to management history, track/trail surface and environmental and cultural values.

The following terms to refer to these locations are used throughout this report (a glossary is also provided in Section 7):

**Location** – a wilderness area containing multiple trails and/or tracks

**Site** – a position along a track/trail at which monitoring occurs

**Track** – an unmaintained, narrow, walking sized pathway that may be indistinct in places and is not traversable by vehicle

**Trail** – a maintained dirt or gravel road, traversable in a four wheel drive vehicle, e.g. a fire trail.

**1. Mummel Gulf National Park (Mummel Gulf Wilderness Area)**

The trial area covers approximately 11 kilometres of well-maintained fire trails along Dicks Hut Fire Trail and River Road. These traverse the declared Mummel Gulf Wilderness Area and access is via the Oxley Highway east of Walcha and Enfield Road (part of the Bicentennial National Trail). Dicks Hut Fire Trail is locked to vehicles. It runs for about 7.5 kilometres from around 1200 metres above sea level (asl) at either end, to 650 metres asl at the Mummel River in the middle. The trail crosses the Mummel River three times, in addition to some tributary crossings. River Road is not locked to traffic. It runs from about 1100 metres asl in the north-east to about 680 metres asl in the south-west for approximately 3.5 kilometres across wilderness to the Mummel River. Horse riders are limited to group sizes of 20 and are not permitted to camp in the wilderness area.

**2. Kosciuszko National Park (Pilot Wilderness Area)**

The trails available for horse riding in wilderness in Kosciuszko National Park are the Nine Mile Trail and Ingeegoodbee Trail. These traverse the Pilot Wilderness Area and access to them is via the Barry Way, about 62 kilometres south of Jindabyne. The trial area covers approximately 30 kilometres of management trails and includes a number of waterway crossings. The Nine Mile is a steep trail that rises from around 300 to 1200 metres above sea level. There are two historic huts along these trails and informal camping is permitted at three locations but these camp locations were not specified until after the commencement of the trial period. Horse riding is not permitted between the June long weekend and the October long weekend each year. Horse riders are limited to group sizes of eight. This area also has a population of wild horses.

**3. Deua National Park (Buckenbowra, Burra–Oulla and Woila–Deua wilderness areas)**

The three tracks involved in the horse riding trial are the WD Tarlinton, Georges Pack and Shoebridge tracks in Deua National Park. These traverse the Woila–Deua, Burra–Oulla and Buckenbowra wilderness areas.

Tracks in Deua National Park are not traversable by vehicle. They are unmaintained, narrow walking sized tracks and are indistinct in places. Group sizes are limited to 20 horses. No camping is permitted on the wilderness tracks as part of this trial. The three tracks to be monitored (Georges Pack Track, WD Tarlinton Track and Shoebridge Track) are collectively referred to as the Far South Coast Tracks.

*3a. Georges Pack Track*

The Burra–Oulla Wilderness Area of Georges Pack Track is approximately 10 kilometres that traverses a gully between two ridgetops. It follows Coondella Creek for approximately three kilometres, with a section where riders will likely traverse along the stream bed. It also crosses the Diamond Creek in addition to minor tributaries. Parts of this track are indistinct.

*3b. WD Tarlinton Track*

WD Tarlinton Track runs north–south for approximately 20 kilometres through the Woila–Deua Wilderness Area and crosses several creeks and tributaries. Parts of this track are indistinct.

*3c. Shoebridge Track*

The Buckenbowra Wilderness Area of the Shoebridge Track is approximately 6 kilometres of a longer track, which traverses several national parks and private property.

**4. Curracabundi National Park (Curracabundi Wilderness Area)**

The inclusion of Curracabundi National Park (Curracabundi Wilderness Area) in the horse riding trial has been delayed, primarily due to access issues and legislative constraints in the park's plan of management. The trail includes the Bicentennial Track and an unnamed trail. Baseline data has been collected for this location but there have been no workshops undertaken or thresholds allocated. No horse riding or monitoring has occurred at this location to date and consequently it will not be discussed at length in this report.

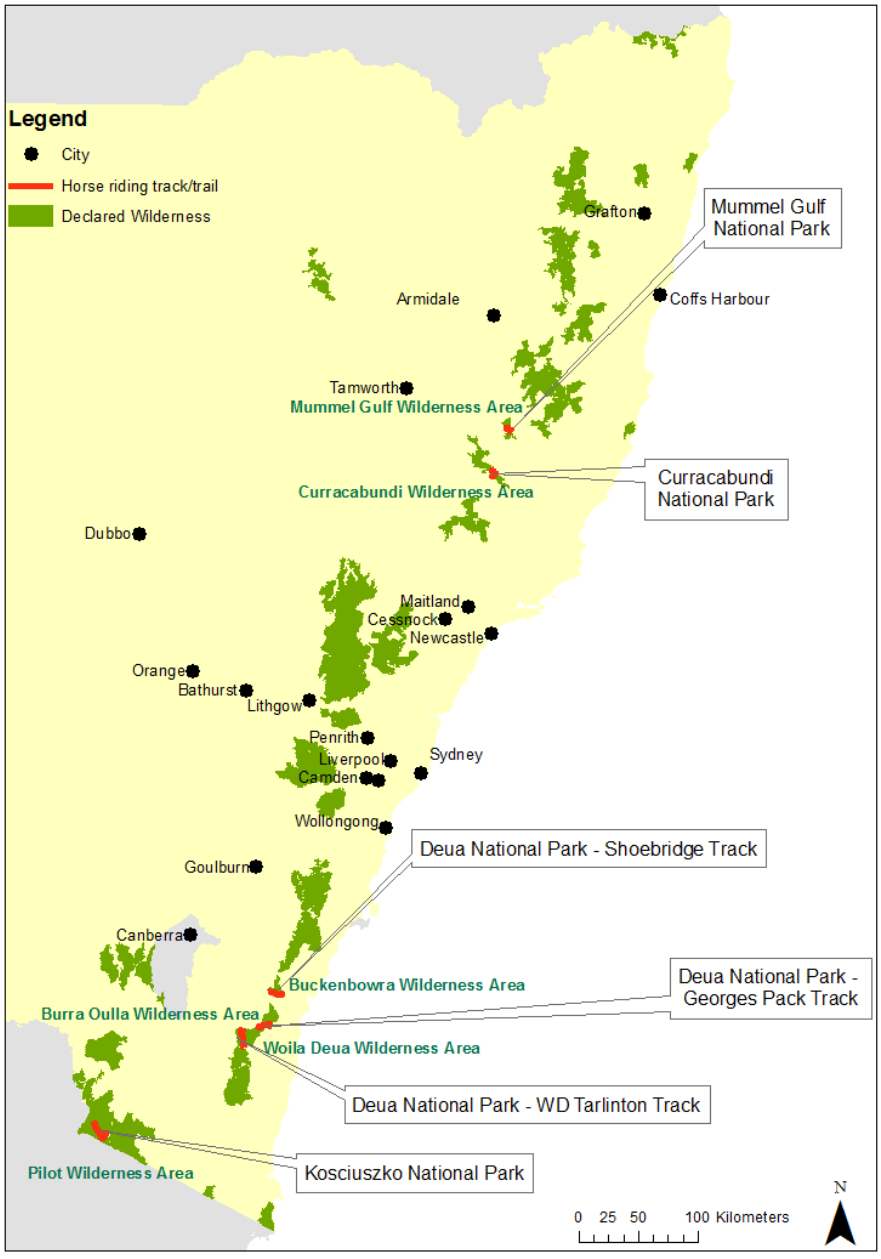


**Figure 1: Locations of wilderness areas involved in the horse riding in wilderness trial**

# 2. Methods

Horse riding in wilderness trial monitoring occurred throughout 2014, 2015 and 2016. Baseline data was collected in February and March 2014 and the final sampling events occurred throughout 2016.

The project design was subject to peer review by experts from the Office of Environment and Heritage (OEH) and external parties (OEH 2015a; OEH 2015b). The methods and design are in accordance with the *OEH Scientific Rigour Position Statement* (OEH 2013) and apply adaptive management principles. Methods (including indicators, thresholds and management responses) were adaptively reviewed in consultation with technical experts and National Parks and Wildlife Service (NPWS) area staff. OEH scientists formally endorse the process and methodology of this monitoring program as adhering to the OEH Scientific Rigour Position Statement.

## 2.1 Monitoring framework

The horse riding in wilderness monitoring program utilised an adaptive management monitoring framework (Figure 2). The framework used indicators to measure impacts on the values of trial locations. Sufficient change in an indicator triggered a threshold, whereupon relevant managers reviewed the need for management interventions. Where necessary, agreed on-ground management interventions were initiated. The approach was responsive, in that indicators, thresholds and actions were subject to review, using real-world data and situations.

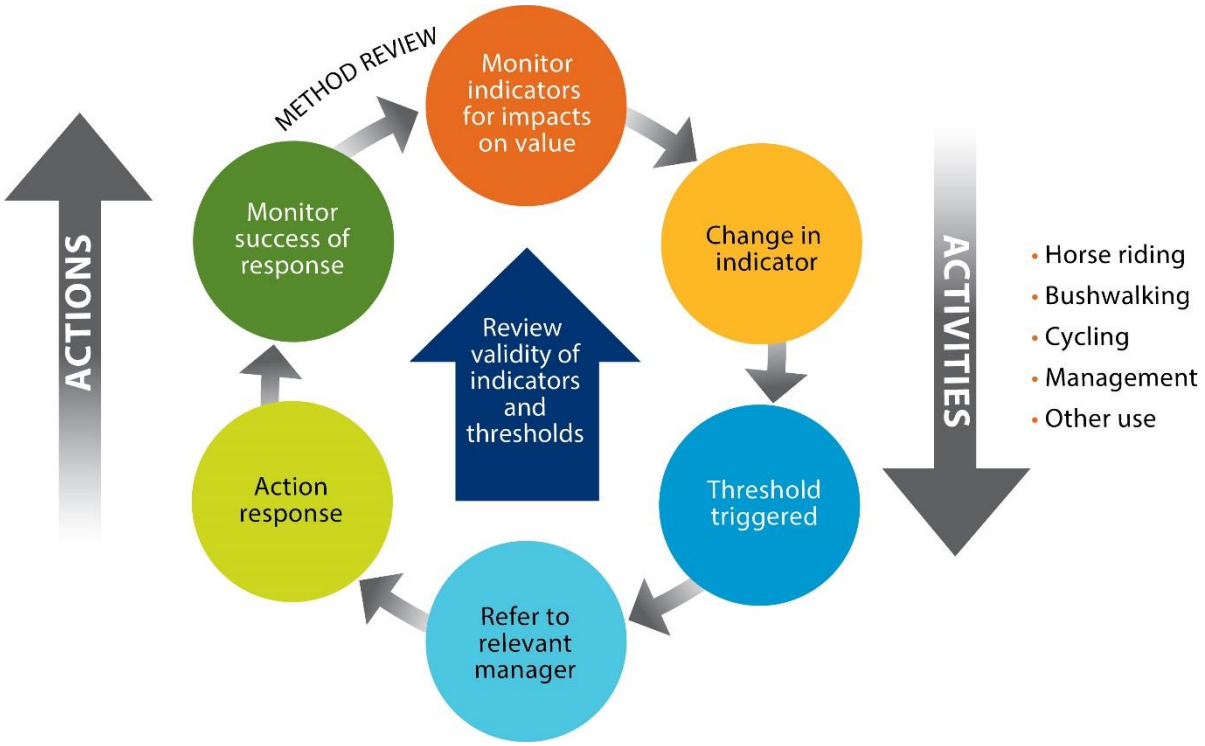


**Figure 2: The adaptive management monitoring framework used in the horse riding in wilderness monitoring program**

Successful implementation of the monitoring framework relied on the identification and clear definition of:

1. **values** that may be affected, e.g. vegetation, soil
2. possible **impacts**, e.g. weed incursion, erosion
3. **indicators** that an impact is occurring, e.g. presence of a new weed species, track/trail incision

4. **thresholds** that define when an indicator has reached a point where management intervention must be implemented, e.g. presence or density of a particular weed species, track/trail incision to a given depth
5. **management interventions**, e.g. weed control, temporary track/trail closure or remediation works.

## 2.2 Values and impacts

Values and associated impacts that were known to be at risk from horse riding (Newsome et al. 2008, Pickering 2008) were considered for monitoring by technical experts within OEH and tabled during facilitated workshops. In addition to the values listed in Figure 3, threatened species values and water values were also considered. Workshops determined that for threatened species, monitoring of threats to habitat would be more meaningful and practical, than developing specific local monitoring methods for individual species. The workshops also decided that water monitoring should be excluded. Water values can be heavily influenced by rainfall and impacts resulting from horse riding would likely result from erosion, which was already included in the monitoring methods as an indicator for soil values (Figure 3 and Appendix 1).

## 2.3 Indicators

Indicators were used to monitor potential impacts on the values that were known to be at risk from horse riding. These indicators were modified from DERM QLD (2010) and were refined in consultation with input from OEH scientists. Indicators and the methods used to detect changes are outlined below. A detailed explanation of all methods is available in *Wilderness horse riding trial: monitoring methods* (OEH 2015b).

*Track/trail condition:*

- Track/trail width – measurement of track/trail width to detect widening.
- Soil compaction – penetrometer reading to measure changes in soil compaction.
- Erosion area – changes in characteristics of both track/trail edge and track/trail centre.
- Track/trail depth – changes at the deepest points across a track/trail.

*Weed assessment:*

- Baseline assessment was undertaken at each site prior to and in the first spring following the commencement of horse riding.
- Weed species number – all weed species were recorded within four transects (at each site) to identify new weed incursions.
- Weed species percentage cover – within each transect weed species were assigned a cover/abundance score to identify changes in weed cover.

*Additional physical disturbances:*

- Pathogens – visual assessment for evidence of vegetation dieback.
- Heritage assets – visual assessment for evidence of damage or deterioration and rubbish/vandalism.

*Landscape Classification System (LCS):*

- *Landscape Classification System for visitor management* (EPA QLD 2007a; EPA QLD 2007b) is used to assess the key attributes of areas for managing visitors and provides a tool to consistently score and examine change over time at a landscape level.

*Informal track scoring:*

- Recorded at potential track/trail deviation points in Mummel Gulf trial area.
- Signs of informal track development along the main track/trail was recorded.

*Social monitoring:*

- Online survey –18 (mostly multiple choice) questions were hosted on the *Survey Monkey* online platform. Respondents were recruited via workshops and through awareness raising at the trial launch. The survey was limited to respondents who had visited the tracks or trails.
- Complaint, feedback and correspondence monitoring.

Photo points were taken at each site to allow a visual reference over time. Photos were taken with the same focal point, field of view and at a fixed distance, height and orientation, each time the site was visited.

## 2.4 Thresholds

Thresholds represent points when management intervention is needed, i.e. when indicators show that an impact is occurring to a previously defined, unacceptable level. To identify a meaningful change in an indicator, measures were compared to baseline data (measured before the commencement of horse riding).

The development of thresholds was facilitated by experts from the University of Melbourne using a structured decision-making process (De Bie & Morris 2015). The process was undertaken over a series of four workshops attended by OEH staff and external stakeholders; one to address overarching objectives and the decision framework and three workshops held in the trial regions to develop thresholds (Narooma, Jindabyne and Armidale). The process is detailed in De Bie & Morris (2015).

Thresholds developed were site and track/trail specific, due to the distinct nature of each track/trail (Section 1.4) and the unique wilderness areas they occupy. Threshold triggers generally involved a presence/absence approach or percentage increases or decreases in values, relative to baseline (Appendix 2). The relationships between values, impacts, indicators and thresholds are demonstrated in Figure 3.

## 2.5 Management interventions

Management interventions were intended to return a value to within a desired range, after a threshold was triggered. Management options were largely identified during threshold development workshops. The indicators, thresholds and associated management interventions developed are detailed in Appendix 2.

Management interventions were track/trail specific, but involved actions such as notifying stakeholders, assessing the need for track hardening, soil testing, temporary trail closure or undertaking remediation/erosion control works.

## 2.6 Site selection for monitoring

The term ‘site’ refers to a specific point along a track or trail where sampling occurred. Based on technical advice and OEH mapping, sites were identified that were considered ‘sensitive’ to change and the most vulnerable to impacts. These desktop-selected sites were ground-truthed and amended as required, based on on-ground considerations.

Sites were classified by potential issues and impacts, e.g. soil stability, erodibility, likely locations of prolonged activity (deemed ‘fan-out sites’) and vulnerable areas such as water crossings. Sites measuring track condition, pathogens and weeds were selected in terms of erodibility and wetness. Sites measuring heritage and landscape values were focused on stopping points where riders are likely to spend some time and/or deviate from the trail. Decisions around indicators measured at each site were driven by these issues (Appendix 3).

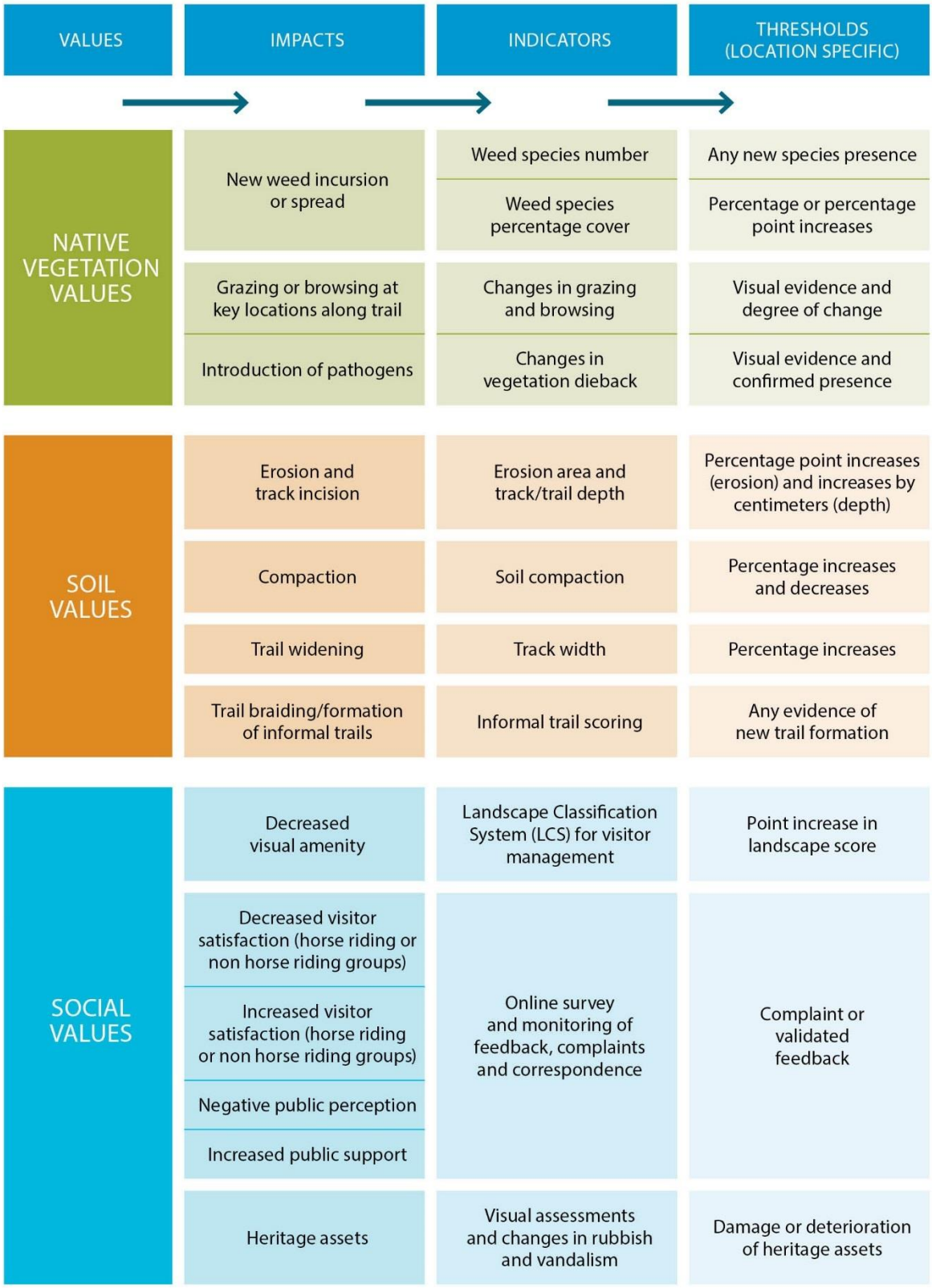


**Figure 3: The relationships between values, impacts, indicators and thresholds used in the monitoring program**

## 2.7 Monitoring usage

Motion sensitive cameras were set for the duration of the trial at key sites on the tracks and trails, to provide data on the frequency and intensity of track/trail use by horse riders and other users. Cameras were installed at sites that were unavoidable by track/trail users and multiple cameras were often deployed on the same track/trail. Usage cameras were inspected and tested before each deployment, however camera failure still occurred. When a camera was found to have failed, a new camera was immediately installed to replace it.

Track and trail usage data is expressed in terms of:

- **Riders** – the total number of horse riders visiting a track/trail. Here, each horse rider is counted only once, even if they pass multiple cameras on the same track/trail during their visit.
- **Groups** – the number of times that groups of horse riders visited the track/trail. Here two horse riders are considered to be in the same group if they are detected within five minutes of each other. One group of horse riders is counted only once, even if they pass multiple cameras on the same track/trail during their visit.
- **Passes** – the number of times a user passes a usage camera on the track/trail.
- **Authorised users** – visitors utilising the trial tracks/trails lawfully.
- **Unauthorised users** – visitors detected travelling with a dog, travelling with a dog and a wild foal, using a motorised vehicle in wilderness areas or horse riding in the Kosciuszko trial area during the June to October closure period.

## 2.8 Monitoring frequency

Site sampling and camera maintenance was undertaken biannually. Sampling was intended to roughly correspond with autumn and spring, but was also driven by practical considerations (access and availability of staff and equipment).

## 2.9 Method review and modification

Following a threshold trigger, indicators and thresholds were reviewed, as illustrated in the monitoring framework (Figure 2). In addition, all methods were evaluated after several sampling events to ensure their utility remained.

**Compaction**

Due to highly variable data, the compaction measure was reviewed in late 2015 with the input of an OEH soil scientist. The data accuracy was questioned due to the narrow range of very low values measurable by a pocket penetrometer. Associated thresholds were also deemed inappropriate due to their dependence on percentage change relative to low and unreliable baseline measures. Following this review, measuring compaction and its associated thresholds was discontinued in January 2016.

# 3. Results

## 3.1 Tracking of threshold triggers and management interventions

Monitoring data was assessed against baseline data and agreed thresholds following each biannual sampling event. This report focuses on the data and findings relevant to the monitoring objectives, but further data (including all species detected) is available on the wilderness horse riding trial website (OEH 2016) .

Usage monitoring frequently detected unauthorised activities. These activities were referred to the appropriate NPWS Area for investigation and management as appropriate.

Threshold exceedances and management responses are detailed in this report by location.

## 3.2 Mummel Gulf National Park (Mummel Gulf Wilderness Area)

Trail sampling was undertaken twice a year at selected sites on the wilderness sections of Dicks Hut Fire Trail and River Road (Table 1; Appendix 4). Detailed biannual summaries are publically available on the wilderness horse riding trial website (OEH 2016). Three cameras were maintained on the trails for the duration of the trial (last checked in February 2016).

No horse riders were detected using the trails for the duration of the trial. Cameras experienced periods of failure due to technical faults. The maximum period with no cameras operational was 36 consecutive days. Trail users are presented in Figure 4 and a full list of users and animals detected on trails is available on the wilderness horse riding trial website (OEH 2016).

In spring 2016, 12 thresholds were triggered in association with weeds. Only one species (gray everlasting (*Gamochaeta coarctata*)) was not detected previously on the trails (Table 2; Figure 5). Gray everlasting is not known to be dispersed by horses (Eco Logical 2016). Surveys found nine weed species in sites where they were not previously recorded (Table 2). None of these weeds were new incursions to the trail, as each had been detected at other sites previously. Two thresholds were triggered for increased weed species percentage cover (Figure 6). Increased cover of *Anthoxanthum odoratum* (sweet vernal grass) can be of concern to native grasslands and woodlands (communication by NPWS Pests and Weeds team) but the species does not have horse dispersal traits (Eco Logical 2014). The Area Manager was notified of the triggers and appropriate action was assessed in accordance with the agreed management responses (Table 2; Appendix 2) using local knowledge of the sites, trail and wilderness area.

No thresholds were triggered for changes in track condition (track width, track depth and erosion), informal trail scoring, physical disturbances (including pathogens), landscape class or social monitoring (Table 1).

**Table 1: Indicators measured at the Mummel Gulf trial location and the number of horse riders detected using the trails**
Biannual site data was compared to baseline data and agreed thresholds (Appendix 2).

| Measure | Number of sites surveyed | Autumn 2014 to Spring 2014 | Spring 2014 to Autumn 2015 | Autumn 2015 to Spring 2015 | Spring 2015 to Summer 2015/16 | Summer 2015/16 to Spring 2016 | Total |
|---|---|---|---|---|---|---|---|
| | | **Count** | | | | | |
| Horse riders | 3 | 0 | 0 | 0 | 0 | n/a | 0 |
| Days with no cameras active | 3 | 0 | 0 | 36 | 0 | n/a | 36 |
| | | **Number of thresholds triggered** | | | | | |
| Trail width | 12 | 0 | 0 | 0 | 0 | n/a | 0 |
| Average trail width | Trail average | 0 | 0 | 0 | 0 | n/a | 0 |
| Erosion area | 12 | 0 | 0 | 0 | 0 | n/a | 0 |
| Average trail erosion area | Trail average | 0 | 0 | 0 | 0 | n/a | 0 |
| Average depth of trail | Trail average | 0 | 0 | 0 | 0 | n/a | 0 |
| Trail formation | 2 | 0 | 0 | 0 | 0 | n/a | 0 |
| New weed species (location) | n/a | n/a | n/a | n/a | n/a | 1 | 1 |
| New weed species (site) | 13 | n/a | n/a | n/a | n/a | 9 | 9 |
| Weed cover increase | 13 | n/a | n/a | n/a | n/a | 2 | 2 |
| Pathogens | 12 | 0 | 0 | 0 | 0 | n/a | 0 |
| Landscape Classification Score | 4 | 0 | 0 | 0 | 0 | n/a | 0 |
| Social cohesion | n/a | 0 | 0 | 0 | 0 | n/a | 0 |

**Table 2: Threshold exceedances at the Mummel Gulf trial location**

| **New weed species at location**<br>**Agreed management intervention – enact regional pest management strategy and Walcha Area Pest Plan** | | | |
|---|---|---|---|
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| n/a | *Gamochaeta coarctata* | Not detected | Detected (Figure 5) |
| **New weed species at a site**<br>**Agreed management intervention – enact regional pest management strategy and Walcha Area Pest Plan** | | | |
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| MRR004 | *Gamochaeta coarctata* | Not detected | Detected (Figure 5) |
| MRR005 | *Gamochaeta coarctata* | Not detected | Detected |
| MDH007 | *Anagallis arvensis* | Not detected | Detected |
| | *Verbena bonariensis* | Not detected | Detected |
| MDH008 | *Gamochaeta coarctata* | Not detected | Detected |
| | *Hypochaeris radicata* | Not detected | Detected |
| | *Oxalis corniculata* | Not detected | Detected |
| | *Verbena bonariensis* | Not detected | Detected |
| MDH012 | *Conyza sp.* | Not detected | Detected |
| **Increase in weed species percent cover (25% increase)**<br>**Agreed management intervention – enact regional pest management strategy and Walcha Area Pest Plan** | | | |
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| MDH007 | *Anthoxanthum odoratum* | <5% of 2/4 transects, 26–50% of 1/4 transects | <5 % 2/4, 26–50% of 2/4 transects (Figure 6) |
| | *Hypochaeris radicata* | <5% of 1/4 transects | <5% of 2/4, 5–25% of 1/4 transects (Figure 6) |

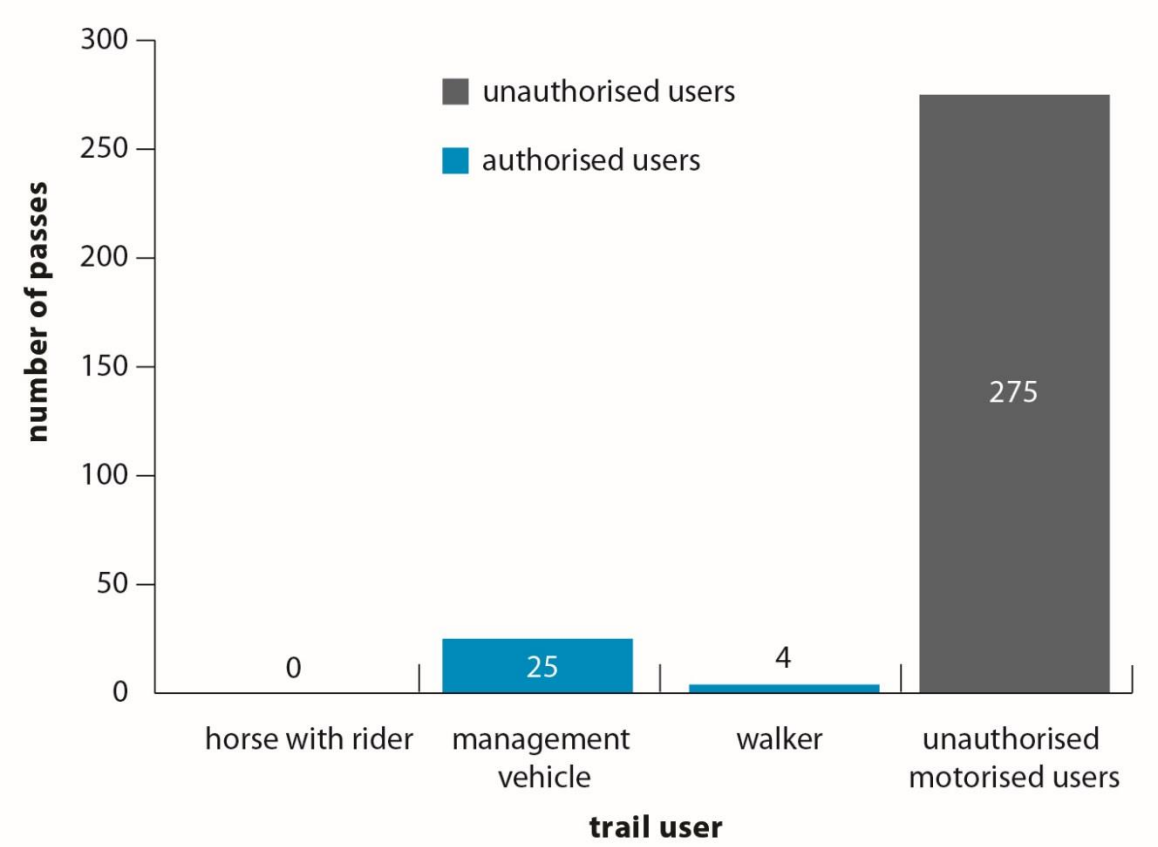


**Figure 4: Trail usage at the Mummel Gulf trial location, determined using three motion sensitive cameras**

'Number of passes' represents the number of times users were detected on any of the three cameras, with one user passing multiple cameras represented as multiple passes. Cameras failed for one 36-day period due to technical issues.


**Figure 5: The threshold trigger for new weed species at a location and new weed species at a site was triggered by *Gamochaeta coarctata* (gray everlasting) at site MRR004 0m transect**

April 2014 shows baseline condition before *Gamochaeta coarctata* was recorded. October 2016 is when the trigger was detected.


**Figure 6: The threshold trigger for increased weed species percent cover at a site was triggered by *Anthoxanthum odoratum* (sweet vernal grass) and *Hypochaeris radicata* (flatweed) at site MDH007 0m transect**

April 2014 and November 2014 show baseline condition. October 2016 is when the triggers were detected.

## 3.3 Kosciuszko National Park (Pilot Wilderness Area)

Trail sampling was undertaken twice a year at selected sites on the nominated wilderness sections of the trails (Table 3). Proposed campsites were nominated following the collection of baseline data, and were added as 'fan-out' sites prior to the spring (November) 2014 sample period. This first collection period was treated as baseline for the purposes of subsequent data comparisons at these campsites. Detailed biannual summaries are publically available on the wilderness horse riding trial website (OEH 2016). Three cameras were maintained on trails for the duration of the trial (last checked in April 2016).

Over the 24-month trial period 33 authorised horse riders (with seven pack horses) were detected using the trails (Figure 7). This represents nine groups with individual riders passing usage cameras on 48 occasions (with 14 pack horse passes). Cameras experienced periods of failure due to technical faults. There was one period of five days during which no cameras were operational due to technical failures and vandalism. Trail users detected are presented in Figure 8 and a full list of users and animals detected on trails is available on the wilderness horse riding trial website (OEH 2016).

Usage cameras detected 29 unauthorised horse riders, representing 11 groups of riders over the trial period. Horse riders were considered unauthorised if they were travelling with a dog, travelling with a dog and a wild foal or riding during the June to October trail closure period. Unauthorised horse riders passed usage cameras on 50 occasions during the trial (Figure 8).

Sites were sampled for changes in track condition (track width, track depth and erosion), physical disturbances (including pathogens and rubbish/vandalism), landscape class and social monitoring with one threshold triggered over the trial period (Table 3; Table 4).The threshold for trail width was triggered at one site (KNP002) along Ingeegoodbee Trail in spring 2014.This was managed through routine trail maintenance prior to the autumn 2015 sampling event. The autumn 2015 measures became the new baseline thereafter. Photo points indicate that the damage could most likely be attributed to vehicle use (Figure 9). No further trail width threshold triggers were detected.

In spring 2016, 46 thresholds were triggered in association with weeds (Table 3; Table 4). Surveys found 28 weed species in sites where they were not previously recorded. None of these weeds were new incursions to the trail, as each had been detected at other sites previously. *Chrondrilla juncea* (skeleton weed; Figure 10) and *Hypericum perforatum* (St John's wort; Figure 12) are of environmental concern and *Rubus fruticosus* aggregate (blackberry) is a Weed of National Significance, but is not known to be dispersed by horses (Eco Logical 2014). The threshold for weed species percentage cover was triggered 18 times, by various species (Table 4; Figure 11; Figure 12). The Area Manager was notified of the threshold triggers and appropriate action was assessed in accordance with the agreed management responses (Table 4; Appendix 2) using local knowledge of the sites, trail and wilderness area.

There were no threshold triggers for track depth, erosion, heritage values, landscape class, physical disturbance or social monitoring throughout the trial period.

**Table 3: Indicators measured at the Kosciuszko trial location and the number of horse riders detected using the trails**

Biannual site data was compared to baseline data and agreed thresholds (Appendix 2).

| Measure | Number of sites surveyed | Autumn 2014 to Spring 2014 | Spring 2014 to Autumn 2015 | Autumn 2015 to Spring 2015 | Spring 2015 to Autumn 2016 | Autumn 2016 to Spring 2016 | Totals |
|---|---|---|---|---|---|---|---|
| | | **Count** | | | | | |
| Authorised horse riders | 3 | 2 | 13 | 18 | 0 | n/a | 33 |
| Unauthorised horse riders | 3 | 19 | 1 | 9 | 0 | n/a | 29 |
| Days with no cameras active | 3 | 5 | 0 | 0 | 0 | n/a | 5 |
| | | **Number of thresholds triggered** | | | | | |
| Trail width | 12 | 0 | 1 | 0 | 0 | n/a | 1 |
| Average trail width | Trail average | 0 | 0 | 0 | 0 | n/a | 0 |
| Erosion area | 12 | 0 | 0 | 0 | 0 | n/a | 0 |
| Average trail erosion area | Trail average | 0 | 0 | 0 | 0 | n/a | 0 |
| Depth of trail | 12 | 0 | 0 | 0 | 0 | n/a | 0 |
| New weed species (location) | n/a | n/a | n/a | n/a | n/a | 0 | 0 |
| New weed species (site) | 16 | n/a | n/a | n/a | n/a | 28 | 28 |
| Weed cover increase | 16 | n/a | n/a | n/a | n/a | 18 | 18 |
| Pathogens | 12 | 0 | 0 | 0 | 0 | n/a | 0 |
| Landscape Classification Score | 3 | 0 | 0 | 0 | 0 | n/a | 0 |
| Heritage assets | 1 | 0 | 0 | 0 | 0 | n/a | 0 |
| Social cohesion | n/a | 0 | 0 | 0 | 0 | n/a | 0 |

**Table 4: Threshold exceedance at the Kosciuszko trial location**

| **Trail width increase (10% increase)**<br>**Agreed management intervention – notify Area Manager who will assess need for hardening and implement as appropriate; notify relevant stakeholders if action is required** | | | |
|---|---|---|---|
| **Site** | **Sample period detected** | **Baseline** | **Trigger measure** |
| KNP002 | Spring 2014 | 2.4m | 3.6m (Figure 9) |
| **New weed species at a site**<br>**Agreed management intervention – enact regional pest management strategy; notify relevant stakeholders if action is required** | | | |
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| KNP001 | *Anagallis arvensis* | Not detected | Detected |
| | *Cerastium glomeratum* | Not detected | Detected |
| | *Myosotis discolor* | Not detected | Detected |
| KNP002 | *Rubus fruticosus* spp. agg. | Not detected | Detected |
| | *Sonchus oleraceus* | Not detected | Detected |
| KNP004 | *Verbascum virgatum* | Not detected | Detected |
| KNP005 | *Cerastium balearicum* | Not detected | Detected |
| | *Cerastium glomeratum* | Not detected | Detected (Figure 11) |
| KNP006 | *Cerastium glomeratum* | Not detected | Detected |
| | *Sonchus asper* | Not detected | Detected |
| KNP007 | *Centaurium erythraea* | Not detected | Detected |
| KNP Camp 2 | *Chondrilla juncea* | Not detected | Detected (Figure 10) |
| | *Taraxacum officinale* s. lat. | Not detected | Detected |
| | *Verbascum thaspus* | Not detected | Detected (Figure 10) |
| | *Trifolium campestre* | Not detected | Detected |
| KNP Camp 3 | *Aphanes inexspectata* | Not detected | Detected |
| | *Bromus molliformis* | Not detected | Detected |
| | *Capsella bursa-pastoris* | Not detected | Detected (Figure 12) |
| | *Hypericum perforatum* | Not detected | Detected (Figure 12) |
| | *Hypochaeris radicata* | Not detected | Detected (Figure 12) |
| | *Linaria arvensis* | Not detected | Detected |
| | *Lolium perenne* | Not detected | Detected |
| | *Myosotis discolor* | Not detected | Detected (Figure 12) |
| | *Silene gallica* | Not detected | Detected (Figure 12) |
| KNP016 | *Cerastium glomeratum* | Not detected | Detected |
| | *Hypochaeris radicata* | Not detected | Detected |
| | *Verbascum virgatum* | Not detected | Detected |
| KNP017 | *Veronica serpyllifolia* | Not detected | Detected |

| **Increase in weed species percent cover (100% increase)**<br>**Agreed management intervention – notify Area Manager; enact regional pest management strategy**<br>**Notify relevant stakeholders if action is required** | | | |
|---|---|---|---|
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| KNP001 | *Trifolium repens* | <5% of 2/4 transects | <5% of 4/4 transects |
| KNP002 | *Hypochaeris radicata* | <5% of 4/4 transects | <5% of 3/4 transects and 5–25% of 1/4 transects |
| | *Rosa rubiginosa* | <5% of 1/4 transects | <5% of 2/4 transects |
| | *Taraxacum officinale* s. lat. | <5% of 1/4 transects | <5% of 4/4 transects |
| | *Veronica serpyllifolia* | <5% of 1/4 transects | <5% of 2/4 transects |
| KNP003 | *Anthroxanthum odoratum* | <5% of 1/4 transects | <5% of 3/4 transects |
| KNP004 | *Taraxacum officinale* s. lat. | <5% of 2/4 transects | <5% of 4/4 transects |
| KNP005 | *Veronica serpyllifolia* | <5% of 1/4 transects | <5% of 2/4 transects (Figure 11) |
| KNP006 | *Taraxacum officinale* s. lat. | <5% of 1/4 transects | <5% of 2/4 transects |
| KNP007 | *Rumex* sp. | <5% of 1/4 transects | <5% of 2/4 transects |
| KNP Camp 3 | *Cardamine* sp. | <5% of 2/4 transects | <5% of 4/4 transects (Figure 12) |
| | *Cerastium glomeratum* | <5% of 2/4 transects | <5% of 4/4 transects (Figure 12) |
| | *Lactuca serriola* | <5% of 1/4 transects | <5% of 2/4 transects (Figure 12) |
| | *Rostraria cristata* | <5% of 1/4 transects | <5% of 3/4 transects |
| | *Verbascum thaspus* | <5% of 1/4 transects | <5% of 2/4 transects (Figure 12) |
| | *Vicia sativa* | <5% of 1/4 transects | <5% of 2/4 transects (Figure 12) |
| | *Vulpia myuros* | <5% of 1/4 transects | 5-25% of 3/4 transects and <5% of 1/4 transects (Figure 12) |
| KNP016 | *Aira elegantissima* | <5% of 1/4 transects | <5% of 4/4 transects |

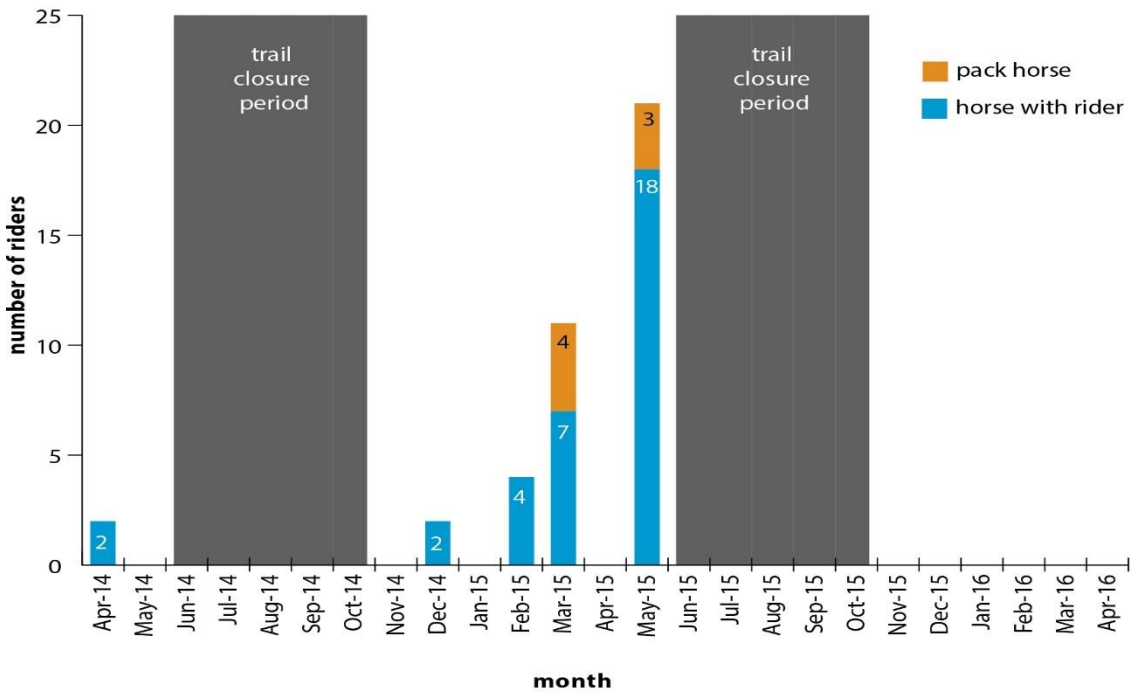


**Figure 7: Authorised horse riders (and pack horses) detected at the Kosciusko trial location**

Users were detected using three motion sensitive cameras. No cameras were active for one five-day period due to technical failures, theft and vandalism.

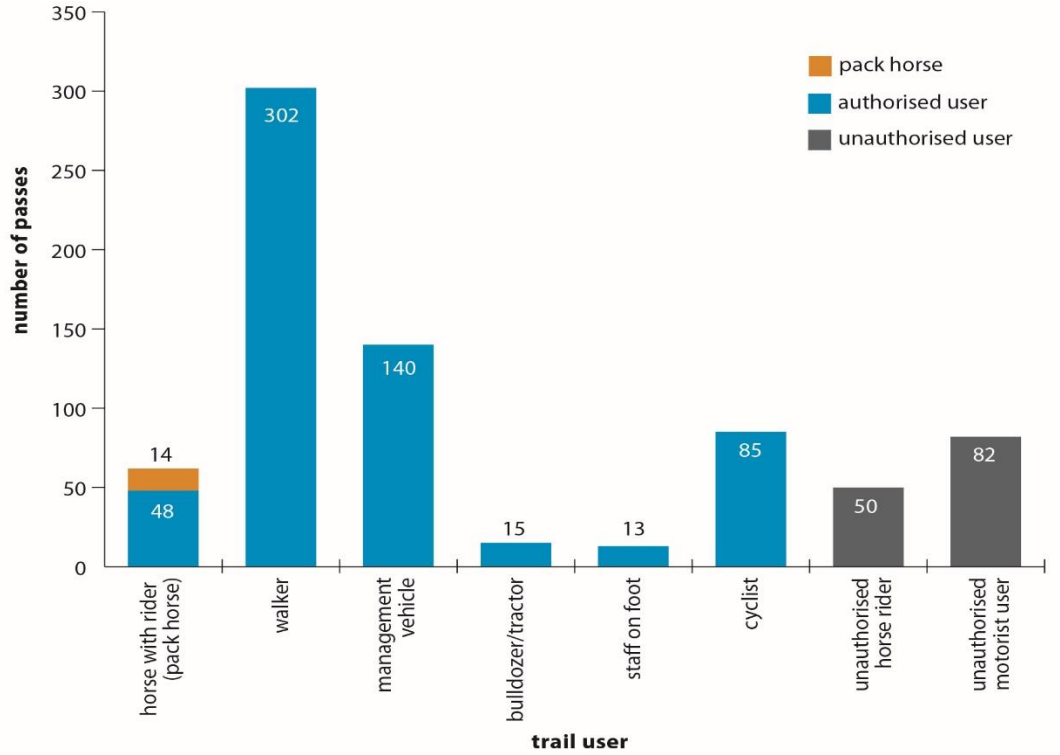


**Figure 8: Trail usage at the Kosciuszko trial location, determined using three motion sensitive cameras**

'Number of passes' represents the number of times users were detected on any of the three cameras, with one user passing multiple cameras represented as multiple passes. No cameras were active for one five-day period due to technical failure, theft and vandalism.


**Figure 9: Photo points showing the threshold trigger for trail width on Ingeegoodbee Trail (site KNP002)**

Measurements are taken across the trail, between two white pegs. March 2014 image shows baseline trail condition, November 2014 is when the trigger was detected and April 2015 is following trail maintenance.


**Figure 10: The threshold trigger for new weed species at a site was triggered by *Chondrilla juncea* (skeleton weed) and *Verbascum thaspus* (common mullein) at site KNP Camp2 0m transect**

April 2014 image shows baseline condition before *Chondrilla juncea* and *Verbascum thaspus* were recorded. November 2016 is when the triggers were detected.


**Figure 11: The threshold trigger for new weed species at a site was triggered by *Cerastium glomeratum* (mouse-eared chickweed) at site KNP005 0m transect; increased weed species percent cover at a site was triggered by *Veronica serpyllifolia* (thyme-leaved speedwell)**

April 2014 and November 2014 show baseline condition at site KNP005 0m transect, November 2016 is when the triggers were detected.


**Figure 12: The threshold trigger for new weed species at a site was triggered by *Capsella bursa-pastoris* (shepherd's perse), *Hypericum perforatum* (St John's wort), *Hypochaeris radicata* (flatweed), *Myosotis discolor* (changing forget-me-not) and *Silene gallica* (common catchfly) at site KNP Camp3 5m transect; increased weed species percent cover at a site was triggered by *Cardamine* sp., *Cerastium glomeratum* (mouse-ear chickweed), *Lactuca serriola* (prickly lettuce), *Verbascum thaspus* (common mullein), *Vicia sativa* (common vetch) and *Vulpia myuros* (annual fescue)**

April 2014 image shows baseline condition at site KNP Camp3 5m transect, November 2016 is when the triggers were detected.

## 3.4 Deua National Park (Buckenbowra, Burra–Oulla and Woila–Deua wilderness areas)

Sampling was undertaken twice a year at selected sites on the nominated wilderness sections of Georges Pack Track (Table 5), WD Tarlinton Track (Table 7) and the Shoebridge Track (Table 9). Detailed biannual summaries are available on the wilderness horse riding trial website (OEH 2016).

### Georges Pack Track

Two usage cameras were maintained on this track for the duration of the trial (last checked September 2016).

Over the 24-month trial period, 44 horse riders (with seven pack horses) were detected using the track (Figure 13). This represents five groups of horse riders passing usage cameras on 73 occasions (with 12 pack horse passes). Cameras experienced periods of failure due to technical faults, with one period of 130 days during which no cameras were operational. Track users are presented in Figure 14 and a full list of users and animals detected on tracks over the trial period is available on the wilderness horse riding trial website (OEH 2016).

In spring 2016, three thresholds were triggered in association with weeds. No new weed species were detected for the track. Surveys found three weed species in sites where they had not been detected during baseline sampling (Table 6; Figure 15). These weeds were not new incursions to the track as each had been detected at other sites previously. No thresholds were triggered for increases in the percentage cover of weeds.The Area Manager was notified of the threshold triggers and appropriate action was assessed in accordance with the agreed management responses (Table 6; Appendix 2) using local knowledge of the sites, track and wilderness area.

No thresholds were triggered for track condition (track width, track depth and erosion), physical disturbances (including pathogens), landscape class or social monitoring over the trial period (Table 5).

**Table 5: Indicators measured on Georges Pack Track and the number of horse riders detected using the track**

Biannual site data was compared to baseline data and agreed thresholds (Appendix 2).

| Measure | Number of sites surveyed | Autumn 2014 to Spring 2014 | Spring 2014 to Winter 2015 | Winter 2015 to Summer 2015 | Summer 2015 to Spring 2016 | Total |
|---|---|---|---|---|---|---|
| | | **Count** | | | | |
| Horse riders | 2 | 17 | 16 | 0 | 11 | 44 |
| Days with no cameras active | 2 | 0 | 130 | 0 | 0 | 130 |
| | | **Number of thresholds triggered** | | | | |
| Average track width | Track average | 0 | 0 | 0 | 0 | 0 |
| Erosion area | 9 | 0 | 0 | 0 | 0 | 0 |
| Average track erosion area | Track average | 0 | 0 | 0 | 0 | 0 |
| Depth of track | 9 | 0 | 0 | 0 | 0 | 0 |
| New weed species (location) | 12 | n/a | n/a | n/a | 0 | 0 |
| New weed species (site) | 12 | n/a | n/a | n/a | 3 | 3 |
| Weed cover increase | 12 | n/a | n/a | n/a | 0 | 0 |
| Pathogens | 11 | 0 | 0 | 0 | 0 | 0 |
| Landscape Classification Score | 2 | 0 | 0 | 0 | 0 | 0 |
| Social cohesion | n/a | 0 | 0 | 0 | 0 | 0 |

**Table 6: Threshold exceedances at Georges Pack Track**

| **New weed species at a site**<br>**Agreed management intervention – notify Area Manager and key groups** | | | |
|---|---|---|---|
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| **DGP003** | *Cirsium vulgare* | Not detected | Detected |
| **DGP007** | *Conyza sumatrensis* | Not detected | Detected |
| **DGP012** | *Conyza sumatrensis* | Not detected | Detected (Figure 15) |

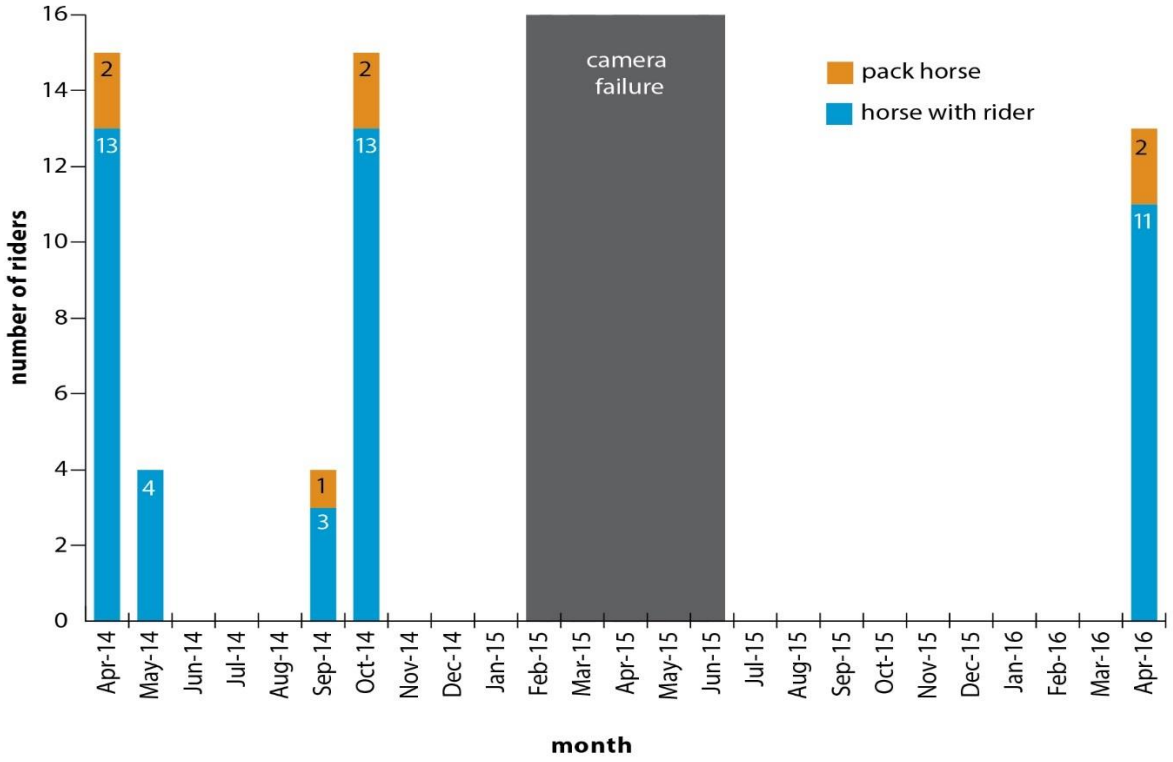


**Figure 13: Authorised horse riders (and pack horses) detected on Georges Pack Track**
Users were detected using two motion sensitive cameras. No cameras were active for one 130-day period due to technical failures.

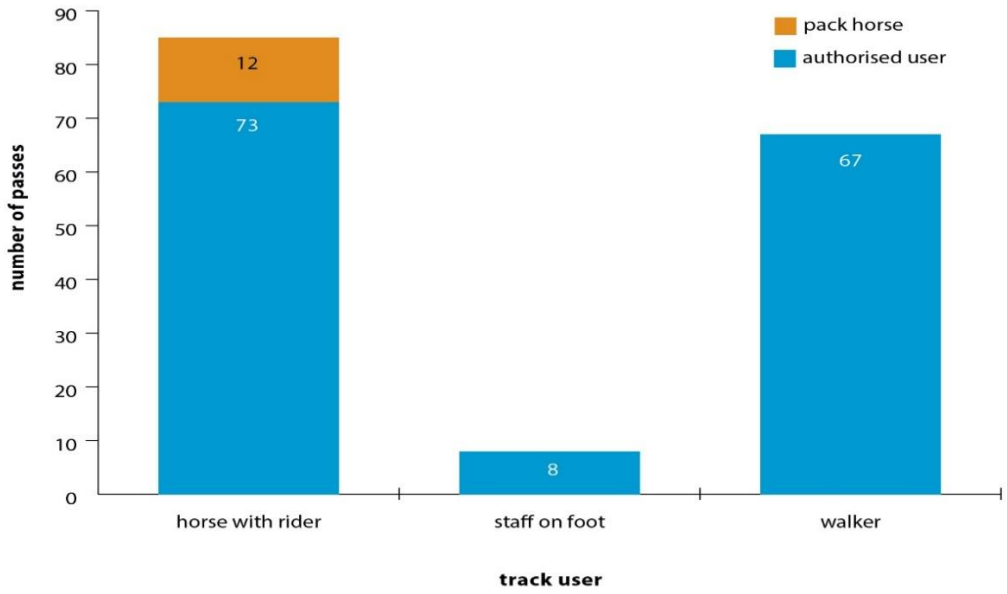


**Figure 14: Track usage on Georges Pack Track, determined using two motion sensitive cameras**

'Number of passes' represents the number of times users were detected on any of the three cameras, with one user passing multiple cameras represented as multiple passes. No cameras were active for one 130-day period due to technical failure.


**Figure 15: The threshold trigger for new weed species at a site was triggered by *Conyza sumatrensis* (fleabane) at site DGP012 5m transect**

April 2014 and November 2014 show baseline condition before *Conyza sumatrensis* was recorded. October 2016 is when the trigger was detected.

## WD Tarlinton Track

Two cameras were maintained on the track for the duration of the trial (the northern camera was last checked in May 2016, the southern camera in August 2016).

Over the 24-month trial period 31 horse riders (with twelve pack horses) were detected using the track (Figure 16). This represents three groups, with individual horse riders passing usage cameras on 55 occasions (with 16 pack horse passes). Usage cameras also detected four horse riders (with one pack horse) travelling with a dog (and therefore considered unauthorised users). Track users detected are presented in Figure 17 and a full list of users and animals detected over the trial period is available on the wilderness horse riding trial website (OEH 2016).

Sites were sampled for changes in track condition (track width, track depth and erosion), physical disturbances (including pathogens), landscape class and social monitoring with four thresholds for track depth triggered over the trial period (Table 7; Table 8). The thresholds were triggered in spring 2014 (DTT005, DTT007), winter 2015 (DTT005, DTT013), summer 2015 (DTT005, DTT007) and winter 2016 (DTT005).

In spring 2016, eight thresholds were triggered in association with weeds. Only one of these species (*Solanum nigrum* black nightshade) was not detected at any sites on WD Tarlinton Track during baseline surveys (Table 8; Figure 22). Black nightshade is a common agricultural weed that may be spread by horses (Eco Logical 2016). Surveys found seven weed species dispersed into sites where they had not previously been recorded (Table 8; Figure 21). None of these weeds were new incursions to the trail, as each had been detected at other sites previously. No thresholds were triggered for increases in the percentage cover of weeds.

No thresholds were triggered for changes in track condition (track width, track depth and erosion), physical disturbances (including pathogens), landscape class or social monitoring (Table 7).

The Area Manager was notified of the threshold triggers and appropriate action was assessed in accordance with the agreed management responses (Table 8; Appendix 2), taking into account photo points (Figure 18; Figure 19; Figure 20) from the sampling events and local knowledge of the sites, track and wilderness area.

**Table 7: Indicators measured on WD Tarlinton Track and the number of horse riders detected using the track**

Biannual site data was compared to baseline data and agreed thresholds (Appendix 2).

| Measure | Number of sites surveyed | Autumn 2014 to Spring 2014 | Spring 2014 to Winter 2015 | Winter 2015 to Summer 2015 | Summer 2015 to Winter 2016 | Winter 2016 to Spring 2016 | Totals |
|---|---|---|---|---|---|---|---|
| | | **Count** | | | | | |
| Authorised horse riders | 2 | 12 | 7 | 12 | 0 | n/a | 31 |
| Unauthorised horse riders | 2 | 4 | 0 | 0 | 0 | n/a | 4 |
| Days with no cameras active | 2 | 0 | 0 | 0 | 0 | n/a | 0 |
| | | **Number of thresholds triggered** | | | | | |
| Average track width | Track average | 0 | 0 | 0 | 0 | n/a | 0 |
| Erosion area | 8 | 0 | 0 | 0 | 0 | n/a | 0 |
| Average track erosion area | Track average | 0 | 0 | 0 | 0 | n/a | 0 |
| Depth of track | 8 | 2 | 2 | 2 | 1 | n/a | 7 |
| New weed species (location) | 9 | n/a | n/a | n/a | n/a | 1 | 1 |
| New weed species (site) | 9 | n/a | n/a | n/a | n/a | 7 | 7 |
| Weed cover increase | 9 | n/a | n/a | n/a | n/a | 0 | 0 |
| Pathogens | 9 | 0 | 0 | 0 | 0 | n/a | 0 |
| Landscape Classification Score | 1 | 0 | 0 | 0 | 0 | n/a | 0 |
| Social cohesion | n/a | 0 | 0 | 0 | 0 | n/a | 0 |

**Table 8: Threshold exceedances at WD Tarlinton Track**

| **Depth of track (5cm increase)**<br>**Agreed management intervention – notify Area Manager who will assess options for on-ground response** | | | |
|---|---|---|---|
| **Site** | **Sample period detected** | **Baseline** | **Trigger measure** |
| DTT005 | Spring 2014 | 44.0 | 52.5 (Figure 18) |
| | Winter 2015 | 44.0 | 55.5 (Figure 18) |
| | Summer 2015 | 44.0 | 55.7 (Figure 18) |
| | Winter 2016 | 44.0 | 54.3 (Figure 18) |
| DTT007 | Spring 2014 | 39.3 | 46.1 (Figure 19) |
| | Summer 2015 | 39.3 | 46.0 (Figure 19) |
| DTT013 | Winter 2015 | 31.3 | 38.1 (Figure 20) |
| **New weed species at location**<br>**Agreed management intervention – enact regional pest management strategy** | | | |
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| n/a | *Solanum nigrum* | Not detected | Detected (Figure 22) |
| **New weed species at a site**<br>**Agreed management intervention – notify Area Manager and key groups** | | | |
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| DTT003 | *Cirsium vulgare* | Not detected | Detected (Figure 21) |
| | *Stellaria media* | Not detected | Detected |
| DTT004 | *Solanum nigrum* | Not detected | Detected (Figure 22) |
| DTT005 | *Conyza sumatrensis* | Not detected | Detected |
| | *Taraxacum officinale* | Not detected | Detected |
| DTT006 | *Conyza sumatrensis* | Not detected | Detected |
| DTT007 | *Cirsium vulgare* | Not detected | Detected |

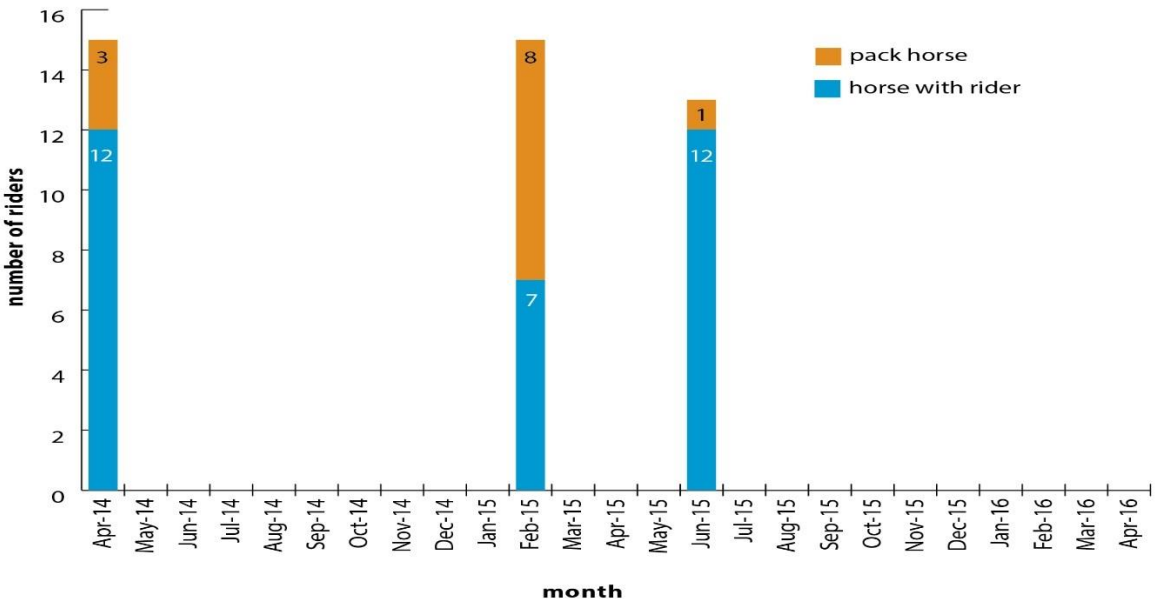


**Figure 16: Authorised horse riders (and pack horses) detected at WD Tarlinton Track**
Users were detected using two motion sensitive cameras.

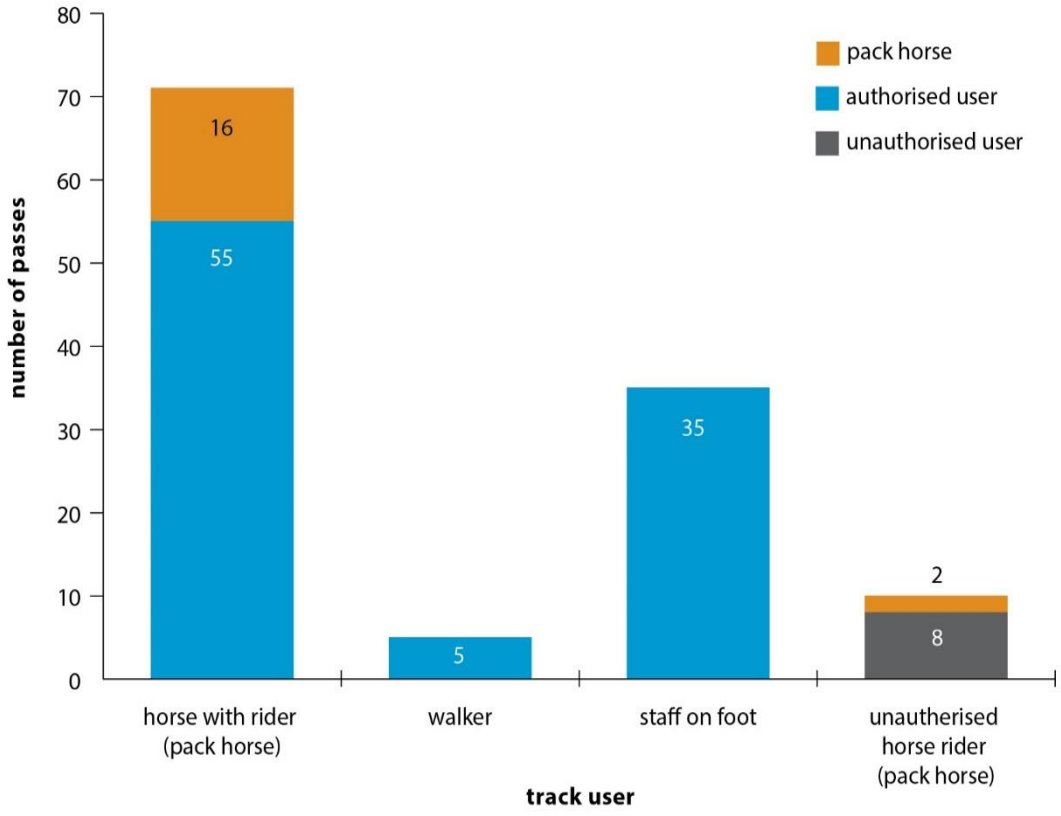


**Figure 17: Track usage on WD Tarlinton Track, determined using two motion sensitive cameras**
'Number of passes' represents the number of times users were detected on either of the two cameras, with one user passing multiple cameras represented as multiple passes.


**Figure 18: Photo points showing threshold triggers for track depth at site DTT005**

Measurements are taken across the track, between two white pegs. February 2014 shows baseline track condition, September 2014, July 2015, December 2015 and August 2016 are when the triggers were detected.


**Figure 19: Photo points showing threshold triggers for track depth at site DTT007**

Measurements are taken across the track, between two white pegs. February 2014 shows baseline track condition, September 2014 and December 2015 are when the triggers were detected.


**Figure 20: Photo points showing threshold trigger for track depth at site DTT013**

Measurements are taken across the track, between two white pegs. February 2014 shows baseline track condition, March 2015 is when the trigger was detected.


**Figure 21: The threshold trigger for new weed species at a site was triggered by *Cirsium vulgare* (spear thistle) at site DTT003 0m transect**

April 2014 and November 2014 show baseline condition before *Cirsium vulgare* was recorded. October 2016 is when the trigger was detected.

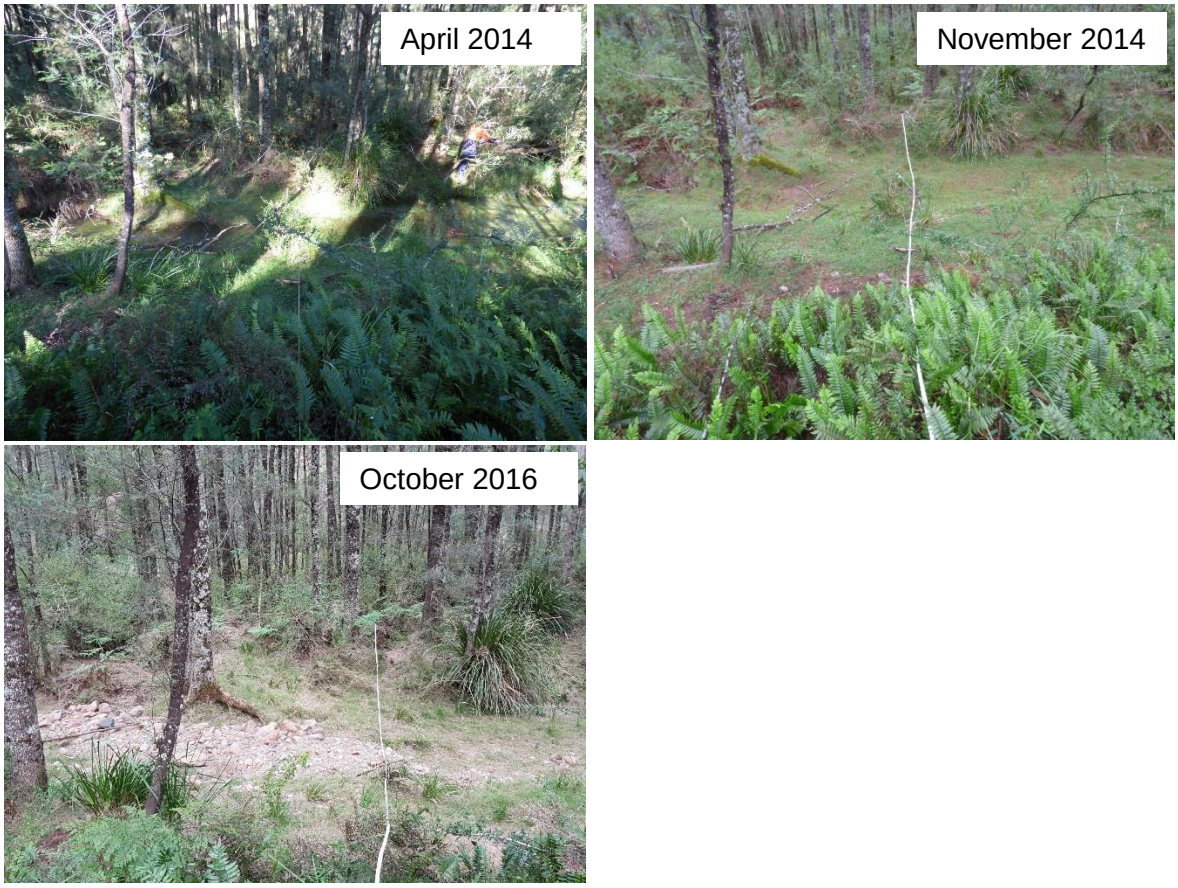


**Figure 22: The threshold trigger for new weed species at a location and new weed species at a site was triggered by *Solanum nigrum* (black nightshade) at site DTT004 20m transect**

April 2014 and November 2014 show baseline condition before *Solanum nigrum* was recorded, October 2016 is when the trigger was detected.

## Shoebridge Track

One camera was maintained on the track for the duration of the trial (last checked May 2016).

Over the 24-month trial period 50 horse riders (with 13 pack horses) were detected using the track (Figure 23). This represents seven groups, with horse riders passing usage cameras on 57 occasions (with 16 pack horse passes). Cameras experienced periods of failure due to technical faults, with one period of 198 days during which no cameras were operational. Track users are presented in Figure 24 and a full list of users and animals detected over the trial period is available on the wilderness horse riding trial website (OEH 2016).

Sites were sampled for changes in track condition (track width, track depth and erosion), weeds, physical disturbances, landscape class and social monitoring with five thresholds triggered over the trial period (Table 9; Table 10). The threshold for track depth was triggered at one site in autumn 2015 (MSB002; Figure 25) and one site in autumn 2016 (MSB003; Figure 26).

Baseline sampling detected no weeds at any site on Shoebridge Track. In spring 2016 a single individual of one weed species (*Hypochaeris radicata* flatweed) was recorded (Table 10; Figure 27). This triggered two thresholds simultaneously: increased weed species number at a site and increased species number on a track. Flatweed is a common, widespread weed, usually dispersed by wind, with possible horse dispersal traits (Eco Logical 2016). No thresholds were triggered for increases in the percentage cover of weeds.

The threshold for social monitoring was triggered in summer 2015 through a letter of complaint about horse riders using the track. This was followed up in accordance with the agreed threshold responses (Table 10 and Appendix 2) which required follow-up correspondence and notification of user groups. The stakeholder has since attended meetings with local area staff and been provided with information about the trial and access to the relevant web reports. There was no other ministerial correspondence or further official complaints regarding horse riding at this location.

No thresholds were triggered for changes in track condition (track width, track depth and erosion), physical disturbances (including pathogens) or landscape class (Table 9).

The Area Manager was notified of the threshold triggers and appropriate action was assessed in accordance with the agreed management responses (Table 10; Appendix 2), taking into account photo points (Figure 25; Figure 26) from the sampling events and local knowledge of the sites, track and wilderness area.

**Table 9: Indicators measured at Shoebridge Track and the number of horse riders detected using the track**

Biannual site data was compared to baseline data and agreed thresholds (Appendix 2).

| Measure | Number of sites surveyed | Autumn 2014 to Spring 2014 | Spring 2014 to Autumn 2015 | Autumn 2015 to Summer 2015 | Summer 2015 to Autumn 2016 | Autumn 2016 to Spring 2016 | Totals |
|---|---|---|---|---|---|---|---|
| | | **Count** | | | | | |
| Horse riders | 1 | 19 | 0 | 22 | 9 | n/a | 50 |
| Days with no cameras active | 1 | 0 | 198 | 0 | 0 | n/a | 198 |
| | | **Number of thresholds triggered** | | | | | |
| Average track width | Track average | 0 | 0 | 0 | 0 | n/a | 0 |
| Erosion area | 3 | 0 | 0 | 0 | 0 | n/a | 0 |
| Average track erosion area | Track average | 0 | 0 | 0 | 0 | n/a | 0 |
| Depth of track | 3 | 0 | 1 | 0 | 1 | n/a | 2 |
| New weed species (location) | 3 | n/a | n/a | n/a | n/a | 1 | 1 |
| New weed species (site) | 3 | n/a | n/a | n/a | n/a | 1 | 1 |
| Weed cover increase | 3 | n/a | n/a | n/a | n/a | 0 | 0 |
| Pathogens | 3 | 0 | 0 | 0 | 0 | n/a | 0 |
| Landscape Classification Score | 1 | 0 | 0 | 0 | 0 | n/a | 0 |
| Social cohesion | n/a | 0 | 0 | 1 | 0 | n/a | 1 |

**Table 10: Threshold exceedances at Shoebridge Track**

| | | | |
|---|---|---|---|
| **Depth of track (5cm increase)**<br>**Agreed management intervention – notify Area Manager who will assess options for on-ground response** | | | |
| **Site** | **Sample period** | **Baseline** | **Trigger measure** |
| MSB002 | Autumn 2015 | 32.9 | 38.1 (Figure 25) |
| MSB003 | Autumn 2016 | 19.5 | 28.8 (Figure 26) |
| **New weed species at location**<br>**Agreed management intervention – enact regional pest management strategy** | | | |
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| n/a | *Hypochaeris radicata* | Not detected | Detected (Figure 27) |
| **New weed species at a site**<br>**Agreed management intervention – notify Area Manager and key groups** | | | |
| **Site** | **Trigger species** | **Baseline** | **Trigger measure (spring 2016)** |
| MSB003 | *Hypochaeris radicata* | Not detected | Detected (Figure 27) |
| **Social monitoring – site specific complaint**<br>**Agreed management intervention – all reports followed up and communicated to user groups** | | | |
| **Site** | **Sample period** | **Baseline** | **Trigger measure** |
| n/a | Summer 2015 | n/a | Complaint |

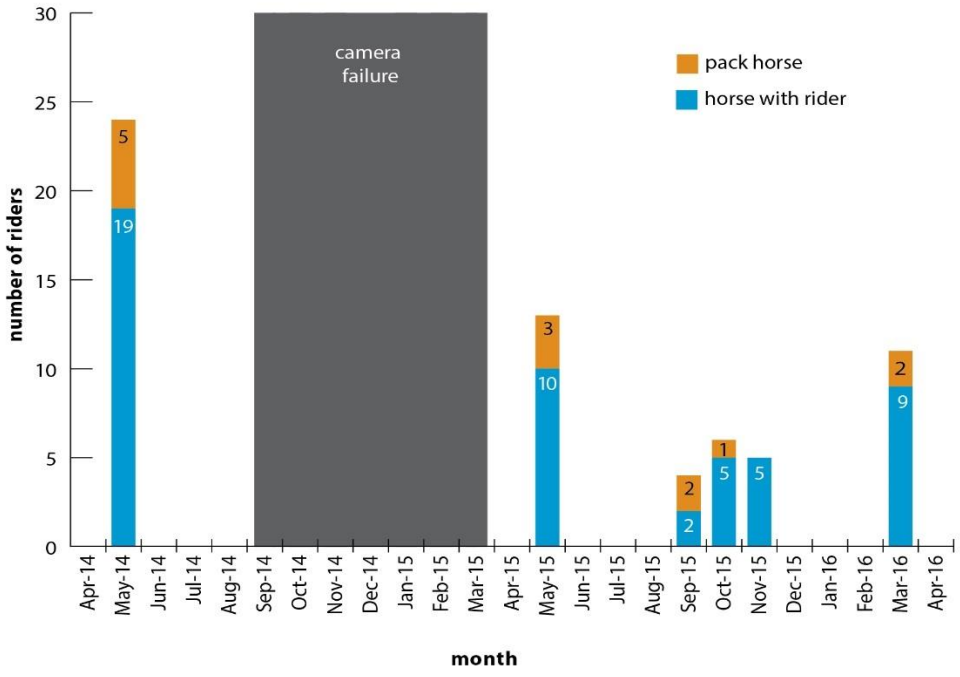


**Figure 23: Authorised horse riders (and pack horses) detected on Shoebridge Track**
Users were detected using a motion sensitive camera. The camera failed for one 198-day period.

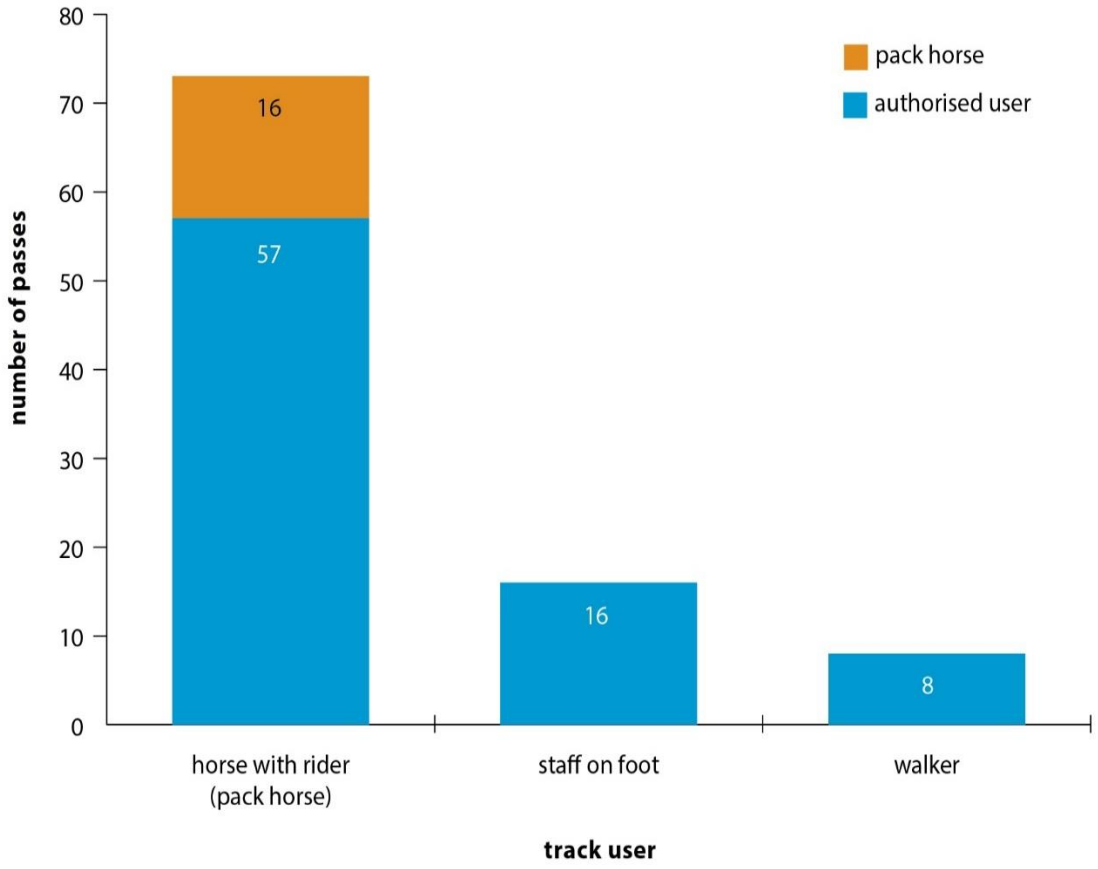


**Figure 24: Track usage on Shoebridge Track, determined using a motion sensitive camera**
'Number of passes' represents the number of times users passed the camera, with one user passing multiple times represented as multiple passes. The camera failed for one 198-day period.


**Figure 25: Photo points showing threshold trigger for track depth at site MSB002**
Measurements are taken across the track, between two white pegs. February 2014 shows baseline track condition and March 2015 is when the trigger was detected.


**Figure 26: Photo points showing threshold trigger for track depth at site MSB003**
Measurements are taken across the track, between two white pegs. February 2014 shows baseline track condition and May 2016 is when the trigger was detected.


**Figure 27: The threshold trigger for new weed species at a location and new weed species at a site was triggered by *Hypochaeris radicata* (flatweed) at site MSB003 5m transect**
April 2014 and November 2014 show baseline condition before *Hypochaeris radicata* was recorded. October 2016 is when the trigger was detected.

## 3.5 Social monitoring

### Online survey

The social monitoring online survey received 21 responses over the trial period. With few respondents relative to track and trail users, the results should be considered indicative at

best. Shoebridge Track was the most visited by respondents, followed by WD Tarlinton Track, and the Nine Mile section of the Kosciuszko trial location. Respondents rarely visited, or did not visit other tracks and trails.

The majority of respondents agreed that the wilderness values of tracks and trails were an important reason for their activity. Horse riding was the most popular primary activity undertaken by respondents, closely followed by hiking/bushwalking.

Almost half of all respondents felt that they were negatively impacted by horse riding on the trial tracks/trails, with the majority of those feeling that the impact was strongly negative. Around a third felt that they were positively impacted by horse riders. For those who felt the impact of horse riders was negative, a range of impacts were cited with the most significant being damage to plants/soil, leaving animal waste, frightening wildlife, creating litter and potential collision/injury. Of the respondents who evaluated horse riding, approximately 60% thought that the activity should be permitted and 40% did not.

## Complaint, feedback and correspondence monitoring

A total of eight written complaints were received during the trial period. Complaints were not specific to any trial location and were generally in opposition to horse riding in wilderness areas and the conducting of the trial.

All complaints requested that the trials be terminated. The rationale provided for ceasing the trial included:

- incompatibility of horse riding with the principles of wilderness
- evidence of illegal activity occurring
- wilderness is only valuable if free from the impacts of human activity
- parks are not suitable for all recreational activities
- parks should not be a place to make money
- horse riding is not considered as a self-reliant activity as required under the *Wilderness Act 1987*
- failure of the adaptive management process to protect wilderness areas from environmental damage
- soil compaction
- group sizes.

All complaints were considered and a response was provided for each. The responses confirmed that the trial would continue with adherence to the adaptive management framework that was developed to support the trial and to enable an evidence based decision on the future of horse riding in these wilderness areas.

# 4. Discussion

The monitoring program was successful in meeting its objectives (Section 1.2) using the adaptive management monitoring framework. Specifically, it was able to detect impacts to the key values of the wilderness areas and use thresholds to trigger management interventions and keep changes within acceptable limits. There were few horse riders utilising the tracks/trails and few impacts were detected. Some tracks and trails monitored in this trial are also used for management purposes and may regularly be regraded to maintain accessibility; doing so restores some monitoring parameters back to reference condition.

Unauthorised users and feral animals, or a combination of these, may also contribute to changing track condition and may impact on wilderness values. It is difficult to predict the influence that prolonged use or an increase in horse rider numbers would have. The wilderness values of these areas were not compromised throughout the horse riding trial.

The monitoring revealed few horse riders participating in the trial, across all tracks and trails. This was particularly evident at Mummel Gulf National Park (Mummel Gulf Wilderness Area), where no horse riders were detected on the trails at any time during the 24-month trial. The online survey also revealed limited engagement by proponents for or against horse riding in these wilderness areas. It is difficult to predict the impact that horse riding may have environmentally and socially if usage increases. If the tracks/trails remain open to horse riding, usage monitoring would be critical to ensure that numbers do not increase without potential physical and social impacts being detected.

Threshold triggers enacted management interventions several times throughout the trial. Interventions involved further site assessment, trail maintenance or stakeholder correspondence and notification. Responses were considered successful as they utilised local knowledge to ensure they were targeted and appropriate to the value at risk. Future management responses may be expanded to include the addition of more monitoring sites in response to certain threshold triggers.

Weed thresholds were triggered at all trial locations. Weed threshold triggers were generally common garden or agricultural species, some of environmental concern and some with potential horse dispersal traits (Eco Logical 2014; Weaver & Adams 1996; communication by NPWS Pests and Weeds Team). Most triggers indicated an increase in weed percentage cover or weeds being detected at sites along tracks or trails where they were already known to occur. Monitoring cannot attribute the cause of the triggers, however with few horse riders and variable environmental conditions between sampling events, the triggers may represent natural variation.

The weed surveys were conducted in spring 2016 following the wettest September ever recorded in NSW (BOM 2016). This may have influenced seedbank germination and percentage cover at survey sites. The suitability of the measures should be reviewed considering the short duration of the trial and the influence of environmental factors on plant growth and germination. Future monitoring may benefit from revision of weed thresholds and may incorporate additional weed sampling events to help eliminate seasonal and environmental influences. The weed threshold triggers demonstrate the dynamic challenge of weeds in wilderness areas and all weed triggers are being assessed and managed by local area staff in accordance with regional pest management strategies.

The vast majority of thresholds were not triggered over the sample period, which is unsurprising given the low numbers of horse riders using the tracks and trails. Most measures, including Landscape Classification Scores, did not trigger any thresholds. This suggests that the naturalness of the landscapes was not altered from a visitor use or management perspective (EPA QLD 2007a; EPA QLD 2007b).

The monitoring program was not designed to attribute the cause of site change to horse riders specifically, but to protect the values from impacts from any source. The indicators

were successful in detecting and mitigating impacts from vehicles (Section 3.3) within the available timeframe, which suggests they are suitable for this purpose.

Improvements could be made in the methods used for usage monitoring of the tracks and trails as the motion sensitive cameras suffered multiple technical failures and one act of vandalism. As a consequence, we do not assert a complete knowledge of track use. Cameras remain the best tool that we currently have for quantifying and categorising track/trail use however detection may have been improved if cameras were checked more frequently or if additional cameras were installed.

Given the low usage by horse riders and few threshold exceedances, if horse riding is to continue on these tracks/trails a streamlined monitoring approach is recommended. This may primarily involve usage monitoring using motion sensitive cameras, checked frequently to avoid long periods of camera failure. Horse rider usage thresholds should be set with reference to technical experts and stakeholders. If horse rider numbers exceed an agreed threshold, a more intensive monitoring design should then be implemented using the indicators, thresholds and management interventions defined in this program.

A more flexible approach to setting and reviewing thresholds is also recommended if horse riding is to continue. The workshop process was valuable in identifying stakeholder values and setting initial thresholds; however, a more rapid, adaptable approach for reviewing and refining thresholds would be useful during the data collection process. The ongoing engagement of stakeholders and technical experts, beyond initial threshold development, could allow for adapting and modifying monitoring design in response to real-world data and limitations.

The rapid implementation of the horse riding trial allowed for only one baseline sampling event (during summer and autumn 2014) and all subsequent sampling was then compared to this baseline. There are two potential issues with this approach. Firstly, comparing to one baseline sampling event does not allow for seasonal variation, meaning natural fluctuations (such as spring vegetation growth or autumn flooding) may trigger a threshold which is difficult to differentiate from genuine indicators of impact. Secondly, with one baseline sampling event anomalies or observer errors at baseline may result in false threshold triggers thereafter. It is recommended that future monitoring programs use several sampling events to form a baseline dataset. If horse riding at these locations is to continue, it is recommended that the data from this program be considered as the new baseline for future monitoring on these tracks and trails. This is justifiable as the tracks/trails were subject to very little horse riding and suffered few measurable impacts.

# 5. Conclusion

The monitoring program was successful in detecting indicator changes and mitigating impacts to values throughout the trial. Monitoring revealed that very few horse riders were utilising the tracks and trails. Thresholds were triggered rarely and management interventions were successfully enacted to demonstrate minimal impact to each track/trail. Critically, the objectives of the program were met and the wilderness values of these areas were not compromised throughout the horse riding trial.

## 5.1 Recommendations

If horse riding is to continue on **current** tracks and trails, the following recommendations should be considered:

1. The data from this trial should be aggregated to become the new baseline for comparison to future monitoring.
2. The current approach should be adapted to focus on measures that are most meaningful, consistent and readily measured. For example, track/trail usage monitoring should continue and potentially be expanded to include more cameras or more frequent usage data collection.
3. Social impact monitoring should continue and focus on on-track/trail interactions.
4. Usage thresholds, if required, should be defined, with reference to technical advisors and stakeholders, as appropriate.
5. More intensive monitoring and potentially usage restrictions should be capable of being activated if defined usage thresholds are exceeded.
6. Monitoring data should continue to be made available to the public on a regular basis.
7. Monitoring results and analysis should be peer reviewed triennially.

## 5.2 Suggestions for future horse riding in wilderness proposals

If new horse riding in wilderness trials are proposed in the future, appropriate monitoring should be considered. Monitoring should reference the values and characteristics of the proposed location and may consider using the current adaptive management framework. If so, it is recommended that the following approach be considered:

1. Utilise and adapt the current adaptive management monitoring framework, including identifying park specific values and impacts. Values may be garnered from plans of management, stakeholders, technical experts, area staff and others, and are likely to be driven by local considerations such as cultural assets and environmental systems.
2. Baseline data about key values and attributes at each track or trail should be gathered well before horse riding commences and when seasonal conditions are optimal to do so. This should include a basic weeds survey that is repeated at appropriate and meaningful intervals (see Table 11).
3. Monitoring indicators, usage thresholds and management interventions should be defined with reference to relevant technical advisors and stakeholders, as appropriate.
4. Track/trail usage and impact monitoring should maximise the use of cameras and photo points and include a minimum set of quantitative attributes that are best monitored using this approach.
5. Social impact monitoring should be included and focus on on-track/trail interactions.
6. More intensive monitoring and potentially usage restrictions should be capable of being activated if defined thresholds are exceeded without an effective or timely mitigation response.
7. Monitoring data should be made available to the public on a regular basis.
8. Monitoring results and analysis should be peer reviewed triennially.

If horse riding in wilderness is to continue, the monitoring methods and framework should be reviewed periodically as data becomes available, to ensure the approach continues to be pragmatic and fit for purpose.

**Table 11: Usage thresholds and associated actions recommended for implementation of horse riding trials**

| Threshold number of horse riders | Action |
|---|---|
| 0 (before trial) | Several baseline sampling events conducted across multiple seasons |
| < threshold usage level | Usage monitoring and management |
| > threshold usage level | Usage monitoring and management<br>Track/trail indicator monitoring and management interventions enacted as required |

# 6. References

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# 7. Glossary

**Authorised users:** visitors utilising the trial tracks/trails lawfully.

**Fan-out site:** a monitoring area where riders are likely to spend time and/or deviate from the trail.

**Impact:** a deterioration or change in the state of a value, e.g. weed incursion, erosion.

**Indicator:** a measure that suggests an impact on a value is occurring, e.g. presence of a new weed species, trail incision.

**LCS:** The Landscape Classification System for visitor management (EPA QLD 2007a; EPA QLD 2007b) is a tool for assessing a landscape setting and provides a scoring system for biophysical, managerial and social aspects.

**Location:** a wilderness area containing trails and/or tracks.

**Management intervention:** an action undertaken in response to a threshold being triggered, e.g. weed control, temporary trail closure or remediation works.

**NPWS:** NSW National Parks and Wildlife Service.

**OEH**: NSW Office of Environment and Heritage.

**Passes:** the number of times a user travels in front of a usage camera on a track/trail.

**Site:** a position along a track/trail at which monitoring occurs.

**Threshold:** a defined point at which management intervention must be implemented, e.g. presence or density of a particular weed species, trail incision to a given depth.

**Track:** an unmaintained, narrow, walking sized pathway that may be indistinct in places and is not traversable by vehicle.

**Trail:** a maintained dirt or gravel road, traversable in a four wheel drive vehicle, e.g. a fire trail.

**Unauthorised users:** visitors detected travelling with a dog, travelling with a dog and a wild foal, using motorised transport in wilderness areas, or horse riding in the Kosciuszko trial area during the June to October closure period.

**Value:** an environmental, heritage or social element that is of importance to wilderness, e.g. vegetation values, soil values.

# Appendix 1: Values considered for monitoring and the rationale for their inclusion or omission

| Value | Potential impact (indicators) | Included in framework? | Considerations and limitations |
|---|---|---|---|
| Native vegetation | New weed incursion or spread | Yes | Monitored at sites selected based on soil wetness<br>Focus on new incursions and known horse vector weeds<br>Two years unlikely to be adequate time to effectively assess weed spread |
| | Grazing or browsing at key locations along trail | Yes | Can be easily captured and quantified at sites and may be relevant at stopping/camping locations<br>Most relevant in locations with sensitive plant communities or populations<br>None are currently recorded from trial sites, but all sites will be monitored using a rapid assessment method |
| | Introduction of pathogens | Yes | Can be captured at sites and along trails by rapid visual assessment (e.g. signs of dieback) but would be difficult to attribute to cause of introduction |
| Soil | Erosion (track incision) | Yes | Monitored at all sites |
| | Compaction | Yes | Monitored at all sites |
| | Trail widening | Yes | Monitored at all sites<br>Unlikely to be relevant on management trails, which are maintained at a width dictated by fire management requirements, unless trail braiding occurs |
| | Trail braiding/ formation of informal trails | Yes | Captured responsively, in addition to identification of likely locations for trail deviation<br>Difficult to capture in Kosciuszko due to the presence of a large population of feral horses |
| Water | Increased turbidity | No | Considered practically unfeasible and unlikely to yield meaningful data at a local or catchment level<br>Highly influenced by rainfall and flow and subject to temporal variation<br>Likely to be influenced by increase in erosion and/or manure, both of which are included in the monitoring methods |
| | Increased nitrification | No | |

| Value | Potential impact (indicators) | Included in framework? | Considerations and limitations |
|---|---|---|---|
| Threatened species | Interruption of life cycle | No | Desktop assessment of threatened species recorded in a 5km area of the trails used to decide whether or not to include<br>Monitoring of threats to habitat likely to be more meaningful and practical in the timeframe of the trial than developing specific local monitoring for threatened species |
| Social | Decreased visual amenity | Yes | Changes in rubbish and vandalism captured at sites and along trails by rapid visual assessment<br>Landscape Classification System provides a rapid assessment tool that captures change in sense of wilderness |
| | Decreased visitor satisfaction (horse riding or non- horse riding groups) | Yes | Survey designed to target riding and non-riding trail users<br>Change can be captured using Landscape Classification system |
| | Increased visitor satisfaction (horse riding or non- horse riding groups) | | |
| | Negative public perception | Yes | Can be quantified by tracking of correspondence and online survey responses |
| | Increased public support | | |

# Appendix 2: Indicators, management thresholds and management responses for all horse riding in wilderness trial locations

Far South Coast thresholds and responses apply to Georges Pack Track, WD Tarlinton Track and the Shoebridge Track. Thresholds were developed primarily through a series of facilitated workshops using a structured decision-making approach, and follow-up review by NPWS staff in relation to baseline data.

| Indicator | Monitoring level | Mummel Gulf | | Kosciuszko | | Far South Coast | |
|---|---|---|---|---|---|---|---|
| | | Threshold | Response | Threshold | Response | Threshold | Response |
| **Track width** | **Average** | +10% | Notify Area Manager, who will assess options including minimal hardening/ restricting with barriers (logs, etc.) and implement as necessary<br>Consider track head signage | +10% | Notify Area Manager who will assess need for hardening and implement as appropriate<br>Notify relevant stakeholders if action is required | +10% | Notify Area Manager & key groups |
| | | | | | | +20% | Assess need for hardening |
| | **Site** | +20% | Assess need for hardening or restricting with barriers (logs, etc.) | +20% | Assess need for hardening and implement as appropriate<br>Notify relevant stakeholders if action is required | – | – |
| | **Sites without existing trail** | Any evidence of trail formation (Sites MDH002 & MDH007 only) | Notify Area Manager, who will assess options including restricting with barriers (logs, etc.) and implement as necessary | – | – | – | – |

| Indicator | Monitoring level | Mummel Gulf | | Kosciuszko | | Far South Coast | |
|---|---|---|---|---|---|---|---|
| | | **Threshold** | **Response** | **Threshold** | **Response** | **Threshold** | **Response** |
| **Soil compaction** | **Average** | +/–40% | Notify Area Manager, who will assess options including minimal erosion control measures and implement as necessary | +/–50% | Notify Area Manager who will assess options for on-ground response | +/–100% | Notify Area Manager who will assess options for on-ground response |
| | **Site** | +/–25% (fan-out site MDH007 only) | Assess need for erosion control measures | +50% (fan-out sites only KNP017, KNPCAMP2, KNPCAMP3) | Notify Area Manager who will assess need for remediation work as appropriate<br>Notify relevant stakeholders if action is required | +/–50% | Notify Area Manager who will assess options for on-ground response |
| **Erosion area** | **Average** | +40 percentage points | Notify Area Manager, who will assess options including need for track hardening and/or erosion control and implement as necessary | +20 percentage points | Notify Area Manager who will assess need for remediation work as appropriate<br>Notify relevant stakeholders if action is required | +20 percentage points | Notify Area Manager who will assess options for on-ground response |
| | **Site** | +50 percentage points (steep site) | Assess need for erosion control measures | +50 percentage points | Notify Area Manager who will assess options for on-ground response | +50 percentage points | Notify Area Manager who will assess options for on-ground response |
| | | +25 percentage points (lowland site) | Assess need for track hardening and/or erosion control | | | | |

| Indicator | Monitoring level | Mummel Gulf | | Kosciuszko | | Far South Coast | |
|---|---|---|---|---|---|---|---|
| | | Threshold | Response | Threshold | Response | Threshold | Response |
| **Depth in quadrat (track depth)** | **Average** | +5cm | Assess need for minimal track hardening and/or erosion control | – | – | – | – |
| | **Site** | – | – | +10cm | Notify Area Manager who will assess need for remediation work as appropriate<br>Notify relevant stakeholders if action is required | +5cm | Notify Area Manager who will assess options for on-ground response |
| **Weed species number** | **Location** | +1 | Enact regional pest management strategy and Walcha Area Pest Plan | +1 | Enact regional pest management strategy<br>Notify relevant stakeholders if action is required | +1 | Enact regional pest management strategy |
| | **Site** | +1 | Enact regional pest management strategy and Walcha Area Pest Plan | +1 | Enact regional pest management strategy<br>Notify relevant stakeholders if action is required | +1 | Notify Area Manager and key groups |
| **Weed species % cover** | **Site** | +25% | Enact regional pest management strategy and Walcha Area Pest Plan | +100% | Notify Area Manager. Enact regional pest management strategy<br>Notify relevant stakeholders if action is required | +20 percentage points | Enact regional pest management strategy |

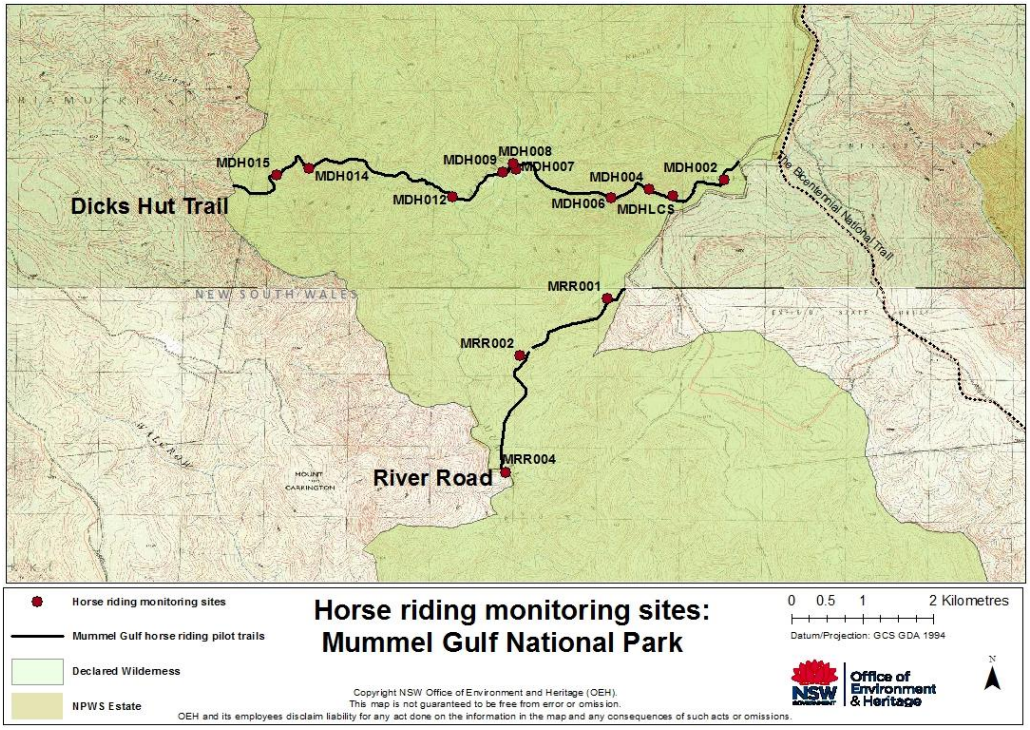
| Indicator | Monitoring level | Mummel Gulf | | Kosciuszko | | Far South Coast | |
|---|---|---|---|---|---|---|---|
| | | **Threshold** | **Response** | **Threshold** | **Response** | **Threshold** | **Response** |
| **Pathogens** | **Site** | 1) Visual evidence | Soil testing and possible temporary site closure | 1) Visual evidence | Soil testing | 1) Visual evidence | Soil testing |
| | | 2) Confirmed presence | Temporary closure and treatment, hygiene protocol implementation | 2) Confirmed presence | Temporary closure and treatment, hygiene protocol implementation | 2) Confirmed presence | Temporary closure, treatment, hygiene protocol implementation |
| **Heritage assets** | **Site** | No heritage items of concern identified in trial area | – | Damage or deterioration | Enact existing management plan<br>Notify relevant stakeholders if action is required | No heritage items of concern identified in trial area | – |
| **Landscape class** | **Site** | +1 | Investigate and treat physical, social or managerial factor that caused increase | +1 | Investigate and treat physical, social or managerial factor that caused increase | +1 | Investigate and treat physical, social or managerial factor that caused increase |
| **Social monitoring** | **Track/trail** | Validated feedback | Reports followed up and communicated if necessary to users | Confirmed complaint | Reports followed up and communicated if necessary to users | Complaint | All reports followed up and communicated to user groups |

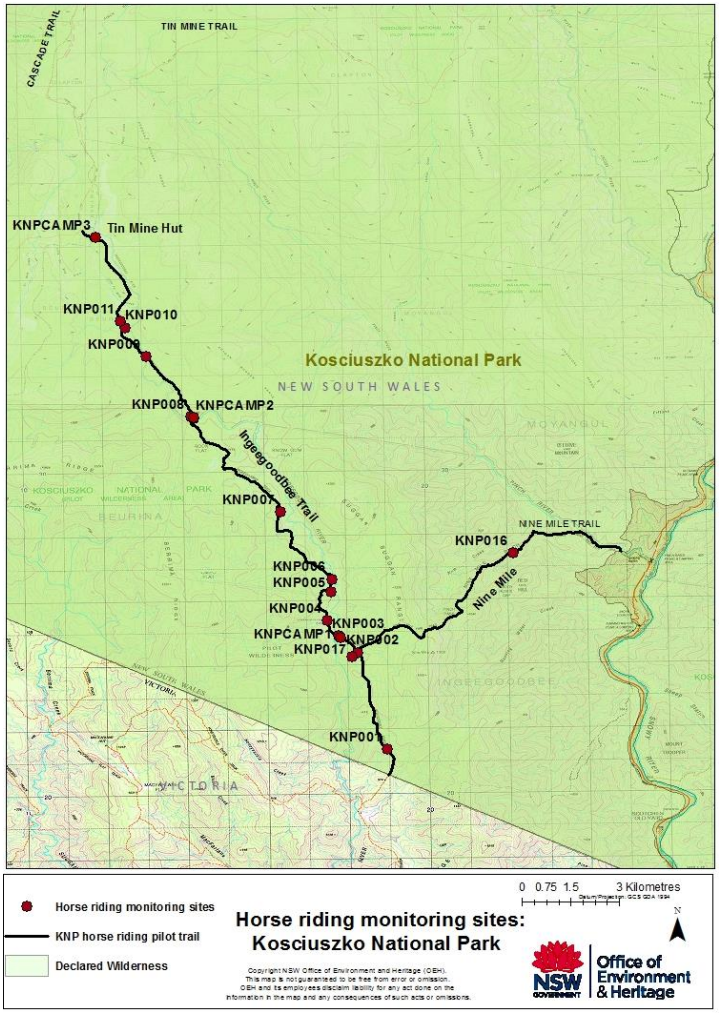
# Appendix 3: Site type, definition and methods to be applied

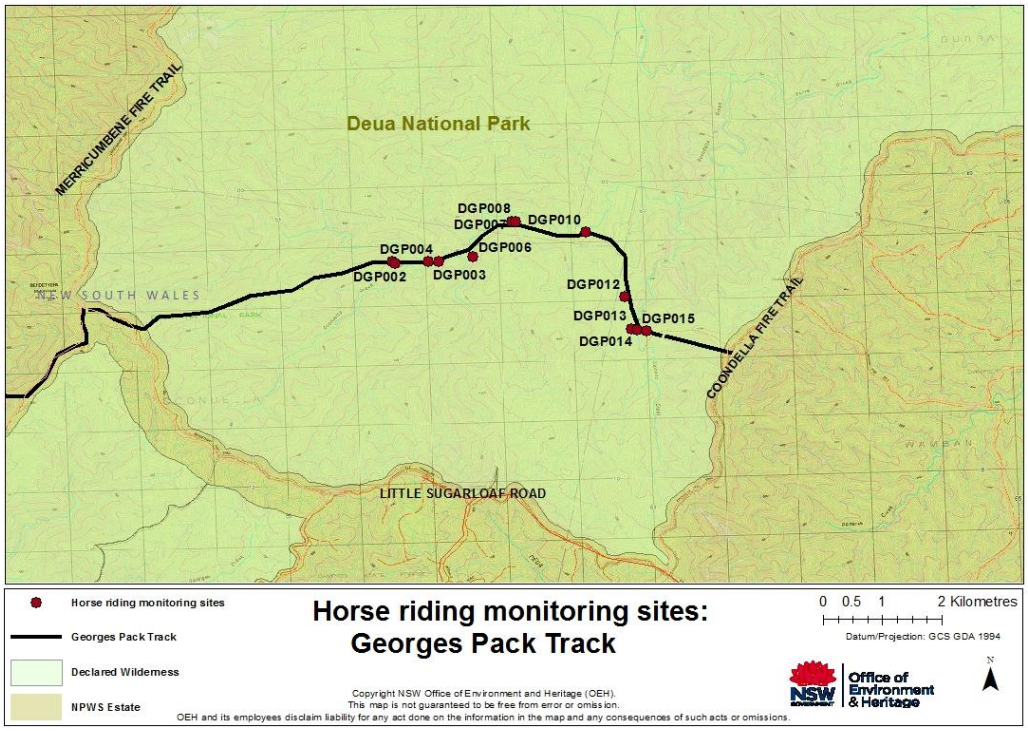
| Site type | Definition | Sites | Methods to be applied |
|---|---|---|---|
| Simple trail, on slope | Trail runs on land identified as erodible, but no other sensitivity issues are apparent | **Mummel Gulf:** MDH004, MDH006, MDH015, MRR001, MRR002<br>**Kosciuszko:** KNP001, KNP016<br>**Georges Pack:** DGP001, DGP002, DGP007, DGP008, DGP015<br>**WD Tarlinton:** DTT005, DTT007, DTT010, DTT011, DTT013<br>**Shoebridge:** MSB002, MSB003, MSB004 | Track condition<br>Photo point<br>Weed assessment<br>Additional physical disturbances |
| Simple trail, wet area | Trail crosses a drainage line or wet area with little opportunity for deviation from the trail | **Mummel Gulf:** MDH008, MDH009, MDH012, MDH014, MRR004<br>**Kosciuszko:** KNP002, KNP003, KNP004, KNP005, KNP006, KNP007, KNP008, KNP009, KNP010, KNP011<br>**Georges Pack:** DGP004, DGP012, DGP013, DGP014<br>**WD Tarlinton:** DTT003, DTT004, DTT012 | Track condition<br>Photo point<br>Weed assessment<br>Additional physical disturbances |
| Stopping/fan-out point | Trail intersects with a point where riders are likely to spend some time and/or deviate from the trail. This includes:<br>• water crossings where riders may stop or 'fan out' from the trail<br>• camping areas<br>• natural likely rest stops | **Mummel Gulf:** MDH007<br>**Kosciuszko:** KNP017, KNPCAMP2, KNPCAMP3<br>**Georges Pack**: DGP003, DGP010<br>**WD Tarlinton:** DTT006 | Multiple soil quadrats, taken to obtain representation of a defined site<br>Photo point<br>Application of the Landscape Classification System (subset)<br>Weed assessment<br>Additional physical disturbances |

| Site type | Definition | Sites | Methods to be applied |
|---|---|---|---|
| Potential trail deviation point (B) | Locations identified as potential trail deviation points where there may be risk of informal trail development | **Mummel Gulf:** MDH002 | Photo point<br>Scoring of informal trail development<br>Additional physical disturbances |
| Camera location (C) | Remote camera placed to monitor number and frequency of trail users and to be located at a subset of SS, SW or F points | Locations not indicated | Camera deployment |

# Appendix 4: Track/trail maps




Deua National Park
MERRICUMBENE FIRE TRAIL
DGP008
DGP007
DGP010
DGP004
DGP006
DGP002
DGP003
DGP012
DGP013
DGP015
DGP014
COONDELLA FIRE TRAIL
LITTLE SUGARLOAF ROAD
NEW SOUTH WALES
Horse riding monitoring sites
Georges Pack Track
Declared Wilderness
NPWS Estate
Horse riding monitoring sites:
Georges Pack Track
0 0.5 1 2 Kilometres
Datum/Projection: GCS GDA 1994
Office of Environment & Heritage
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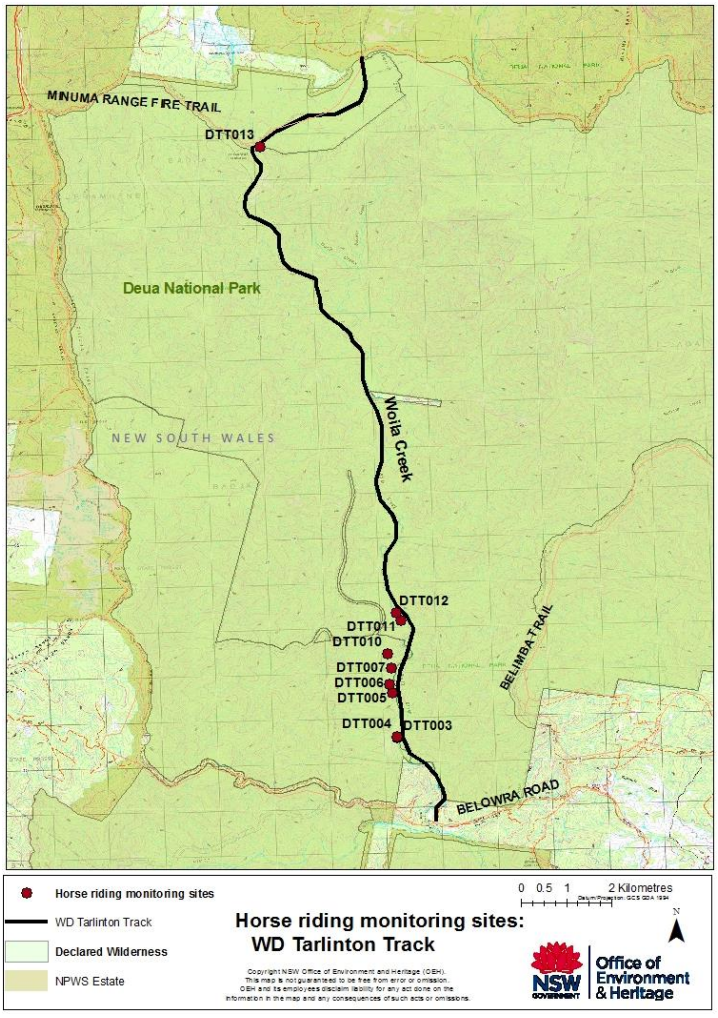
MINUMA RANGE FIRE TRAIL
DTT013
Deua National Park
NEW SOUTH WALES
Wolla Creek
DTT012
DTT011
DTT010
DTT007
DTT006
DTT005
DTT004
DTT003
BELIMBA TRAIL
BELOWRA ROAD
Horse riding monitoring sites
WD Tarlinton Track
Declared Wilderness
NPWS Estate
Horse riding monitoring sites:
WD Tarlinton Track
0 0.5 1 2 Kilometres
Office of Environment & Heritage
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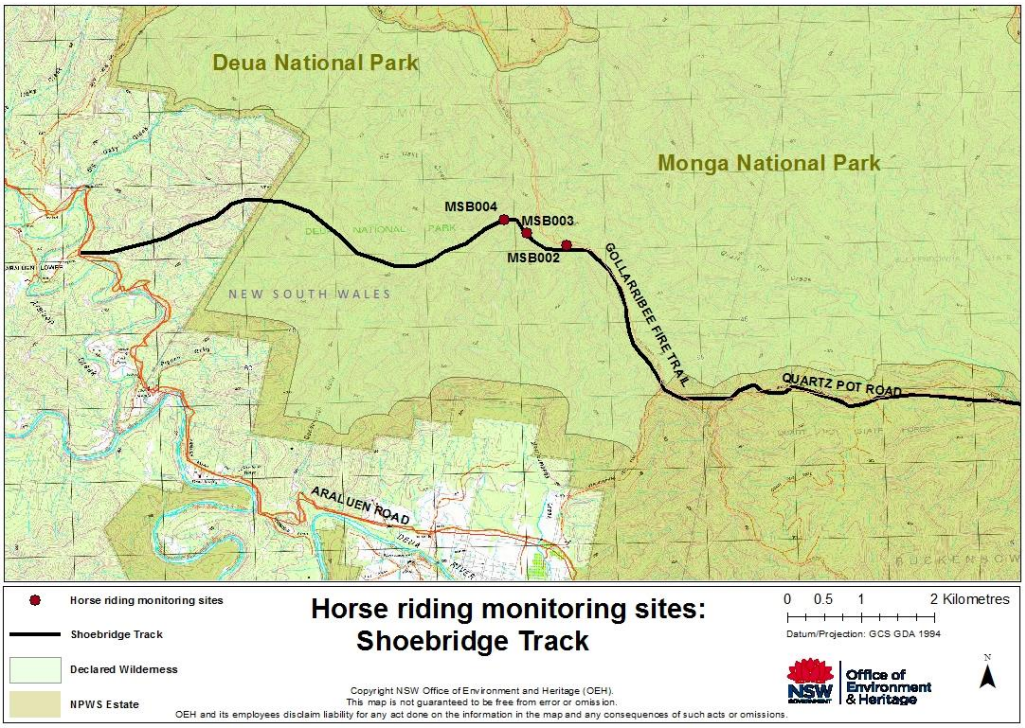
Deua National Park
Monga National Park
MSB004
MSB003
MSB002
GOLLARRIBEE FIRE TRAIL
QUARTZ POT ROAD
ARALUEN ROAD
NEW SOUTH WALES
Horse riding monitoring sites
Shoebridge Track
Declared Wilderness
NPWS Estate
Horse riding monitoring sites:
Shoebridge Track
0 0.5 1 2 Kilometres
Datum/Projection: GCS GDA 1994
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