Developing management thresholds for the N.S.W. Office of Environment and Heritage framework for trialling horse riding on wilderness trails

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SUMMARY

In November 2012 the NSW Government released the *Strategic Directions for Horse Riding in NSW National Parks* (OEH, 2012) - the 'strategy'. The strategy committed to providing horse riding opportunities in parks, including the implementation of a two-year pilot program involving a trial of horse riding in five wilderness areas, subject to adopted amendments to the relevant parks' plan of management. The proposed pilot program was to be based on a strategic adaptive management framework. The framework for this pilot program involved implementing the following process in collaboration with user groups (particularly the National Parks and Wildlife Service (NPWS) Horse Riding Consultative Group), regional advisory committee members, NPWS field staff, specialists and an expert panel.

Process:

1. Identify and agree on known or potential impacts on important park values which may arise in the context of the pilot program and the relevant park and plan of management;

2. Choose and agree on appropriate social, economic and environmental indicators of change for each of the known or potential impacts;

3. Develop a methodology for scientifically credible and practical monitoring, analysis and reporting on these indicators and their trends;

4. Agree on acceptable limits of change (i.e. thresholds or triggers) following the measurement and analysis of baseline data for each indicator; and

5. Agree on appropriate management intervention options for responding to any unacceptable change or observable trend (i.e. trigger or threshold exceeded) in the indicators.

This is the first time that NPWS has used such a framework to the implementation of a new visitor activity program. The pilot program has therefore been informed by the similar approaches adopted in South East Queensland (Pickering, 2008) and has been informed by other related reviews (e.g. Newsome et al, 2008). The Monitoring Framework for Wilderness Horse Riding Trial (OEH, 2014) summarises the general approach to be taken in implementing Steps 1-3 above. The University of Melbourne has experience in helping agencies adopt similar adaptive management approaches and was therefore engaged to assist the NSW NPWS in working through steps 4 and 5 of this process. This was achieved through the running of four workshop sessions.

A structured decision making (SDM) approach was used throughout these workshops. This approach ensures that management thresholds are clearly connected to key management objectives and that the monitoring indicators represent the most appropriate way to measure the performance in achieving management objectives. The SDM approach also identifies management alternatives that are available to influence the management objectives.

The first workshop was held with NSW OEH staff and key stakeholders on the 4th April, 2014 at Hurstville, Sydney. The primary aim of the workshop was to outline the process for setting thresholds to form part of the monitoring framework. A structured decision making approach was used in the workshop and is outlined in this report.

Subsequent regional workshops were conducted for each trial site (Kosciuszko NP, Deua NP, Mummel Gulf NP) with the aim of developing quantitative thresholds for each of the objectives identified in the first workshop. Each workshop included local staff and interested stakeholder representatives. The aim of these workshops was to specify thresholds (decision points) and management actions that meet the local context for each trail. The workshops prioritised the objectives developed in the first workshop with local context; identified any local issues and operational/management options that should be considered in developing the thresholds; and contributed local knowledge and expertise to the development of values for thresholds and management actions.

This document builds on the Monitoring Framework for Wilderness Horse Riding Trial (OEH, 2014) and further explains the SDM process, as well as documenting the outcomes of each of the workshops.

Contents

INTRODUCTION

This document compliments the Monitoring Framework for Wilderness Horse Riding Trial (OEH, 2014) by outlining the process used to establish management thresholds (acceptable limits of change) and providing the outputs from the four workshops held to achieve this end.

Threshold concepts in natural resource management

Thresholds are a useful tool for state-dependent, natural resource management decision-making. They provide a mechanism with which to decide when management should be implemented or altered, to prevent or reverse undesirable system changes (Nichols and Williams 2006, Lyons et al. 2008). In this context, management thresholds (referred to as *standards* in visitor management) are measurable statements that define limits of acceptable conditions. By specifying a limit on the amount of change that will be tolerated, thresholds narrow the focus of management from broad, qualitative statements of management intention, to specific statements about desired conditions that provide a basis for decisions. In visitor management, thresholds define the compromise between resource protection and access to (and quality of) recreational opportunities. Importantly, thresholds define the point past which conditions *become* unacceptable, they do not define desired or unacceptable conditions (Leung and Marion 2000).

Setting management thresholds ultimately involves inherently subjective and value-based management decisions. Meaningful and actionable thresholds need to be explicitly linked to fundamental management objectives via relevant indicators and appropriate management actions. It is desirable that thresholds are developed through a collaborative process with input from stakeholders.

Structured Decision Making

Structured decision making (hereafter SDM) is a tool for guiding managers through a decision process to facilitate transparent, logical and defensible decisions (Gregory et al. 2012). The SDM framework is applicable to a range of problem types, from localised decisions about specific issues to complex decisions with multiple stakeholders. Recently, SDM has been advocated as a useful approach for developing and setting thresholds for natural resource management (Martin et al. 2009, Gutenspergen 2014).

An SDM decision framework is driven by the objectives, or values, of those involved in the decision-making process. Essentially, the process involves an organised analysis of a problem to reach a decision that is focused explicitly on addressing fundamental objectives. This is accomplished through a core set of steps which help to structure and guide thinking about the decision problem (Runge 2011, Gregory et al. 2012). Each step of the SDM approach is undertaken formally and cooperatively to support defensible decision making. These steps are shown in Figure 1 and key definitions of common terms used are shown in Table 1. In the workshops, we worked through the first four steps of the framework.
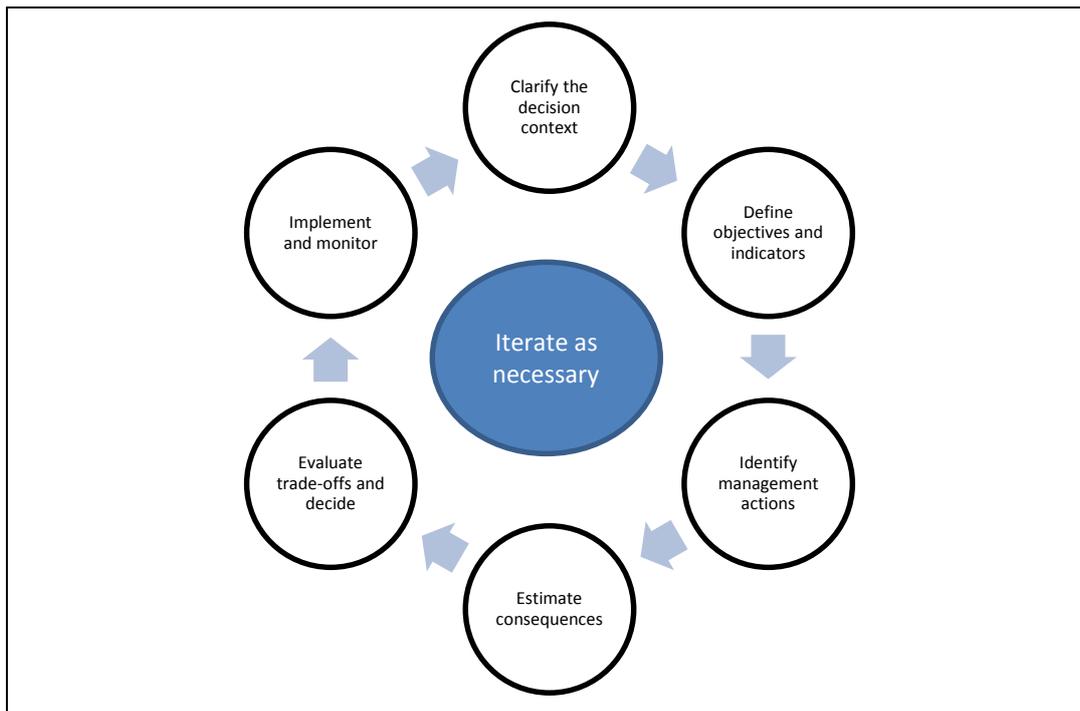
Figure 1: Steps in a Structured Decision Making Framework (from Gregory et al 2012)

Table 1: Definition of keys terms used in SDM

Fundamental objectives	The broadest objective that will be directly influenced by the management alternatives and within the control of the decision maker. The outcome you really care about.
Role in SDM	Used to evaluate the performance of management alternative
Example	Minimise number of weed species
Means objectives	The specific methods for meeting fundamental objectives.
Role in SDM	Need to be separated from fundamental objectives and inform management alternatives
Example	Minimise soil disturbance
Process objectives	Reflect how the decision should be made, or the design of the decision process
Role in SDM	Present in objectives hierarchies but not included decision analysis as they reflect desires about the decision process but do not directly influence the outcome
Example	Scientific credibility of approach to monitoring, analysis and reporting
Indicator (also called performance measure)	A specific metric
Role in SDM	Defines how an objective will be measured and evaluated in decision context
Example	Dollars ($) is often used as the indicator of total resource
Objectives hierarchy:	Categorising of objectives by type
Role in SDM	To distinguish between fundamental and means objectives

WORKSHOPS

Four participatory workshops were undertaken in order to engage staff and local stakeholders in the process of setting management thresholds. Details of the workshops are shown in Table 2.

Table 2: Details of the four workshops held in order to set management thresholds as part of the Monitoring Framework for Wilderness Horse Riding Trial

Location	Date	Aim	Park
Hurstville	4/4/14	Apply a SDM framework (steps 1-3) to define decision context, develop objectives and indicators, and identify candidate management actions	
Narooma	19/9/14	Specify management thresholds and management actions that meet the local context	Deua and Monga National Parks
Jindabyne	26/9/14	Specify thresholds and management actions that meet the local context	Kosciuszko National Park
Armidale	12/12/14	Specify thresholds and management actions that meet the local context	Mummel Gulf National Park

HURSTVILLE WORKSHOP

A structured decision making framework was utilised in the first Hurstville workshop. In the workshop, we worked through the first four steps of the SDM framework. The output from each step is outlined below.

Step 1: Clarify the decision context

Before the Hurstville workshop, the facilitators and OEH staff collaboratively defined the decision statement. This is an crucial step as it helps to bound and clarify what is important within the decision at hand (Gregory et al 2012).

The key elements of the decision statement include:

1. **Brief background/trigger** – NSW state government is expanding the range of recreational horse riding opportunities in parks, including on some select tracks and trails in wilderness.
2. **Who the ultimate decision maker is** – High level management in OEH
3. **Key stakeholders** – horse riders, other wilderness users, wilderness advocates, OEH staff
4. **What the decision is** – how to manage potential impacts on wilderness values in the locations in which the horse riding trial is taking place during the 2 year trial (using thresholds as indicators of impact)
5. **Scale and scope** (space and time) – the trial period 2 years, five trails in 4 National Parks
6. **Linked to other decisions** – if horse riding on trails and tracks in wilderness will be continued beyond the trial
7. **Constraints** – must trial horse riding on trails and tracks in wilderness, resources, and timing.

Decision Statement:

"The NSW government has committed to providing horse riding opportunities on trails and tracks in wilderness areas of national parks. This is being carried out through implementation of a two-year trial, with the introduction of horse riding on five trails/tracks in wilderness in National Parks. High level OEH management needs to determine how to manage impacts on wilderness values and park assets during the trial period within levels of acceptable change that ensure values are not irreparably degraded while facilitating public appreciation. Key stakeholders for this decision are horse riders, other wilderness users, wilderness advocates and OEH staff. This decision is constrained by available resources, timing, and the requirement that horse riding is trialed on trails and tracks in wilderness. Management of horse riding during the trial will contribute to a decision concerning this activity beyond the trial."

Step 2: Define objectives and indicators

Workshop participants collaboratively developed an objectives hierarchy. Fundamental, process, and means objectives were identified. Effective decision support deals with exclusively with fundamental objectives. Fundamental objectives define the core reasons for being interested in the decision (Keeney 2007). The fundamental objectives identified here are shown in Table 3. Process objectives govern the methods by which the decision will be made, who will be included, and how the decision will be documented and communicated; often the process objectives are influenced by agency or institutional policy (Runge and Walshe 2014). The achievement of process objectives rests substantially on the facilitator's capacity to assist decision-makers and stakeholders structure the decision problem appropriately and are not dealt with specifically during the steps of the framework. While process objectives may have an effect on the design of the decision process, they only relate indirectly to the outcome of the decision. Process objectives identified during the workshop are shown in Table 4.

Indicators are used to judge the performance of alternative actions with respect to the fundamental objectives. Indicators are measurable and on a scale that reflects the relative achievement of each fundamental objective (Runge and Walshe 2014). Here indicators were drawn from the monitoring framework and linked to the fundamental objectives that had been specified during Step 1 and shown in Table 3.

Table 3: Summary of fundamental objectives, indicators, the desired direction of change and associated management alternatives identified by participants in the Hurstville workshop (4 April 2014).

Objective	Indicator	Preference	Management Alternative
Track condition	Erosion (cross sectional area) Soil compaction (change in) Total track width (change in)	Minimise Minimise Minimise	Site hardening (targeted action at the site where change detected)
Weed species	Number of species (change in) Percentage cover (change in)	Minimise Minimise	Treat and remove as per Regional Pest Management Strategy Further monitoring
Pathogens	Visual presence	Minimise	Temporary or seasonal track closure Further monitoring Signs and notification
Landscape Classification	Landscape Class (change)	Minimise	Drill down (further investigation of the cause of change) to provide context for observed results
Heritage Assets	Presence of damage	Minimise	Regional process for maintenance and protection of heritage assets
Social cohesion	Number of incidents reported per user	Minimise	Separation of users in time and/or space
Horse riding wilderness users	Satisfaction index (%) per user	Maximise	Communication with user groups and education programs
"Other" Wilderness Users	Satisfaction index (%) per user	Maximise	Communication with user groups and education programs
Resources (staff time & cost of management actions)	Dollars	Minimise	Involve users of tracks and trails or other volunteers to undertake management actions/interventions

Table 4: Process objectives identified by participants during the Hurstville workshop (4 April 2014)

Process Objectives	Description
Scientific credibility	The monitoring program and management decisions are scientifically credible
Quality monitoring	The monitoring plan appropriately targeted and meaningful, is able to detect change, differentiate between recreation impacts and natural variability (including climate change)
User groups working together	Both horse riding and non horse riding users work together to ensure sustainable use of wilderness areas
Practical links	Practical links between methods, thresholds and management
Balance	Finding a balance between the dual mandate of conserving the environment and providing recreation experiences
Increase appreciation	To increase appreciation and value of nature by creating visitor experience in wilderness areas

Step 3: Identify management actions

Management actions need to be able to influence objectives, by shifting the indicator in the desired direction. Within a SDM framework, alternatives can be a single action, or a management scenario that encompasses a range of management actions (Gregory *et al* 2012). We identified management actions for each of the objectives. This step ensures that for all indicators for which a threshold is set, decision makers have identified a potential response that can satisfy each fundamental objective. The management actions identified are outlined in Table 3.

Step 4: Estimate consequences

For this step, we developed a decision sketch that identified both positive and negative links between actions, indicators and objectives. The purpose of this is to determine any potential interactions between management actions associated with each objective and the other stated objectives. Any identified relationship should then be taken into account when determining the appropriate value of a threshold and how much variation for current conditions might be considered acceptable. For the purpose of this report, this decision sketch has been broken down into its components, and displayed in Table 5.

Table 5: The decision sketch broken down into individual actions and the interactions with all fundamental objectives*

Action	Interaction	Objective (Indicator)
Regional process for managing heritage condition	Positive	Heritage Assets (condition/presence of damage)
	Negative	Resource ($)
Temporary/seasonal closure + extra monitoring	Positive	Pathogens (presence/absence)
	Positive	Weeds (% cover, # species)
	Positive	Track condition (all measures)
	Positive	Social cohesion (incidence reported)
	Negative	Horse riding wilderness users (satisfaction)
	Negative / positive	Other wilderness users (satisfaction) and resources
Treat and remove weeds as per strategy + extra monitoring for weeds?	Positive	Weeds (% cover, # species)
	Positive	Horse riding wilderness users (satisfaction)
	Positive	Other wilderness users (satisfaction)
Site hardening	Positive	Track condition (all measures)
	Negative	Weeds (% cover, # species)
	Negative	Landscape Class (LCS)
	Negative	Horse riding wilderness users (satisfaction)
	Negative	Other wilderness users (satisfaction)
	Negative	Resources ($)
Communications with stakeholders and education initiatives	Positive	Horse riding wilderness users (satisfaction)
	Positive	Other wilderness users (satisfaction)
	Positive	Social cohesion
	Negative	Resources ($)
Separation of users in time and space	Positive	Horse riding wilderness users (satisfaction)
	Positive	Other wilderness users (satisfaction)
	Positive	Social cohesion (incidence reported)
	Negative	Resources ($)
	Positive	Credible program (Process objective)
Drill down (further investigation of the cause of change) to provide context for observed results	Negative	Resources ($) *For this action to have a positive interaction with landscape condition, it would need a secondary action that would directly influence LCS rating*

*Additions to this table suggested in the regional workshops can be found in Table 6

SETTING THRESHOLDS: APPROACH IN REGIONAL WORKSHOPS

Through the process of the Hurstville workshop we identified: fundamental objectives, indicators for these objectives, actions that can influence the objectives and the positive or negative outcomes for each objective given the management actions. We recommended that thresholds be set for all indicators where management alternatives were identified that could have a positive impact. The quantity or value of this threshold would be based on:

1. The **baseline data** for each indicator, on each trail
2. The **number of positive and negative interactions** with other objectives and the relative strength of these interactions.
3. Manager's **weightings (values)** of each objective.

The setting of thresholds for each of the identified indicators was completed at secondary workshops held in the regions impacted by the trial. These regional workshops involved key parks staff and stakeholder representatives.

Thresholds were developed during the workshop through eliciting from parks staff what a response would be to a change in each indicator and then quantifying what level of change in each of the indicators would indicate the need for such a response. Some indicators required multiple thresholds with different associated responses. Thresholds were also set for both the site and average level for a number of indicators. A summary of the thresholds determined for each park can be found in Table 7, Table 8 and Table 9.

REGIONAL WORKSHOP RECOMMENDATIONS

Deua and Monga National Parks

1. The preferred terminology was 'tracks' rather than 'trails' to reflect the heritage values. The key European heritage assets for these parks are the tracks themselves. There are some passing lanes that have heritage value but are not impacted by the trial.

2. The presence/absence of trail braiding was suggested as an additional indicator of track condition.

3. The percentage bare ground was suggested as an additional indicator for erosion.

Kosciuszko National Park

1. The Lone Pine trail already has heavy horse rider use and is bordering a wilderness area, which may provide a reference for the kind of impact that could be expected with more intense usage over a longer timeframe.

2. North of the Tin Mine hut, the trail is similar to the trial area, but without horse riding. This provides potential for control/benchmark sites.

3. The presence/absence of trail braiding was suggested as an additional indicator of track condition. It was suggested that GPS locations could be recorded for any informal trails encountered.

4. Horse riding users can inform about presence of weed species. It was suggested that a formalised system be established for users reporting issues.

5. Soil compaction may be more relevant for monitoring camping areas than other measures used on trails.

Note that in Kosciuszko NP the trails will have seasonal use only, with closures in the winter, limiting the effective length of the two-year trail.

Mummel Gulf National Park

1. Erosion can be measured as bare ground as well as eroded area.

2. Trail braiding an issue with fan out points near water crossing sites.

3. Track width is not an issue with sites that are on the on the slope.

4. Seasonal closures is a management alternative for soil compaction of low, wet sites

5. Sites at different altitudes can be categorised as steep or low depending on the location. Different thresholds have been set for the two catergories for some indicators. This categorisation will need to be formalised to ensure that each site can be accurately allocated.

6. The depth of track measure will be most problematic on steep slopes

7. Increases in erosion (eroded area) is more likely to be a problem at low sites.

8. The LCS be used to assess whether a planned management action is appropriate to the setting (i.e. that an action does not negatively affect the landscape class

9. See Table 6 for suggested additions to the interactions between landscape class and management actions presented in Table 5.

Table 6: Interactions between the Landscape Class objective and the suggested management actions.

Action	Interaction	Objective (indicator)	Rationale
Temporary/seasonal closure + extra monitoring	Positive	Landscape Class	*Temporary closure may provide for rehabilitation of **physical** disturbance and assist in maintaining Landscape Class*
Treat and remove weeds as per strategy + extra monitoring for weeds?	Positive	Landscape Class	*Treatment of weeds may provide for rehabilitation of **physical** disturbance and assist in maintaining Landscape Class*
Communications with stakeholders and education initiatives	Negative or Positive	Landscape Class	***Management** inputs through the installation of signs could change the Landscape Class* *Use of online channels and mobile devices or off-site methods to communicate could achieve positive on-ground outcomes without the need for on-site management activity with possible change in Landscape Class*
Separation of users in time and space	Positive	Landscape Class	*Separation of users in space and time could reduce **social** impacts and assist in maintaining Landscape Class*

Table 7: Deua and Monga indicators (including direction of change), management thresholds and management response. Note some thresholds have two levels if thresholds, indicated as (1), (2).

Objective	Indicator	Monitoring level	Management threshold	Response
Track condition	Track width (+ change)	Average (1)	10%	Notify area manager and key groups
		(2)	20%	Assess need for hardening
	Soil compaction (change in)	Average	100%	
		Individual site	50%	
	Eroded area (+ change)	Average	20%	
		Individual site	50%	
	Depth in quadrat (+ change)	Average		
Weed species	Number of species (+ change)	Individual site	1	Notify area manager and key groups
		At trail	1	Enact regional pest management strategy
	Percentage cover (+ change)	Individual site	20 percentage points	Enact regional pest management strategy
Pathogens	Visual presence	Individual site	Any evidence of damage	Soil testing
			Confirmed presence of pathogen	Temporary closure, treatment, hygiene protocol implementation
Heritage Assets	Presence of damage (Huts)	Individual site	N/A	
Landscape Class	Score	Individual site		
Social cohesion	A reported complaint	Park	Confirmed complaint	All reports followed up and communicated to user groups

Table 8: Kosciuszko National Park indicators (including direction of change), management thresholds and management response. Note some thresholds have two levels if thresholds, indicated as (1), (2).

Objective	Indicator	Monitoring level	Management threshold	Response
Track condition	Track width (+ change)	Average	10%	Notify area manager and key groups
		Individual site (1)	25%	Notify area manager and key groups
		(2)	50%	Maintain site
	Soil compaction (change in)	Average	200%	Notify area manager and key groups
	Eroded area (+ change)	Average	10%	Notify area manager and key groups
	Depth in quadrat (+ change)	Average (1)	10cm	Notify area manager and key groups
		(2)	30cm	Maintain site
Weed species	Number of species (+ change)	Individual site	1	Notify area manager and key groups
		At trail	1	Enact regional pest management strategy
	Percentage cover (+ change)	Individual site	100%	Notify area manager and key groups
Pathogens	Visual presence	Individual site (1)	Any evidence of damage	Soil testing
		(2)	Confirmed presence of pathogen	Temporary closure and treatment, hygiene protocol implementation
Heritage Assets	Presence of damage (Huts)	Individual site	Damage or deterioration present	Enact existing management plan
Landscape Class	Score	Individual site	Increase in score	Drill down and treat cause
Social cohesion	A reported complaint	Park	Confirmed complaint	Follow complaint management guidelines

Table 9: Mummel Gulf indicators (including direction of change), management thresholds and management response

Objective	Indicator	Monitoring level	Management threshold	Response
Track condition	Track width (+ change)	Average	10%	Notify Area Manager, who will assess options including the need for minimal hardening or restricting with barriers (logs etc.) and implement as necessary. Consider track head signage.
		Individual site	20%	Assess need for hardening or restricting with barriers (logs etc.)
	Soil compaction (change in)	Average	40%	Notify Area Manager, who will assess options including the need for minimal erosion control measures and implement as necessary
	Steep (- change)	Individual site	50%	Assess need for erosion control measures
	Low lands (- change)	Individual site	25%	Assess need for minimal track hardening and/or erosion control
	Eroded area (+ change)	Average	40%	Notify Area Manager, who will assess options including need for track hardening and/or erosion control and implement as necessary
		Site (steep)	50%	Assess need for erosion control measures
		Site (low lands)	25%	Assess need for track hardening and/or erosion control
	Depth in quadrat (+ change)	Average	5cm	Assess need for minimal track hardening and/or erosion control
Weed species	Number of species (+ change)	Individual site	1	Enact regional pest management strategy and Walcha Area Pest Plan
		On trail	1	Enact regional pest management strategy and Walcha Area Pest Plan
	Percentage cover (+ change)	Individual site	25%	Enact regional pest management strategy and Walcha Area Pest Plan
Pathogens	Visual presence	Individual site	Possible evidence of pathogen	Soil testing and possible temporary site closure
			Confirmed presence of pathogen	Temporary closure and treatment, hygiene protocol implementation
Heritage Assets	Presence of damage	Individual site	N/A	
LCS	Increase in score	Individual site	1	Investigate and treat physical, social or managerial factor that caused increase
Social cohesion	User feedback	Trial area	Validated feedback	Reports followed up and communicate if necessary to users

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