a.s.miner
Geotechnical
Consulting Engineers
50 Calder Street, Manifold Heights, VICTORIA 3218
Tel : 03.52294568 Mobile : 0438.294568
ABN 72 856 478 451
Email: aminer@pipeline.com.au

The Department of Primary Industries

Field Verification of Relative Risk to Asset Rankings for Erosion and Landslides in Landscape Zones in the CCMA

Supporting Document to the Corangamite Soil Health Strategy

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Prepared for Troy Clarkson

Department of Primary Industries

PO Box 103

Geelong

VIC 3220

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Executive Summary

Soils are seen as a significant asset within the Corangamite region as they control water quality to a significant degree and provide the medium for plant and crop production whilst supporting infrastructure and development. In accordance with the overall aims of the Corangamite Regional Catchment Strategy, the Corangamite Soil Health Strategy (CSHS) was developed to promote soil health by reducing the consequences and effects of soil threatening processes which can impact both public and private assets.

In order to facilitate the assessment of soil related risks in the region, the CSHS adopted the Corangamite Landscape Zones as the basis for delineating the various soil threats throughout the region. 15 landscape zones exist throughout the CMA and these were each individually assessed for 12 different soil threatening processes.

The initial process of assessment was commenced in 2002 and has involved a number of workshops with technical experts and asset managers. A relative risk to asset method was adopted for the assessment of risks to assets posed by the various soil threatening processes. This method was based on a desktop type analysis whereby the intersection of mapped occurrences of soil threatening process with known assets was calculated using GIS techniques. The severity of the impact of the threat on the asset was estimated using a relative asset value and an overall risk ranking value was calculated for 150 different combinations of soil threats and landscape zone combinations.

The relative risk value then allowed the various combination to be ranked from 1 to 150 and the top twenty threat-landscape combinations where chosen as priority areas for the CSHS.

As part of an overall quality control program aimed at confirming the validity and accuracy of this desktop type process, a number of field based studies and assessments were undertaken as background studies to the CSHS. These studies from the basis of a verification process which is intended to ratify areas designated as having high relative risk to assets from soil threats and to ensure any future investment is based on a sound and defensible understanding of the ranking processes.

This report details the field verification program used to review and revise (where appropriate) the initial rankings for the soil degradation processes of *erosion and landslides.* Based on further GIS methods, expert knowledge and field observations, a number of target areas were selected from those top 20 ranked landscape zones with erosion and landslide issues. A risk based methodology was devised for the assessment of risk in the field and extensive field inspections undertaken. As a result, 21 target areas for erosion were assessed in 5 different landscape zones and 37 target areas for landslides were assessed in 5 different landscape zones

Using the results and insight obtained from the observations and field assessment of risk, a subsequent more detailed assessment of asset classes and sub classes was undertaken for these target areas and rankings established within landscape zones for erosion and landslides.

The individual target rankings were then used to assess overall landscape zone rankings and the landscape zones were re-ranked. The reassessment of the overall landscape zone rankings was firstly conducted as a re ranking process within each individual category (i.e. revised ranks for erosion and revised ranks for landslides) and then combined with the results of other field studies on acid sulphate soils and secondary salinity to allow an overall review of the top 20 ranked threat-landscape zone combinations.

The overall rankings for erosion and landslides varied to different degrees with most threat-landscape combinations either staying in the same place in the top 20 listing or changing places by 1 or 2 places. A few combinations varied by up to 6 places such as gully/tunnel erosion in the Moorabool landscape zone. In an extreme case, sheet/ rill erosion in the Thompson landscape zone was downgraded by 9 places from No 9 to No 18.

In relation to the overall rankings for all soil threatening processes, a study reported elsewhere for acid sulphate soils resulted in the significant downgrading of potential acid sulphate soils in the Bellarine landscape zone, dropping it from No 3 to No 19.

Whilst limitations in the methods are recognised due to gaps in mapped data and the fact that not all soil threats are adequately identified in databases, the process undertaken in this field verification project for erosion and landslides has been based on established methods of risk analysis supported by extensive field observations. The revised relative risks for both target areas and landscape zones as a whole are considered to be a good representation of what actually exists. Enhanced confidence in both the initial method of assessment and that used in this project was gained from confirmation of the presence of mapped soil threatening processes and observation of actual impacts on assets in the field.

1. Introduction and Background

Soils are seen as a significant asset within the Corangamite region as they control water quality to a significant degree and provide the medium for plant and crop production whilst supporting infrastructure and development.

The Corangamite Regional Catchment Strategy (RCS) developed by the Corangamite Catchment Management Authority (CCMA) helps to set guidelines and policy for investment to ensure overall catchment health (including soil health) throughout the region. The Corangamite Soil Health Strategy (CSHS) is one of a number of sub strategies under the RCS aimed at achieving this overall objective of healthy and sustainable catchments.

As such, the CHSH has been developed to minimise the detrimental effects of soil threatening processes throughout this region. The CSHS aims to promote soil health by reducing the consequences and effects of soil threatening processes which can impact both public and private assets.

The CSHS was developed by the Department of Primary Industries (DPI) for the CCMA over a four year period with a final draft produced in August 2006. A critical part of the development included the completion of a background paper by MacEwan in 2003 which identified threatening processes related to soil health. Such soil threatening processes included soil structure decline, soil erosion, landslides, waterlogging, nutrient management, soil salinity, soil acidification, acid sulphate soils, soil contamination and management of soil organic matter and biota (Dahlhaus 2006).

In order to assist the assessment process the CSHS adopted the Corangamite Landscape Zones (based on sub catchment areas) as the basis for delineating the various soil threats throughout the region (see Figure1). 15 landscape zones exist throughout the CMA and these were each individually assessed for 12 different soil threatening processes.

A workshop including technical experts on soil degradation processes and regional asset managers was held in 2003 to identify and assess the threats in each landscape zone. The threats were rated on both private and public assets according to their impact and importance to the asset manager. This process was later expanded and the CSHS describes the “relative risk to asset” approach used to rank 150 combinations of soil threatening process and landscape zones throughout the CMA region.

The ranking process used a GIS based method to identify soil threatening risks and assets as they are known and mapped in existing CCMA databases. As part of an overall quality control program aimed at confirming the validity and accuracy of this desktop type process, a number of field based studies and assessments were undertaken. These studies form the basis of a verification process which is intended to ratify areas designated as having high relative risk to assets from soil threats and to ensure any future investment is based on a sound and defensible understanding of the ranking processes.

This report details the process undertaken for the field verification of the initial relative risk to assets rankings for *erosion and landslides*. It details the methodology used, records both the field observations and the field based assessment of risk and describes the process for revision and readjustment of the initial rankings.

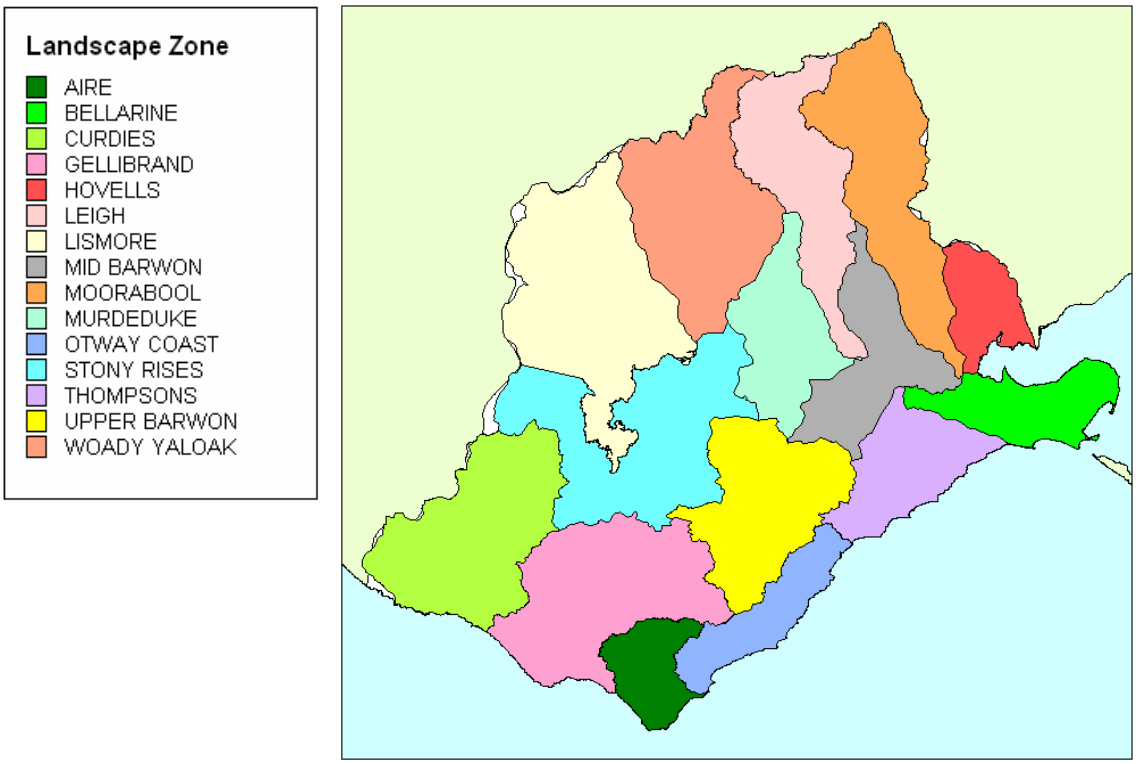

Figure 1 Location of CCMA landscape zones (after Dahlhaus 2006)

2. Scope of Commission

A.S. Miner Geotechnical was commissioned by Troy Clarkson (DPI and Project Manager for the Corangamite Soil Health Strategy) to undertake the following task in relation to the verification of the rankings of “relative risks to assets “assigned to various soil degradation processes within the 15 landscape zones contained within the CCMA region:

- *Prepare a background report for the CSHS on the verification project for erosion and landslides including methods and results*.

As a result, the following processes were undertaken in order to achieve the overall project task aim:

- Establish a methodology and approach based on risk assessment principles previously used with landslides and erosion in the CCMA region.
- Objectively select a number of representative landslide and erosion target areas for field verification within the top 20 ranked threat-landscape zone combinations.
- Verify the presence of the mapped occurrences of erosion and landslides in the field.
- Verify the proximity of these hazards to key assets.
- Assess the potential for interaction between the threat and the asset.
- Assess the impact, consequences and importance of such interaction.
- Review and confirm the original rankings of “relative risk to assets” for the top 20 ranked threat-landscape zone combinations and recommend revisions where the field verification differed significantly from the initial desk based approach.

This report documents the processes involved in undertaking the above tasks and provides detailed results from the field verification assessments for landslide and erosion.

3. An Overview of the Initial Ranking Process.

As discussed, the CSHS used a “relative risk to asset” based approach to allocate rankings to soil threatening processes within each of the 15 landscape zones in the CCMA. A detailed description of the approach is described in the final draft of the CSHS (August 2006) and as such only a summary is provided below.

The CSHS identified 12 different types of soil related threatening process that have the potential to impact assets within the CCMA region. These included:

- Landslides
- Secondary salinity
- Water erosion
- Acid sulphate soils
- Waterlogging
- Soil structure decline
- Wind erosion
- Soil nutrient decline
- Soil acidification
- Soil contamination
- Soil organic carbon decline
- Soil biota decline

The CSHS then identified a number of key asset classes and sub classes to be assessed in the overall risk rankings and these included:

- Land (agricultural, forestry, conservation, urban and peri-urban)
- Biodiversity (wetlands, areas of significant plants and animals)
- Water Quality (water proclaimed areas, waterways and lakes)
- Infrastructure (roads, cables, bridges, buildings, communication towers etc)
- Cultural and heritage sites (Aboriginal and European sites of significance)

A process of assigning relative values to each asset class according to their importance to the community was then undertaken within each of the 15 landscape priority zones with emphasis given to those relating directly to catchment health and public assets.

The spatial distribution of each soil threatening process was then assembled using a combination of three distinct data sources: factual data, derived data and interpretative data. The differences in these data sources relate to the spatial accuracy and resolution of the mapped hazards and further detailed discussion is contained in the final draft of the CSHS.

Based on expert knowledge and judgement of the likelihood and impact of each soil threatening processes in each of the landscape zones, an assessment of the relative severity (or impact) of the identified processes was then able to be undertaken.

Using GIS based techniques to identify locations where assets and soil threatening processes intersect according to their mapped geographic locations, it was possible to use the relative value of the asset and the severity of the soil threatening process to estimate the relative impact of the threat to the asset and hence estimate a relative risk to the asset resulting in a relative risk value (RRV).

Due to gaps in data knowledge and mapping inventories, it was only possible to assess 10 out of the 12 soil related threatening process. Assessment of these 10 processes was then undertaken in each of the 15 landscape priority zones and rankings assigned for each of the 150 possible threat-landscape zone combinations. Of these, the top 20 ranked combinations were chosen as priority issues for the CSHS.

The top 20 results from this initial ranking system are shown in Table 1. Within the top 20 highest ranked combinations of threats and landscape zones, 5 different soil threatening processes were included (i.e. landslides, sheet/rill erosion, gully/tunnel erosion, acid sulphate soil and secondary salinity) in 13 different landscape zones (Gellibrand, Lismore, Bellarine, Woady Yalloak, Stony Rises, Curdies, Otway Coast, Thompson, Moorabool, Murdeduke, Leigh, Upper Barwon and Aire).

Rank	*Threatening Process*	*Landscape Zone*	*Relative Risk Value*
1	Landslides	Gellibrand	3167
2	Secondary salinity	Lismore	2886
3	Potential acid sulphate soil	Bellarine	2748
4	Gully/tunnel erosion	Woady Yalloak	2501
5	Sheet/rill erosion	Woady Yalloak	2317
6	Secondary salinity	Stony Rises	1925
7	Landslides	Curdies	1903
8	Landslides	Otway Coast	1872
9	Sheet/rill erosion	Thompson	1804
10	Secondary salinity	Woady Yalloak	1646
11	Sheet/rill erosion	Moorabool	1154
12	Secondary salinity	Murdeduke	1090
13	Gully/tunnel erosion	Leigh	938
14	Landslides	Upper Barwon	917
15	Gully/tunnel erosion	Moorabool	893
16	Sheet/rill erosion	Upper Barwon	752
17	Gully/tunnel erosion	Upper Barwon	743
18	Sheet/rill erosion	Leigh	734
19	Potential acid sulphate soil	Thompson	557
20	Landslides	Aire	548

Table 1 The initial top 20 rankings for threat-landscape zone combinations

4. Methodology for Verification-General

4.1 Adoption of a Risk Based Approach

A risk based approach was adopted to standardise the method for verification of the “relative risks to assets” for erosion and landslide soil threatening processes in the top 20 ranked threat-landscape combinations. The following sections describe the general principles of risk assessment and form the basis of the methodology used in the preparation of standard analysis sheets used to record and assess risks in the field.

4.1.1 General Principles of Risk Management

The process of risk management is best described by reference to the following definitions contained in the Australian/New Zealand Standard on Risk Management AS/NZS 4360:2004.

- *Risk Management:* The culture, processes and structures that are directed towards realizing potential opportunities whilst managing adverse effects.
- *Risk Management Process*: The systematic application of management policies, procedures and practices to the tasks of communicating, establishing the context, identifying, analysing, evaluating, treating, monitoring and reviewing risk.

The main elements of risk management are shown in Figure 2 which is taken from AS/NZS 4360:2004. In general, the risk management process can be described as comprising three main components:

- Risk Analysis (incorporating Hazard Identification, Frequency Analysis, Consequence Analysis and Risk Estimation).
- Risk Evaluation.
- Risk Treatment.

In essence the process involves answering the following questions:

- What might happen? (Assess the likely modes of land degradation).
- How likely is it? (Assess the probability of occurrence).
- What impact, damage or injury may result? (Assess the consequence of the hazard).
- How important is it? (Assess the significance of the impact in relation to the regulatory criteria and public opinion).
- What can be done about it? (Assess treatment options including management and mitigation options)

The combination of what might happen (known as the *danger or threat*) including its size, magnitude and how far it will travel or impact and the likelihood of occurrence is collectively known as *hazard*.

Likelihood is used as a general description of probability or frequency of an event. The likelihood of erosion and landslides can be further described as the function of two separate factors as follows:

- *Preparatory Casual Factors (or Susceptibility)* including such factors as geology terrain, slope length, soil type, erosivity which create an opportunity for occurrence.
- *Triggering Casual Factors (or Triggers)* including those factors such as rainfall and anthropogenic actions (land use and management) which produce an effect.

Hence Likelihood relating to erosion and landslide can be defined as follows:

Likelihood = Function (Susceptibility and Triggering Events)

Consequence of a hazard can be defined as the outcome or impact of an event where impact relates to a strong or significant effect or impression.

In evaluating risk, the hazard is assessed against a number of *elements at risk* within the sphere of influence from the hazard. *Elements at risk* may include property, people, vehicles on roads and infrastructure such as water supply, drainage, electricity supply, roads, communications or other transport media. However more importantly from the CCMA point of view, such elements at risk also include, water quality, the environment including flora and fauna, agricultural land/activity and cultural/ heritage issues.

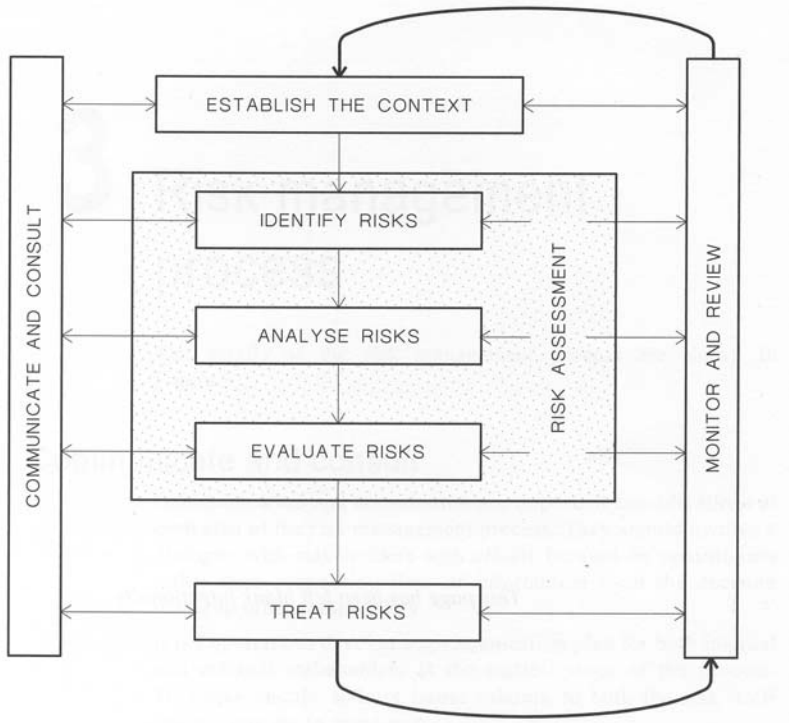

Figure 2 Risk Management Framework

4.1.2 Risk Analysis

The context of the assessment is established whereby the scope of the assessment, the nature of the methodology and the criteria against which risk is to be evaluated are to be defined and fully communicated at the start of the assessment.

Hazard identification identifies what, why and how things can arise as the basis for further analysis. The identification process should be broad so that all possible risks are considered.

Risk analysis is undertaken after hazard identification and involves the estimation of both hazard and likelihood (in this case a probability-based likelihood) and the consequence or impact of occurrence. The combination of these two elements provides an estimation of the level of risk i.e.

Risk=Function (Likelihood and Consequence).

In particular a common expression of risk is as follows:

Risk= Likelihood x Consequence

4.1.3 Risk Evaluation

The levels of estimated risk are compared against pre-established criteria. Criteria may be in terms of qualitative criteria for a qualitative approach or may involve a numerical level of risk against criteria which may be expressed as a specific number. Risks can then be ranked so as to identify management priorities.

4.1.4 Risk Treatment

If levels of risks are low they may fall into the acceptable category and require no further treatment. However, if risk levels are moderate or higher, they will require some degree of risk treatment and/or risk mitigation. In these cases, specific management plans may be required to be developed and implemented.

In some cases levels of risks may be of such a degree that the proposed development or activity is unacceptable and may not proceed.

In addition, other important elements of the risk management process present at all times of the assessment include monitoring and review of the performance of the risk management process and communication and consultation with stakeholders during appropriate stages of the assessment.

5. Methodology for Verification-Specific

The adopted methodology for verification of rankings for landslide and erosion issues in the top 20 ranked threat-landscape zone combinations was based on a number of fundamental premises for the validation process. These included:

- Given the extensive size of the landscape zones, a number of target areas within each zone should be initially determined for detailed field inspections and assessments.
- The determination of the target areas within zones should use a process of determining where threats intersect with assets similar to that employed in the initial ranking process.
- Given many of the occurrences of landslide and erosion have been mapped directly from ortho-corrected aerial photographs without field confirmation, one of the initial aims of the field validation process should be to confirm the presence and extent of the threat as portrayed in the current erosion and landslide inventory.
- Consideration of asset classes and sub classes should be consistent where possible with those chosen in the initial ranking process.
- The thought processes for the assignment of likelihood and consequence should be sufficiently transparent and be documented for each field inspection of target areas.
- Due to the time limitations and lack of detailed data for many issues of likelihood and consequence, the process of risk estimation should be relatively quick, simple to perform and qualitative in nature.
- Results from field inspections should be recorded in a standard manner using the approach as described above. Data should be catalogued for possible future use once the on-ground works for target areas are finalised.

As a result, the following sections describe the processes undertaken to achieve the aims of the verification process detailed above.

5.1 The use of a GIS-Based Method for Identifying the Intersection between Threats and Assets.

A study identifying soil processes threatening assets and setting priorities was completed by the University of Ballarat (UoB) in July 2006 as a background report for the CSHS (Dahlhaus 2006). The report summarises much of the earlier work completed as inputs to the CSHS and contains two main components:

- A GIS based assessment of the intersection of potential soil threatening processes with assets.
- The analysis of quantitative data to set priorities.

As part of the first report component, statistics were produced for each of the 15 landscape zones describing the number of polygons (i.e. the mapped occurrences of erosion and landslides), total area in hectares and total area percentage of various land uses throughout the zone.

The statistics were produced using MapInfo GIS and a number of its spatial analysis add-on tools such as Vertical Mapper and Encom Discover.

In addition, a summary of key assets in each landscape zone was summarised as well as the threats to both private and public lands.

The report provides a significant insight into soil threatening processes throughout the 15 landscape zones of the CCMA as well as recognising the limitations with both the adopted method and the data used.

As part of this project, further data was made available to the current verification study from the UoB study in the form of a series of maps for each of the 15 landscape zones. The maps show the intersection of erosion and landslides with assets in landscape zones for 6 key asset classes which included:

- Roads
- Public Land
- Waterways
- Wetlands
- Native Vegetation
- Land Use

An example of a typical map produced from this analysis depicting the intersection of gully erosion with waterways in the Woady Yalloak landscape zone is shown in Figure 3. A full set of the maps is available from Troy Clarkson at DPI.

A workshop comprising Troy Clarkson and Shari Wallis from the DPI and the author was then convened to select erosion and landslide target areas for verification within the top 20 ranked threat-landscape combinations. Through a process of visual inspection of the 6 different asset class maps for a particular threat-landscape zone combination (e.g. landslides in Gellibrand) it was possible to identify hot spots or geographical clusters of intersection points within the landscape zone. These hot spots or potential target areas for more detailed field verification were then transferred by hand onto a series of road atlas maps and later digitised onto a GIS layer.

It is important to note that the target areas were based on the intersection of threats and assets and not on the spatial density of the threat alone.

Other target areas were also added to each landscape zone after later discussions amongst the workshop team members and /or as a result of observations in the field during the initial field inspections. It should also be noted that whilst some target areas are spatially large and contain a number of sites, other target areas are smaller and more representative of individual sites but have been added due to their significant interaction between a threat and a key asset.

As a result, 21 target areas for erosion were identified in 5 different landscape zones and 37 target areas for landslides were identified in 5 different landscape zones. The final lists of target areas for landslides and erosion respectively in each landscape zone are detailed in Tables 2 and 3.

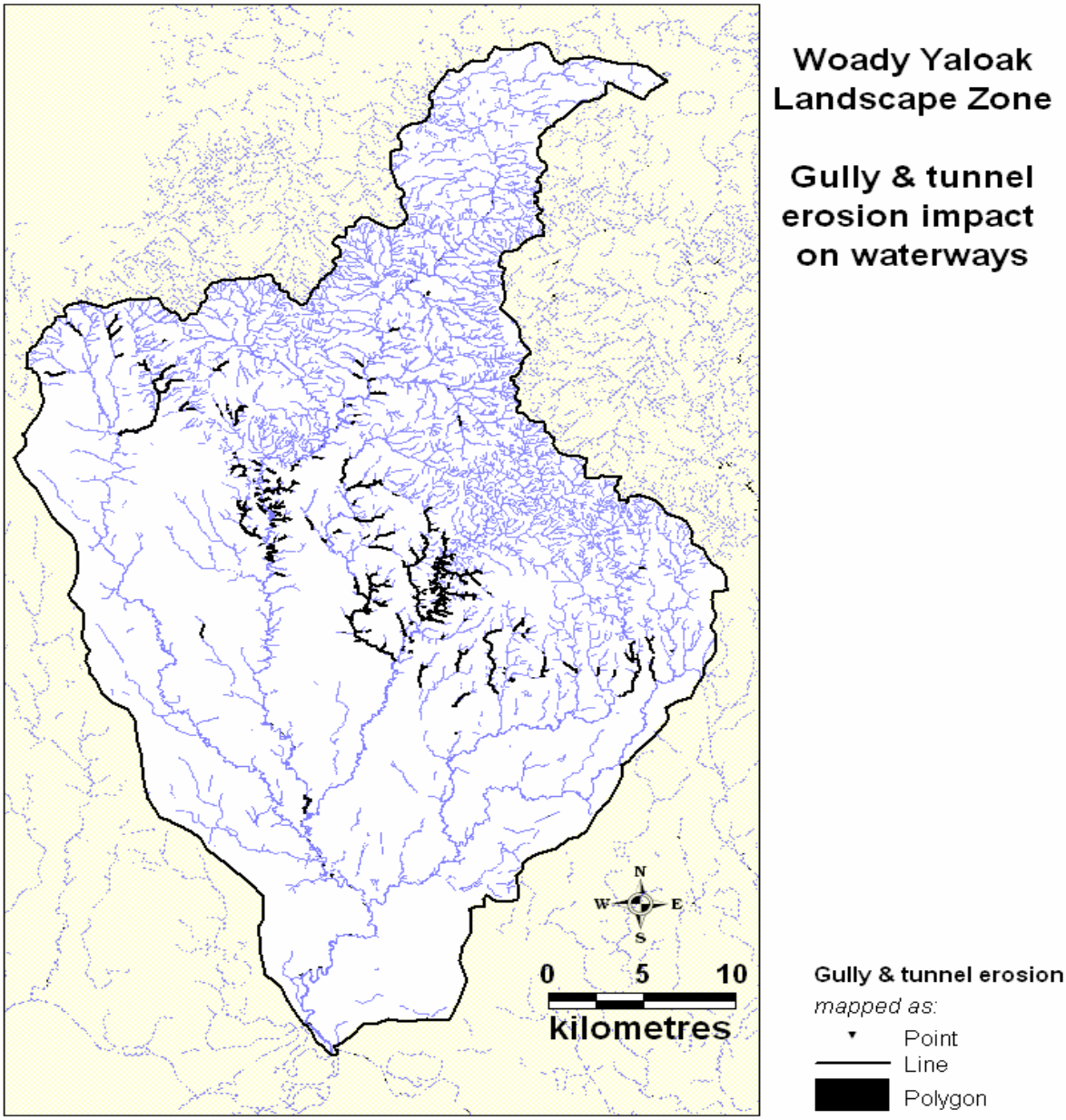

Figure 3 **Typical map showing Intersection of Gully erosion with waterways in the Woady Yalloak Landscape Zone from University of Ballarat analysis (Dahlhaus 2006)**

Priority Landscape Zone	*Landslide Target Area ID*	*Description*
Gellibrand	G1	Johanna Heights
	G2	Gellibrand River Estuary
	G3	Wiridjil / Valley View Rds
	G4	Great Ocean Rd Old Princetown PO
	G5	Tomahawk Cr / Coradjil Rds
	G6	Turton's Track
	G7	Kawarren East / Frys Rds
	G8	West Gellibrand Reservoir / Arkins Ck
	G9	Moonlight Head / Gables Rds
	G10	Princetown-Simpson Rd (Bouwman's Landslide)
Otway Coast	OC1	Fairhaven (Clarkes Landslide)
	OC2	Big Hill / Lorne
	OC3	Windy Point
	OC4	Mt Defiance to Jamieson River
	OC5	Wye River
	OC6	Kennett River to Grey River
	OC7	Skenes Creek / Beacon Point
	OC8	Wongarra Gt Ocean Rd
	OC9	Wild Dog / Sunnyside Rd
	OC10	Apollo Bay / Barham Valley
Curdies	C1	Pt Campbell-Cobden Rd
	C2	Cooriemungle / Williams Rds
	C3	Scotts Creek Area
	C4	12 Apostles and Coast
Upper Barwon	UB1	Winchlesea-Lorne Rd
	UB2	Bambra / Coal Mine Creek Rds
	UB3	Pennyroyal Area
	UB4	Forest including Lake Elizabeth
	UB5	Deans Marsh-Lorne Rd (Sincocks Rd)
	UB6	Birregurra-Yeodene Rd (Phillips Landslide)
Aire	A1	Gt Ocean Rd
	A2	Forestry at Bins Rd Aire Valley
	A3	Ford River
	A4	Hordern Vale Rd
	A5	Gt Ocean Rd near Glenaire / Castle Cove
	A6	Upper Ridge (Beech Forest to Lavers Hill)
	A7	Aire River Forestry

Table 2 Selection of target areas for landslides based on GIS analysis, expert judgement and field observations.

Priority Landscape Zone	*Erosion Target Area ID*	*Description*
Woady Yalloak	WY1	Misery Moonlight Creek Area
	WY2	Paddy Gully Rd
	WY3	Cars / Boyles Rd
	WY4	Rokewood-Corindhap Rd
Moorabool	M1	Eclipse Creek
	M2	West Branch of the Moorabool River
	M3	Lynches Road
	M4	Demotts Rd (Fire affected area)
	M5	Robs Rd
	M6	Yendon / Lal Lal
Thompson	T1	Willowite Rd
	T2	Blackgate Rd
	T3	Thompsons Creek (off McCann Rd)
Upper Barwon	UB1	Deans Marsh Rd / Coal Mine Creek / Wurdale Rds
	UB2	Yan Yan Gurt Ck and Retreat Ck
	UB3	West Barwon River Valley-Colac-Muroon / Birregurra
Leigh	L1	Magpie
	L2	Sand Rd
	L3	Coopers Rd
	L4	Shelford-Mt Mercer Rd (inc Robbies Rd)
	L5	Shelford-Meredith Rd

Table 3 Selection of target areas for erosion based on GIS analysis, expert judgement and field observations.

The locations of the target areas are provided in Appendix A

5.2 Confirmation of Mapped Occurrences and Spatial Accuracy

As previously described, the initial process of relative risk ranking and the later work undertaken by UoB was based on a GIS based technique which identified locations where mapped occurrences of soil threatening processes (in this case erosion and landslides) intersected with key assets.

As such, one of the key tasks of the verification methodology was to confirm in the field the location of mapped occurrence and its correlation with the data record in the erosion and landslide database.

Confirmation and description of the mapped occurrence is provided on the field sheets including (where appropriate) discussion of poor spatial accuracy and /or temporal changes to the feature that may have occurred since the time of data capture.

5.3 Consideration of Assets

In keeping with the list of asset classes used in the initial assessment the following asset classes and subclasses were adopted for consideration in the current verification of rankings;

- Infrastructure (including major roads, minor roads, dwellings, channels, dams and other structures).
- Water Quality (including major waterways, minor waterways/streams/creeks, and proclaimed catchment areas).
- Biodiversity (wetlands, conservation sites, natural vegetation, environment).
- Land use (dairying, pasture/ grazing, forestry/plantations, public recreation/tourism).

5.4 Assessment of Hazard including Likelihood and Magnitude

Whilst the assessment of likelihood or the annual probability of occurrence of a threat is largely a subjective process, it must be based on expert judgement and the available information on occurrences of similar events in the same or similar setting. Regional experience, review of historical records, assessment of aerial photos and an appreciation of geomorphological processes can significantly assist the judgement of likelihood of soil degradation processes such as landsliding and erosion.

Detailed knowledge of landslide and erosion processes in the CCMA region has been gained by the author through his involvement with development of the SW erosion and landslide database at the University of Ballarat in addition to involvement with numerous commercial projects throughout the region. Furthermore, the author's involvement with the National Taskforce on Landslide Risk Management for the Australian Geomechanics Society has provided invaluable insight into the issues of likelihood and frequency assessment.

Troy Clarkson and Shari Wallis have extensive on-ground knowledge of erosion projects through the implementation of numerous soil extension projects throughout the region as well as detailed knowledge and understanding of soil health issues through the recent development of the detailed CSHS.

In keeping with the philosophy of a simple qualitative approach, a series of standard likelihood descriptors were developed for use to describe likelihood. These have been adopted from various studies and reports (AGS 2000, AS/NZS 4360:2004, ASMG 2005). The qualitative descriptors for both landslide and erosion are shown in Tables 4 and 5.

Category	***Likelihood Descriptor for Landslide***	***Description***	***Implied indicative landslide recurrence interval***
A	Almost Certain	The event is expected to occur	Less than 1 years
B	Likely	The event will probably occur under adverse conditions	1 to 100 years
C	Possible	The event could occur under adverse conditions	100 to 1000 years
D	Unlikely	The event might occur under very adverse conditions	More than 1000 years
E	Very Unlikely	The event is conceivable but under exceptional circumstances	Very much more than 1000 years

Table 4 Qualitative likelihood descriptors for landslides.

Category	***Likelihood Descriptor***	***Description***
A	Probable (very high)	Erosion and/or sedimentation is expected to occur in most circumstances
B	Likely (high)	Erosion and/or sedimentation will probably occur in most circumstances
C	Possible (moderate)	Erosion and/or sedimentation could to occur at some time
D	Unlikely (low)	Erosion and/or sedimentation might occur at some time
E	Improbable (very low)	Erosion and/or sedimentation may occur only in exceptional circumstances

Table 5 Qualitative likelihood descriptors for erosion.

An important aspect of the description of the overall hazard includes the consideration of the possible combinations of the threat (i.e. the event) and its characteristics (i.e. size, volume or run out distance). Hence the process developed for this project required the assessor to describe both aspects for each assessment of risk. As an example a hazard may be described as a rotational landslide travelling up to a metre or sheet erosion of a moderate size and spatial extent.

Guidance was provided to the assessor in the explanatory notes attached to the field sheets and generally only the most likely of the possible combinations was recorded on the field sheet. Hence whilst a landslide could move anywhere from a few mms to many metres, historical evidence, expert opinion and in-situ observations may indicate the most common (and likely) form of movement at a site may involve movement of only up to a metre. As such this combination of threat and behaviour is the one that would be recorded. If multiple examples of behaviour are possible under adverse conditions then those modes for the same hazard would be recorded.

5.5 Consequence Analysis

A useful way of describing consequence is the outcome of an event expressed either qualitatively or quantitatively and involving a loss, injury, disadvantage or gain. Other elements associated with consequence can be vulnerability to the hazard, and spatial/temporal considerations

An event may also be considered to have an impact if it invokes a strong or significant effect. The initial CSHS referred to severity of impact which can be interpreted as the significance of the consequences experienced by an asset as the result of the occurrence of the threatening process.

Various qualitative descriptions of consequence are available and previous descriptions developed by A.S. Miner Geotechnical (ASMG 2005) for broad asset classes of the environment, infrastructure and human life were adopted for this current study, and are detailed in the following tables:

Level	***Descriptor***	***Description***
1	Catastrophic	Almost certain fatality ,
2	Major	Likely fatality, extensive injuries
3	Moderate	Possible fatality, medical treatment required
4	Minor	Unlikely fatality, first aid treatment minimal
5	Insignificant	Rare fatality, no injuries

Table 6 A qualitative measure of consequence effecting human life.

Level	*Descriptor*	*Description*
1	Catastrophic	Total degradation and/or complete loss of beneficial uses of land, water, environment, toxic release off site with detrimental effects, total loss of stream water quality or habitat, complete loss of biodiversity
2	Major	Extensive degradation and/or significant partial loss of beneficial uses of land, water, environment, off site release with some detrimental effects, extensive deterioration of stream water quality or habitat, major significance on biodiversity, loss of water supply
3	Moderate	Limited effect on the beneficial uses of land , water, environment up to acceptable limits of change and modification as per State and Federal legislation, on-site release contained with outside assistance, continuous significant change of stream water quality and habitat, noticeable effect on biodiversity and water quality
4	Minor	No significant effect on the beneficial uses of land , water, environment, on- site release immediately contained, seasonal or episodic elevated stream salinity in most years, minor impact on biodiversity and water quality,
5	Insignificant	No measurable effect on the beneficial uses of land , water, environment, gradual minor change to stream water quality or habitat, no measurable effect on biodiversity

Table 7 A qualitative measure of consequence for the environment.

Level	*Descriptor*	*Description*
1	Catastrophic	Structure completely destroyed or large scale damage requiring major engineering works for stabilisation, huge financial loss
2	Major	Extensive damage to most of the structure or extending beyond site boundaries requiring significant stabilisation works, major financial loss
3	Moderate	Moderate damage to some structure or significant part of the site requiring large stabilisation works, moderate financial loss
4	Minor	Limited damage to small part of the structure or part of the site requiring some reinstatement or stabilisation, minor financial loss
5	Insignificant	Little damage ,low financial loss

Table 8 A qualitative measure of consequence for infrastructure.

5.6 Estimation of Overall Risk

The estimation of risk to the asset as posed by the threat is based on a simple matrix approach. It is assumed that the level of risk is proportional to each of its two components as described previously i.e. likelihood and consequence). As such risk can be simply expressed as a product whereby

Risk =likelihood x consequence

It must be recognised that this simple relationship does not take account of complicating factors such as non linear relationships between the occurrence of the hazard and the value of consequence. The assessment of a more complicated inter-relationship is currently beyond the capabilities of the proposed methodology and is duly acknowledged.

Based on the above premise and its inherent limitations, the use of a risk matrix allows for a simple method of estimation of the level of the risk. An example of a possible risk matrix is presented in Table 9

Likelihood Level (Probability scale)	***Consequence***				
	1 Catastrophic	2 Major	3 Medium	4 Minor	5 Insignificant
A (Probable)	VH	VH	H	H	M
B (Likely)	VH	H	H	M	L
C (Possible)	H	H	M	L	L
D (Unlikely)	H	M	L	L	VL
E (Improbable)	M	L	L	VL	VL

Note: VH=Very High risk, H=High risk, M=Moderate risk, L=Low risk and VL=Very Low risk

Table 9 Risk estimation matrix showing the level of risk.

It must be noted that the calculation of risk must be conducted for each significant threat-characteristic or behaviour combination as previously described in section 5.4

5.7 Development of Standard Field Verification Sheets

The standardisation of reporting and the approach to analysis for the field verification of the risks posed by threats to assets is considered to be a critical element of the field verification process. As such, a series of field recording sheets were developed for use in the inspections.

The sheets incorporate the overall risk assessment approach whist maintaining a simple and essentially qualitative approach. A series of explanatory notes were also produced to provide guidance to the assessors and standardise the approach as much as possible given the assessments were carried out by various people with different skills and understanding.

Key elements of the sheets include the 5 fundamental questions representing the stages of risk assessment and the requirement to describe the most significant combination of the type of threat and the magnitude/run out distance being considered. The provision of three risk matrices allows for multiple hazards (e.g. debris flow, translational landslide or rotational landslide) and/or different forms of the same hazard (e.g. a translational slide moving a few mms, moving up to a metre or moving 10's of metres).

An example of the standard field verification sheet is provided in Appendix B.

5.8 Field Inspections

After the selection of the initial target areas for landslide and erosion (Tables 2 and 3), a series of field inspections were arranged throughout the various landscape zones. Details of all field inspections are contained in Table 10. Further details for the landslide inspections and some of the erosion inspections are contained in Appendix C

Date of Inspection	*Initial Ranking*	*Landscape Priority Zone*	*Soil Threatening Process*	*Personnel*
27/07/06	14	Upper Barwon	Landslides	ASM, TC
27/07/06	16	Upper Barwon	Sheet/rill erosion	ASM, TC
27/07/06	17	Upper Barwon	Gully/tunnel erosion	ASM, TC
27/0706	9	Thompson	Sheet/rill erosion	ASM, TC
1/8/06	8	Otway Coast	Landslides	ASM
2/8/06	20	Aire	Landslides	ASM
2/8/06	1	Gellibrand	Landslides	ASM
2/8/06	13	Leigh	Gully/tunnel erosion	TC, SW
2/8/06	18	Leigh	Sheet/rill erosion	TC, SW
2/8/06	4	Woady Yalloak	Gully/tunnel erosion	TC, SW
2/8/06	5	Woady Yalloak	Sheet/rill erosion	TC, SW
3/8/06	7	Curdies	Landslides	ASM
3/8/06	11	Moorabool	Sheet/rill erosion	TC, SW
3/8/06	15	Moorabool	Gully/tunnel erosion	TC, SW

Note: TC=Troy Clarkson, SW=Shari Wallis and ASM= Tony Miner

Table 10 Details of site inspections of target areas in landscape priority zones

6. Results and Evaluation of Risks

6.1 Results

The results of the field assessments are contained on the standard field sheets and detailed in Appendix C. The field inspections are divided into erosion sites mainly inspected by Troy Clarkson and Shari Wallis and landslide sites mainly inspected by the author.

The next sections describe the use of the field inspection and field assessments in a secondary process used to review and revise risks and the rankings within the top 20 combinations of threats and landscape zone.

6.2 Secondary Assessment of Risk and Method of Evaluation

Following the initial field inspections and the field estimation of risk at the various target areas and sites, a secondary assessment of risks was conducted for each target area. This included a more detailed assessment of risk for the four main assets classes and associated subclasses based on the field observations and insight gained from the field verification process. To assist the process of more detailed assessment, a series of asset sub classes were adopted for this secondary risk assessment as follows:

Primary Asset Class	***Asset Subclass***
Infrastructure	Major Roads Minor Roads Dwellings Other structures, channels, dams
Water Quality	Major waterways, rivers Minor waterways, streams, creeks Catchment areas
Biodiversity	Conservation sites Natural or remnant vegetation Wetlands Environment
Land Use	Dairying Pasture and grazing Forestry and Plantations Public recreation and tourism

Table 11 Asset classes and subclasses used in secondary risk assessment

Based on the specific field observations and risk estimations, an average or indicative level of risk posed by erosion and landslide was assigned to each asset subclass in every target area. Risk levels were assigned a numeric value between 0 and 5 where 0=not present or no risk, 1=very low risk, 2=low risk, 3=moderate risk ,4=high risk and 5=very high risk.

It must be noted that the understanding and insight of processes gained during the field inspections and onsite assessment of risk was vital in the assignment of individual rankings to asset sub classes during this secondary detailed risk appraisal.

Individual risk levels were then multiplied by the relative asset value (RAV) for that asset sub class. The total risk for each target area was then calculated as the sum of all subclass risk values adjusted for the RAV. This process allowed for an internal ranking of target areas within landscape zones and results are detailed in Tables 12 and 13 for erosion and landslides respectively.

The next phase of the process then involved developing an overall landscape risk value for the broader primary asset classes based on the specific results of the target areas and the expert knowledge and understanding of the landscape zone as a whole. The overall asset class risk values were again adjusted for the relative asset value and the total landscape risk value calculated as the sum of the broader primary asset class risks adjusted for the RAV. Results are detailed in Tables 14 and 15.

This process allowed for a inter ranking of the landscape zones within the two categories of erosion and landslide. Discussion of how final rankings of threat-landscape zone combinations were revised is detailed in the next section

It should be noted that after field inspections of the erosion target sites a decision was made to amalgamate sheet/rill erosion and gully/tunnel erosion into a single erosion threat. This was done as the two main erosion processes coincided in many instances and involved similar consequences and impacts. As such, there was not enough information or justification to treat them as separate processes during this secondary phase of risk assessment. However they were kept separate in the final review of risk in the top twenty as deference to the more detailed initial desktop assessment process.

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Project **Field Verification of Target Areas For Erosion**

Client **DPI** **Risk Levels** **5=VH, 4=H, 3=M, 2=L, 1=VL, 0=Not present**

Indicative Level of Risk Posed by Landslides to:

Priority Landscape Zone	*Target Area ID*	*Description*	*Infrastructure*				*Water Quality*			*Biodiversity*				*Land use*				*Total Risk adjusted for RAV*
			Major Roads	*Minor Roads*	*Dwellings*	*Other strutures channels dams*	*Major waterways rivers*	*Minor waterways streams/ creeks*	*Catchment Areas*	*Conservation sites*	*Natural vegetation*	*Wetlands*	*Environment Visual Amenity*	*Dairying*	*Pasture and grazing*	*Forests and Plantations*	*Public Rec. Tourism*	
		Relative Asset Value (RAV)	*10*	*8*	*8*	*9*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*4*	*2*	*3*	*7*	
Woady Yalloak	WY1	Misery Moonlight Creek area	0	2	0	0	2	5	0	0	2	0	2	0	4	0	0	134
	WY2	Paddy Gully Road	0	1	0	0	1	3	0	0	1	0	2	0	3	0	0	84
	WY3	Cars / Boyles Road	0	1	0	0	1	4	0	0	1	0	1	0	3	0	0	84
	WY4	Rokewood Corindhap Road	0	0	0	0	2	2	0	0	2		2	0	2	0	1	91
Moorabool	M1	Eclipse Creek	0	2	0	2	2	3	2	0	1	0	2	0	2	1	0	141
	M2	West Branch	0	0	0	0	2	3	2	0	1	0	1	0	2	0	0	94
	M3	Lynches Road	0	2	0	0	0	1	1	0	2	0	1	0	1	0	0	68
	M4	Demotts Road (Fire affected area)	0	2	0	4	0	1	1	0	2	0	1	0	4	0	0	110
	M5	Robs Road	0	0	0	0	0	2	1	0	1	0	1	0	1	0	0	52
	M6	Yendon / La La	0	0	0	1	3	3	3	0	0	0	0	0	1	0	0	101
Thompsons	T1	Willowite Road	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	30
	T2	Blackgate Road	1	0	0	0	1	0	0	1	1	1	1	0	0	0	0	60
	T3	Thompsons Creek off McCann Road	0	1	0	0	2	0	0	1	1	1	0	0	0	0	0	58
Upper Barwon	UB1	Deans Marsh Rd_ Coal Mine Creek_ Wurdale Rd	1	0	0	1	1	0	1	0	1	0	1	0	2.5	0	0	64
	UB2	Yan Yan Gurt Ck and Retreat Ck	1	0	0	0	0	1	0	0	1	0	1	0	1	0	0	42
	UB3	West Barwon Valley-Colac Muroon/ Birregurra	1	1	0	0	2	1	1	0	1	0	0	0	2	0	0	72
Leigh	L1	Magpie	2	1	0	1	2	2	0	1	1	0	0	0	1	0	0	99
	L2	Sand Road	0	2	0	1	2	2	0	0	1	0	0	0	1	0	0	77
	L3	Coopers Road	0	0	0	0	1	1	0	0	2	0	0	0	2	0	0	44
	L4	Shelford , Mt Mercer Road inc Robbies Road	0	0	0	1	1	2	0	0	0	0	0	0	3	0	0	45
	L5	Shelford Meredith Road	0	0	0	1	1	2	0	0	1	0	0	0	2	0	0	53

Note: Individual risk values for each asset sub class have been multiplied by the Relative Asset Value and then summed to give the Total Risk value for the target site.

Table 12 Relative risk rankings for individual target areas for erosion

Table 12 Relative risk rankings for individual target areas rankings for erosion

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Project Field Verification of Target Areas For Landslides

Client DPI **Risk Levels 5=VH, 4=H, 3=M, 2=L, 1=VL, 0=Not Present**

Average or Indicative Level of Risk Posed by Landsldies to:

Priority Landscape Zone	*Target Area ID*	*Description*	*Infrastructure*				*Water Quality*			*Biodiversity*				*Land use*				*Total Risk adjusted for RAV*
			Major Roads	*Minor Roads*	*Dwellings*	*Other strutures channels dams*	*Major waterways rivers*	*Minor waterways streams/ creeks*	*Catchment Areas*	*Conservation sites*	*Wetlands*	*Natural vegetation*	*Environment*	*Dairying*	*Pasture and grazing*	*Forests and Plantations*	*Public Rec. Tourism*	
		Relative Asset Value (RAV)	10	8	8	9	10	10	10	10	10	10	10	4	2	3	7	
Gellibrand	G1	Johanna	1	2.5	2.5	0	0	2	0	1	1	1	2	0	3	0	2	140
	G2	Gellibrand River Estuary	0	2.5	1	0	2	2	0	2	2	2	2	0	1	0	1	157
	G3	Wiridjil/ Valley View Rds	1	1	1	0	0	2	0	0	0	0	0	2	1	0	0	56
	G4	Great Ocean Rd Old Princetown PO	5	2.5	2	0	0	3	0	0	2	0	0	0	3	0	4	170
	G5	Tomahawk Cr/ Coradjil Rds	0	2	2	0	0	2	0	0	0	1	0	2	0	0	0	70
	G6	Turtons Track	5	0	0	0	0	4	3	2	0	3	3	0	0	0	3	221
	G7	Kawarren East / Frys Rds	0	3	2.5	2.5	2	2	1	0	0	0	0	0	3.5	0	0	124
	G8	West Gellibrand Res/ Arkins Ck	0	1	0	4	4	2	5	0	0	2	2	0	0	0	0	194
	G9	Moorlight Head/ Gables Rds	0	1	1	0	0	3	0	0	0	2	2	0	3	0	1	99
	G10	Princetown Simpson Rd Bouwmans	5	0	5	0	0	0	0	0	0	0	0	5	0	0	0	110
Otway Coast	OC1	Fairhaven Clarkes Slide	2.5	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	0	2.5	108
	OC2	Big Hill/ Lorne	5	0	0	0	0	2.5	0	0	0	2	2	0	0	0	4.5	147
	OC3	Windy Point	5	0	0	0	0	0	0	0	0	1	4	0	0	0	4.5	132
	OC4	Mt Defiance to Jamieson River	3	0	0	2	2	0	0	0	0	2	4	0	0	0	3	149
	OC5	Wye River	3	3	3	0	3	0	0	0	2	2	2	0	0	0	2	182
	OC6	Kennett River to Grey River	3	0	0	1	2	0	0	0	0	2	3	0	0	0	3	130
	OC7	Skenes Creek/ Beacon Point	3	0	3	2	0	3	0	0	0	2	2	0	0	0	3	163
	OC8	Wongarra Gt Ocean Rd	3.5	0	3.5	0	0	1	0	0	0	1	1	0	3.5	0	3	121
	OC9	Wild Dog/ Sunnyside Rd	0	4	4	0	4	0	0	0	0	2	1	0	2.5	0	2	153
	OC10	Apollo Bay/ Barham Valley	2	2	2.5	2	2	0	0	0	1	2	2	0	1	0	2	160
Curdies	C1	Pt Campbell Cobden Road	4	0	2	0	0	2	0	0	0	0	2	3	0	0	3	129
	C2	Cooriemungle/ Williams Road	1	4	2	0	0	3	0	0	0	0	2	3	0	0	0	120
	C3	Scotts Creek	1	3	2	0	0	3	0	0	0	0	2	4	2	0	0	120
	C4	12 Apostles and Coast	1	1	0	0	0	0	0	4	0	4	4	0	0	0	4	166
Upper Barwon	UB1	Winchleseа Lorne Rd	2	0	0	0	2	0	1	0	0	0	1	0	2	0	0	64
	UB2	Bambra/ Coal Mine Creek Rd	0	2	0	0	0	3	1	0	1	0	2	0	2.5	0	0	91
	UB3	Pennyroyal	0	2	1	0	0	1	1	0	0	1	1	0	2	1	0	71
	UB4	Forest including Lake Elizabeth	0	2.5	1	4	4	3	3	0	3	3	2.5	0	0	0	1	256
	UB5	Deans Marsh Lorne Rd Sincocks Rd	1	1	2	0	0	1	0	0	0	1	0	0	1	0	0	56
	UB6	Birregurra Yeodene Rd / Phillips landslide	0	1	1	0	4.5	0	2	0	0	0	4	0	4	0	0	129
Aire	A1	Gt Ocean Road	2.5	2.5	0	0	0	2	0	0	0	2	2	0	0	0	2	119
	A2	Forestry at Bins Rd Aire Valley	0	1	0	0	2	2	1	0	0	0	0	0	0	2	0	64
	A3	Ford River	0	1	0	0	5	3	2	3	0	3	3	0	0	0	1	205
	A4	Hordern Vale Rd	0	3	0	0	0	1	0	0	0	1	1	0	1	0	1	63
	A5	Gt Ocean Rd near Glenaire/ Castle Cove	2	0	2	0	1.5	1	1	0	1	1	1	0	2	0	0	105
	A6	Upper ridge Beech Forest to Lavers Hill	2	2	1	0	0	1	1	0	0	1	1	0	1	1	1	96
	A7	Aire River Forestry	0	1	0	0	2.5	2	0	0	0	2	1	0	0	5	2.5	116

Note: Individual risk values for each asset sub class have been multiplied by the Relative Asset Value and then summed to give the Total Risk value for the target site.

Table 13 Relative risk rankings for individual target areas for landslides

Table 13 Relative risk rankings for individual target areas for landslides

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Project Field verification of Target Areas For Erosion

Client DPI **Risk Levels** 5=VH, 4=H, 3=M, 2=L, 1=VL, 0=Not Present

Indicative Level of Risk Posed by Erosion to:

Priority Landscape Zone	Target Area ID	Description	Infrastructure				Water Quality			Biodiversity				Land use				Total Risk adjusted for RAV
			Major Roads	Minor Roads	Dwellings	Other strutures channels dams	Major waterways rivers	Minor waterways streams/ creeks	Catchment Areas	Conservation sites	Natural vegetation	Wetlands	Environment Visual Amenity	Dairying	Pasture and grazing	Forests and Plantations	Public Rec. Tourism	
		Average Relative Asset Value (RAV)			8.5			10				10				4		
Woady Yalloak					17			40			20				16			93
Moorabool		Average Relative Asset Value x			21.25			30			20				10			81.25
Thompsons		Overall Landscape Zone Risk Value			8.5			20			10				4			43.5
Upper Barwon					8.5			15			10				10			43.5
Leigh					17			20			15				10			62

Priority Landscape Zone	Target Area ID	Description	Infrastructure				Water Quality			Biodiversity				Land use			
			Major Roads	Minor Roads	Dwellings	Other strutures channels dams	Major waterways rivers	Minor waterways streams/ creeks	Catchment Areas	Conservation sites	Natural vegetation	Wetlands	Environment Visual Amenity	Dairying	Pasture and grazing	Forests and Plantations	Public Rec. Tourism
Woady Yalloak	WY1	Misery Moonlight Creek area	0	2	0	0	2	5	0	0	2	0	2	0	4	0	0
	WY2	Paddy Gully Road	0	1	0	0	1	3	0	0	1	0	2	0	3	0	0
	WY3	Cars / Boyles Road	0	1	0	0	1	4	0	0	1	0	1	0	3	0	0
	WY4	Rokewood Corindhap Road	0	0	0	0	2	2	0	0	2	0	2	0	2	0	1
Woady Yalloak		Overall Landscape Zone Risk Value			2			4			2				4		
Moorabool	M1	Eclipse Creek	0	2	0	2	2	3	2	0	1	0	2	0	2	1	0
	M2	West Branch	0	0	0	0	2	3	2	0	1	0	1	0	2	0	0
	M3	Lynches Road	0	2	0	0	0	1	1	0	2	0	1	0	1	0	0
	M4	Demolts Road (Fire affected area)	0	2	0	4	0	1	1	0	2	0	1	0	4	0	0
	M5	Robs Road	0	0	0	0	0	2	1	0	1	0	1	0	1	0	0
	M6	Yendon / La La	0	0	0	1	3	3	3	0	0	0	0	0	1	0	0
Moorabool		Overall Landscape Zone Risk Value			2.5			3			2				2.5		
Thompsons	T1	Willowite Road	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0
	T2	Blackgate Road	1	0	0	0	1	0	0	1	1	1	0	0	0	0	0
	T3	Thompsons Creek off McCann Road	0	1	0	0	2	0	0	1	1	1	0	0	0	0	0
Thompsons		Overall Landscape Zone Risk Value			1			2			1				1		
Upper Barwon	UB1	Deans Marsh Rd_ Coal Mine Creek_ Wurdale Rd	1	0	0	1	1	0	1	0	1	0	1	0	2.5	0	0
	UB2	Yan Yan Gurt Ck and retreat Ck	1	0	0	0	0	1	0	0	1	0	1	0	1	0	0
	UB3	West Barwon Valley-Colac Muroon/ Birregurra	1	1	0	0	2	1	1	0	1	0	0	0	2	0	0
Upper Barwon		Overall Landscape Zone Risk Value			1			1.5			1				2.5		
Leigh	L1	Magpie	2	1	0	1	2	2	0	1	1	0	0	0	1	0	0
	L2	Sand Road	0	2	0	1	2	2	0	0	1	0	0	0	1	0	0
	L3	Coopers Road	0	0	0	0	1	1	0	0	2	0	0	0	2	0	0
	L4	Shelford . Mt Mercer Road inc Robbies Road	0	0	0	1	1	2	0	0	0	0	0	0	3	0	0
	L5	Shelford Meredith Road	0	0	0	1	1	2	0	0	1	0	0	0	2	0	0
Leigh		Overall Landscape Zone Risk Value			2			2			1.5				2.5		

Note: Overall landscape zone risk values for each asset class have been multiplied by the Relative Asset Value and then summed to give the Total Risk value for the landscape zone

Table 14 Relative risk rankings for overall landscape zones for erosion

Table 14 Relative risk rankings for overall landscape zones for erosion

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Project Field Verification of Target Areas For Landslides

Client DPI **Risk Levels 5=VH, 4=H, 3=M, 2=L, 1=VL, 0=Not present**

Indicative Level of Risk Posed by Landsldies to:

Priority Landscape Zone	Target Area ID	Description	Infrastructure				Water Quality			Biodiversity				Land use				
			Major Roads	Minor Roads	Dwellings	Other strutures channels dams	Major waterways rivers	Minor waterways streams/ creeks	Catchment Areas	Conservation sites	Natural vegetation	Wetlands	Environment	Dairying	Pasture and grazing	Forests and Plantations	Public Rec. Tourism	
		Average Relative Asset Value			8.5			10				10				4		
Gellibrand					38.25			40				20				12		110.25
Otway Coast					38.25			20				20				14		92.25
Curdies		Average Relative Asset Value x			34			25				15				16		90
Upper Barwon		Overall Landscape Zone Risk Value			17			40				20				8		85
Aire					12.75			30				30				8		80.75

Priority Landscape Zone	Target Area ID	Description	Infrastructure				Water Quality			Biodiversity				Land use				
			Major Roads	Minor Roads	Dwellings	Other strutures channels dams	Major waterways rivers	Minor waterways streams/ creeks	Catchment Areas	Conservation sites	Natural vegetation	Wetlands	Environment	Dairying	Pasture and grazing	Forests and Plantations	Public Rec. Tourism	
Gellibrand	G1	Johanna	1	2.5	2.5	0	0	2	0	1	1	1	2	0	3	0	2	
	G2	Gellibrand River Estuary	0	2.5	1	0	2	2	0	2	2	2	2	0	1	0	1	
	G3	Windjili/ Valley View Rds	1	1	1	0	0	2	0	0	0	0	0	2	1	0	0	
	G4	Great Ocean Rd Old Princetown PO	5	2.5	2	0	0	3	0	0	0	2	0	0	3	0	4	
	G5	Tomahawk Cr/ Coradjil Rds	0	2	2	0	0	2	0	0	1	0	0	2	0	0	0	
	G6	Turtons Track	5	0	0	0	0	4	3	2	3	0	3	0	0	0	3	
	G7	Kawarren East / Frys Rds	0	3	2.5	2.5	2	2	1	0	0	0	0	0	3.5	0	0	
	G8	West Gellibrand Res/ Arkins Ck	0	1	0	4	4	2	5	0	2	0	2	0	0	0	0	
	G9	Moonlight Head/ Gables Rde	0	1	1	0	0	3	0	0	2	0	2	0	3	0	1	
	G10	Princetown Simpson Rd Bouwmans	5	0	5	0	0	0	0	0	0	0	0	5	0	0	0	
Gellibrand		Overall Landscape Zone Value			4.5			4				2				3		
Otway Coast	OC1	Fairhaven Clarkes Slide	2.5	2.5	2.5	0	0	0	0	0	2.5	0	0	0	0	0	2.5	
	OC2	Big Hill/ Lorne	5	0	0	0	0	2.5	0	0	2	0	2	0	0	0	4.5	
	OC3	Windy Point	5	0	0	0	0	0	0	0	1	0	4	0	0	0	4.5	
	OC4	Mt Defiance to Jamieson River	3	0	0	2	2	0	0	0	2	0	4	0	0	0	3	
	OC5	Wye River	3	3	3	0	3	0	0	0	2	2	2	0	0	0	2	
	OC6	Kennett River to Grey River	3	0	0	1	2	0	0	0	2	0	3	0	0	0	3	
	OC7	Skenes Creek/ Beacon Point	3	0	3	2	0	3	0	0	2	0	2	0	0	0	3	
	OC8	Wongarra Gt Ocean Rd	3.5	0	3.5	0	0	1	0	0	1	0	1	0	3.5	0	3	
	OC9	Wild Dog/ Sunnyside Rd	0	4	4	0	4	0	0	0	2	0	1	0	2.5	0	2	
	OC10	Apollo Bay/ Barham Valley	2	2	2.5	2	2	0	0	0	2	1	2	0	1	0	2	
Otway Coast		Overall Landscape Zone Value			4.5			2				2				3.5		
Curdies	C1	Pt Campbell Cobden Road	4	0	2	0	0	2	0	0	0	0	2	3	0	0	3	
	C2	Cooriemungle/ Williams Road	1	4	2	0	0	3	0	0	0	0	2	3	0	0	0	
	C3	Scotts Creek	1	3	2	0	0	3	0	0	0	0	2	4	2	0	0	
	C4	12 Apostles and Coast	1	1	0	0	0	0	0	4	4	0	4	0	0	0	4	
Curdies		Overall Landscape Zone Value			4.0			2.5				1.5				4		
Upper Barwon	UB1	Winchlesea Lorne Rd	2	0	0	0	2	0	1	0	0	0	1	0	2	0	0	
	UB2	Bambra/ Coal Mine Creek Rd	0	2	0	0	0	3	1	0	0	1	2	0	2.5	0	0	
	UB3	Pennyroyal	0	2	1	0	0	1	1	0	1	0	1	0	2	1	0	
	UB4	Forest including Lake Elizabeth	0	2.5	1	4	4	3	3	0	3	3	2.5	0	0	0	1	
	UB5	Deans Marsh Lorne Rd Sincocks Rd	1	1	2	0	0	1	0	0	1	0	0	0	1	0	0	
	UB6	Birregurra Yeodene Rd / Phillips landslide	0	1	1	0	4.5	0	2	0	0	0	4	0	4	0	0	
Upper Barwon		Overall Landscape Zone Value			2.0			4				2				2		
Aire	A1	Gt Ocean Road	2.5	2.5	0	0	0	2	0	0	2	0	2	0	0	0	2	
	A2	Forestry at Bins Rd Aire Valley	0	1	0	0	2	2	1	0	0	0	0	0	0	2	0	
	A3	Ford River	0	1	0	0	5	3	2	3	3	0	3	0	0	0	1	
	A4	Hordern Vale Rd	0	3	0	0	0	1	0	0	1	0	1	0	1	0	1	
	A5	Gt Ocean Rd near Glenaire/ Castle Cove	2	0	2	0	1.5	1	1	0	1	1	1	0	2	0	0	
	A6	Upper ridge Beech Forest to Lavers Hill	2	2	1	0	0	1	1	0	1	0	1	0	1	1	1	
	A7	Aire River Forestry	0	1	0	0	2.5	2	0	0	2	0	1	0	0	5	2.5	
Aire		Overall Landscape Zone Value			1.5			3				3				2		

Note: Overall landscape zone risk values for each asset class have been multiplied by the Relative Asset Value and then summed to give the Total Risk value for the landscape zone

Table 15 Relative risk rankings for overall landscape zones for landslides

Table 15 Relative risk rankings for overall landscape zones for landslides

6.3 Revised Threat-Landscape Combination Rankings for Landslides and Erosion

Based on the field observations, the field estimation of risk and the secondary risk assessment and evaluation of both target areas and landscape zones, a final process of re-evaluation and revision of the initial threat-landscape combinations was undertaken.

Due to the fact that risks associated with sheet/rill erosion and gully/tunnel erosion were not specifically separated in the field or assessed individually in the secondary risk assessment, rankings for the sheet/rill–landscape combination and the gully/tunnel-landscape combinations were grouped together in the new listing but kept in the same order as the original list.

The ranking of the grouped erosion–landscape pairings was then revised and adjusted to match the intra landscape order established in the secondary risk assessment (i.e. Table 17). Where only one of the types of erosion appeared in the top twenty (i.e. sheet/rill erosion in Thompson), the ranking was adjusted according to an assessment of the landscape zone in comparison to the other zones.

For example the intra landscape rankings for erosion from the secondary risk assessment were as follows:

Intra rankings for landscape zones after secondary risk assessment of erosion	***Landscape Zone***	***Relative ranking value adjusted for RAV***
1	Woady Yalloak	93
2	Moorabool	81.25
3	Leigh	62
4	Upper Barwon	43.5
5	Thompson	42.5

Table 17 Intra landscape rankings for erosion

As a result of these revisions to rankings between landscape zones, a revised ranking for the various individual erosion-landscape combinations within the top 20 initial rankings was undertaken with results as follows:

Initial Rank	*Threat*	*Zone*	*New Rank*	*Threat*	*Zone*
4	Gully/tunnel	Woady Yalloak	**3**	Gully/tunnel	Woady Yalloak
5	Sheet/rill	Woady Yalloak	**4**	Sheet/rill	Woady Yalloak
9	Sheet/rill	Thompson	**8**	Sheet/rill	Moorabool
11	Sheet/rill	Moorabool	**9**	Gully/tunnel	Moorabool
13	Gully/tunnel	Leigh	**12**	Gully/tunnel	Leigh
15	Gully/tunnel	Moorabool	**13**	Sheet/rill	Leigh
16	Sheet/rill	Upper Barwon	**16**	Sheet/rill	Upper Barwon
17	Gully/tunnel	Upper Barwon	**17**	Gully/tunnel	Upper Barwon
18	Sheet/rill	Leigh	**18**	Sheet/rill	Thompson

Table 18 Revised erosion-landscape combinations within the top 20 combinations

The use of the intra rankings for landslide-landscape combinations (see Table 15 and Table 19) was then used to adjust the order of the combinations in the tope twenty.

Intra rankings for landscape zones after secondary risk assessment of landslides	*Landscape Zone*	*Relative ranking value adjusted for RAV*
1	Gellibrand	110.25
2	Otway Coast	92.25
3	Curdies	90
4	Aire	80.75
5	Upper Barwon	80

Table 19 Intra landscape rankings for landslide

The final revision of the top 20 threat-landscape zone combinations was then primarily undertaken using the revised rankings of landscape zones within the two categories of erosion and landslide based on the secondary risk assessment. No attempt was made to revise rankings between these two groups based on the absolute value of the relative ranking value as this method was not considered to be as transferable across threat types as per the initial analysis.

6.4 Final Revision to the Initial Ranking List

The final process for overall revision undertaken involved a review and readjustment of all threat landscape combinations within the top 20 lists. Whilst not specifically part of this report which focuses primarily on the revision of rankings for landslide and erosion processes, other expert judgements and field studies were conducted to verify and revise the initial rankings for other soil threatening processes such as secondary salinity and potential acid sulphate soil. These studies were prepared as background studies prepared for the CSHS and are described in more detail in the draft CSHS. Some of the more important aspects are summarised below.

A study by CSIRO on the Bellarine Peninsula indicated that while acid sulphate soils are present they are located mainly in areas not likely to be developed or disturbed and as such represent a lower risk. As a result, the rankings of the potential acid sulphate soil-landscape combinations have been significantly downgraded within the top 20.

The significance of secondary salinity was considered to be unaltered from the initial assessments and all combinations of secondary salinity-landscape zones in the top 20 were kept in the same or as near to same position in the top 20 ranking list.

It should be noted that no attempt has been made to elevate any other combinations outside the initial top 20 into the final list or, to downgrade any of the initial top 20 so that it fell outside of the top 20. As such, the final revision and readjustment of rankings has only been carried out on the initial top 20 listings.

A final workshop was held with Troy Clarkson and the author to assess the revised intra rankings for erosion and landslide, the results of the assessment for salinity and PASS and other available information. By using all the available data and information, a final revised top twenty list of threat-landscape zone combinations was agreed upon. The final adjusted list is as follows:

Final ranking based on secondary risk assessment	*Threat*	*Landscape Zone*	*Previous Ranking*	*Adjustment*
1	Landslides	Gellibrand	1	Same
2	Secondary Salinity	Lismore	2	Same
3	Gully/tunnel	Woady Yallaok	4	Up 1 place
4	Sheet/rill	Woady Yallaok	5	Up 1 place
5	Secondary salinity	Stony Rises	6	Up 1 place
6	Landslides	Otway Coast	8	Up 2 places
7	Landslides	Curdies	7	Same
8	Sheet/rill	Moorabool	11	Up 3 places
9	Gully/tunnel	Moorabool	15	Up 6 places
10	Secondary salinity	Woady Yalloak	10	same
11	Secondary salinity	Murdeduke	12	Up 1 place
12	Gully/tunnel	Leigh	13	Up 1 place
13	Sheet/rill	Leigh	18	Up 5 places
14	Landslides	Upper Barwon	14	Same
15	Landslides	Aire	20	Up 5 places
16	Sheet/rill	Upper Barwon	16	Same
17	Gully/tunnel	Upper Barwon	17	Same
18	Sheet/rill	Thompson	9	Down 9 places
19	Potential acid sulphate	Bellarine	3	Down 16 places
20	Potential acid sulphate	Thompson	19	Down 1 place

Table 20 Final revised ranking list for the initial top 20 threat-landscape combinations

7. Qualitative Summary of Risks

In order to assist with the overall process of review and re-ranking of erosion and landslide issues within the CCMA, the following qualitative descriptions of relative risk to assets has been provided as a summary of the process undertaken. The descriptions are based on the initial GIS based desk top assessment, expert knowledge, previous information, data inventories ,the results of the field inspections and the secondary risk assessment described in the previous sections. In keeping with the division of threats and target areas inspected in the field, the summaries for landslides have been written by the author whilst the summaries for erosion have been provided by Troy Clarkson.

7.1 Gellibrand-Landslides

The highest ranking landscape zone was the Gellibrand which was found to contain a diverse range of landslides. Significant impacts were noted on major tourist roads at various locations on the Great Ocean including a recent failure at Princetown requiring engineering works and major stabilisation. In excess of $700,000 remediation works were required on Turton's Track due to landslide damage after a severe rainfall event in February 2004 and ongoing occurrences of landslides below these remedial works were noted during the recent inspection.

Other roads such as East Kawarren Rd and Colac Lavers Hill Rd have also been damaged or impacted through the occurrence of landslides. Ongoing landslide movement on the Princetown-Simpson Rd on the western boundary of this zone has caused extensive road damage as well as the destruction of a number of sheds and the severe damage and the ultimate demolition of a dwelling. The potential for damage to dwellings was also noted at Johanna where a number of cabins are located on a large active landslide.

Significant risk to water supply infrastructure and water quality was also confirmed at West Gellibrand reservoir where an old landslide has reactivated in recent times on one of the flanks of the water supply reservoir. In addition a landslide adjacent to Arkins Creek is known to have impacted on water quality whilst also threatening the main water supply to Camperdown. Other minor risks to water quality were also identified in the Johanna area and along the Gellibrand River although impact was restricted due to limited travel distance or run-out.

Although inspection of forestry and logging operations was restricted by road access, such activity has been assessed as having a potential to impact on water quality through initiation of landslides and erosion if good forestry practice is not adhered to. A major slide on the Aire River and subsequent plantation establishment resulted in some sections of this operation now being unusable due to the potential for further movements and impact on the river.

Finally, risks to agricultural land were identified in the Johanna area, the area east of Simpson at Tomahawk Creek and at Kennedy's Creek where shallow translational slides in the Gellibrand Marls have caused minor disruption to pastures and grazing lands.

7.2 Otway Coast-Landslides

The main impacts from landslides in this landscape zone were confirmed as damage to infrastructure and disruption to road infrastructure effecting tourism.

Significant numbers of dwellings have been located within or adjacent to two large coastal landslides at Fairhaven. Whilst impact to date has been minimal potential risks exist if larger movements associated with reactivation under adverse conditions occur. Other locations within this zone have also been assessed as having moderate to high risks of property damage associated with the occurrence of landslides and include some isolated parts of Lorne, Wye River, the northern areas of Skenes Creek, Wongarra, some outer areas of Apollo Bay and rural developments in the adjacent valleys of Barham River and Wild Dog Creek.

A significant and ongoing impact from landslides has occurred on the Great Ocean Road and recent closures of this major tourist road have occurred at Big Hill outside Lorne and at Cumberland River. A large scale failure occurred on the Great Ocean Road in the late 1970's at Windy Point to the west of Lorne. This slide closed the Great Ocean Road for six months and required significant engineering stabilisation works using numerous rock bolts. Such installations have a limited design life and further works can be expected in the future and newly installed monitoring instrumentation at the site by VicRoads confirms the ongoing risks associated at this site. Numerous slides also occur regularly along stretches of the Great Ocean Rd near Jamieson River and Kennett River and inspections of these sites indicate ongoing potential for minor failures requiring maintenance and cleanups.

7.3 Curdies-Landslides

The main impacts within the Curdies landscape zone occur on major road infrastructure, sites of natural beauty and agricultural lands.

Significant and ongoing damage has been experienced along the Port Campbell Cobden Road which is a major tourist route to the twelve apostles and other sites of natural importance. Remedial works have failed to fully alleviate damage associated with shallow translational slides (so typical of the region) which transect the road in a number of locations. Damage to a series of timber retaining walls along minor roads such as Williams Rd and the Timboon Colac Rd has also been identified as being caused by relatively shallow but long translational landslides. As previously discussed significant damage has continued to occur on the Princetown Simpson Rd which is located on the boundary with Gellibrand landscape zone.

A recent landslide below the Great Ocean Rd near the Old Princetown Post office caused significant damage and has required significant remedial engineering works.

Significant disruption to agricultural land has occurred throughout the region due to numerous and widespread shallow translational landslides. Whilst the impact has been minor in many cases some areas have been completed removed from usage (see FigASM1) and have been fenced off and in some cases actively remediated.

Ongoing landslide and instability along the coast have also recently impacted on the natural environment and include the collapse of one of the twelve apostles and London Bridge. Impact to waterways and wetlands is considered to be relatively minor although many small failures ere noted directly adjacent to creeks and streams and there is some potential for sediment loading.

7.4 Upper Barwon-Landslides

This zone is characterised by potential impacts to water quality including proclaimed water catchment areas with some risks to agricultural lands.

Minor slides on the Barwon River at the Lorne Winchelsea Rd were noted as having a minor risk to water quality with a similar assessment of risks along some of the smaller creeks such as Scrubby Creek. More significant risks have been assessed for some sections of the water supply infrastructure in the region with landslides known to have impacted on the main supply channel and associated syphons taking water from the West Barwon Dam to the Wurdee Boluc reservoir. Other isolated slides are also known to have occurred adjacent to the channel near Wurdale Rd and any long term disruption to this channel represents a significant risk to Geelong's water supply network.

The potential impact of rarer large scale landslides in this area was graphically illustrated in 1952 when the Lake Elizabeth landslide failed and blocked the east branch of the Barwon River. The slide was of the order of 60 hectares and significantly disrupted flows in the river until the landslide dam was breached in the following year sending a 7 m wall of mud and water down the river.

Disruption and loss of agricultural lands was also noted along a long section of the Barwon River at Birregurra. Assessment of the Phillips Landslide indicated approximately 4 hectares had been lost as viable grazing land and there was also a potential likelihood that further reactivation may have impacted on the Barwon River

7.5 Aire-Landslides

The Aire region is the smallest of the landscape zones within the CCMA and contains limited infrastructure but includes areas of significant environmental importance such as the Otway National Park. As such the risks are mainly associated with water quality and the environment.

Some minor infrastructure risks are present along the Great Ocean Road and a number of landslides directly adjacent to the road were noted during the recent inspection and will require remedial engineering works. Other recent engineering repair works due to landsliding have also been undertaken by Colac Otway Shire on Wait–a-While Rd and landslides are also known to have caused some damage on the Horden Vale Rd.

Risks to water quality and the environment were recently emphasised by the closure of the Ford River due to a landslide which occurred after forestry activities. Other areas of logging and forestry were also noted at the northern end of Bins Rd and in the Beech Forest area and whilst access to such areas was restricted risk to water quality and the environment are considered possible if good forestry practice is not employed.

7.6 Woady Yalloak-Erosion

Erosion in the Woady Yaloak was verified to be significant risk to assets, particularly in the Misery/Moonlight areas. Risk from erosion was mostly from large volumes of sediments impacting water quality in the Misery and Moonlight Creeks, which flow into the Woady Yaloak River. Erosion was also seen to significantly impact agricultural production and some risk posed to remnant vegetation.

7.7 Moorabool-Erosion

Water erosion in the Moorabool was also verified to be of significant risk to assets, particularly along Eclipse Creek. Risk from erosion on water quality may have severe consequences as the area is in a water supply proclaimed area. Risk to agricultural production and some remnant vegetation was also verified.

7.8 Leigh- Erosion

Assets in the Leigh were also verified to be at risk from water erosion. Risk to water quality, agricultural production and some biodiversity significant areas were all verified.

7.9 Upper Barwon Erosion

Erosion in the Upper Barwon was not verified to have the magnitude of risk indicated by the initial relative risk to asset analysis in the CSHS. Most erosion was in the form of stream bank, and evidence of fencing and revegetation programs appears to be successfully addressing much of the risk.

Despite the initial high ranking of sheet/rill erosion risk in the Thompson there was little evidence available to verify this from the field verification. Many erosion sites appeared to be stable and other areas were mistakenly identified as erosion sites when they were not.

8. Discussion of Limitations and Comments

The process of verification of initial “relative risk to asset” rankings is a critical element of the overall process for identifying soil threatening risks in the CCMA region. It allows the use of field based observations to confirm initial threat-landscape rankings which were essentially a desk top, GIS based process. The top 20 threat-landscape combinations chosen as priority areas are essential in demonstrating effective investment in soil health. They will form the basis for on ground works and will ultimately demonstrate the benefits of the CSHS through the achievement of reductions in significant risks posed by various soil threatening processes.

The choice of target areas was based on information relating to threats and assets contained within the database and the GIS method adopted to assess the intersection of these threats with assets. As such, the method is limited by the completeness, the quality and spatial accuracy of the data in the databases. Whilst a significant amount of detailed information has been recently assembled for erosion and landslides, it must be recognised that this data is still only a sub set of what actually exists. The spatial distribution of such data is limited by the methods of collection (in this case inspection of ortho corrected aerial photos) and the scale at which occurrences can be accurately assessed. Variable quality of aerial photos throughout the CCMA means different levels of data resolution occur. Hence the ability to recognise like processes throughout the region differs.

Inspection of aerial photos is significantly more revealing in stereo and as such the previous non stereo method of interpretation somewhat limits the type and number of occurrences that may be recognised and ultimately included into the database. Hence there is a limitation with the GIS based initial method of ranking and the later choice of target areas through a GIS based analysis of intersection of threats and assets due largely to data deficiencies.

The other major issue with data completeness is that threats other than erosion and landslide are poorly mapped. Hence any GIS based intersection analysis and relative risk calculation will be biased by a lack of spatial data for certain threats and risks may not represent a true distribution across all threats.

Another limitation in the verification and assessment of risks in target areas was field access to many of the mapped occurrences. Field inspections were essentially limited to access via existing public roads and whilst this provided good vantage points in many cases, some instances of erosion in particular where located within property boundaries and as such were not able to be observed. This was offset to a degree through expert local knowledge of regional occurrences and previous field extension projects but access issues prevented detailed site observation in many cases.

Finally, as for all risk assessment methods, the verification of risk is only as good as the judgements for likelihood and consequence. Whilst detailed knowledge of the region and observation of previous soil threatening process throughout the region have assisted the inspection team in assessing likelihood and consequence, it must be recognised that such judgements are still subjective and will most likely vary to some degree between different assessors. The use of standard descriptors, risk estimation approaches and evaluation procedures adopted in this project are intended to limit the effect of such subjective judgements as much as possible. The key element of allocation of likelihood and consequence, and hence risk, lies with the use of expert judgement based on all available facts.

Not withstanding the limitations described above, the process undertaken in this field verification project has been based on established methods of risk analysis supported by extensive field observations. The revised relative risks for both target areas and landscape zones as a whole are considered to be a good representation of what actually exists. Enhanced confidence in both the initial method of assessment and that used in this project was gained from confirmation of the presence of mapped soil threatening processes and the observation of actual impacts on the assets in the field.

9. References

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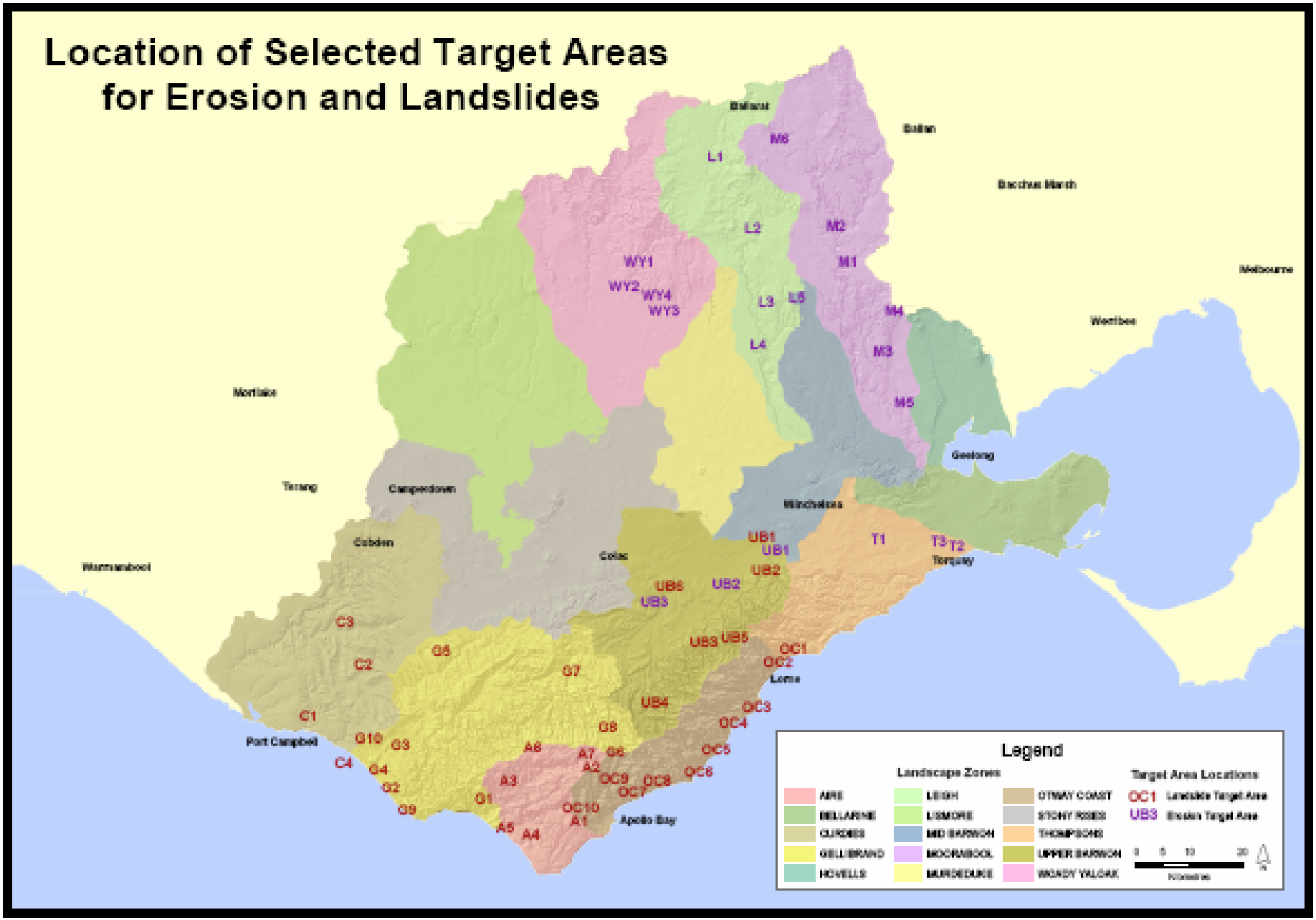
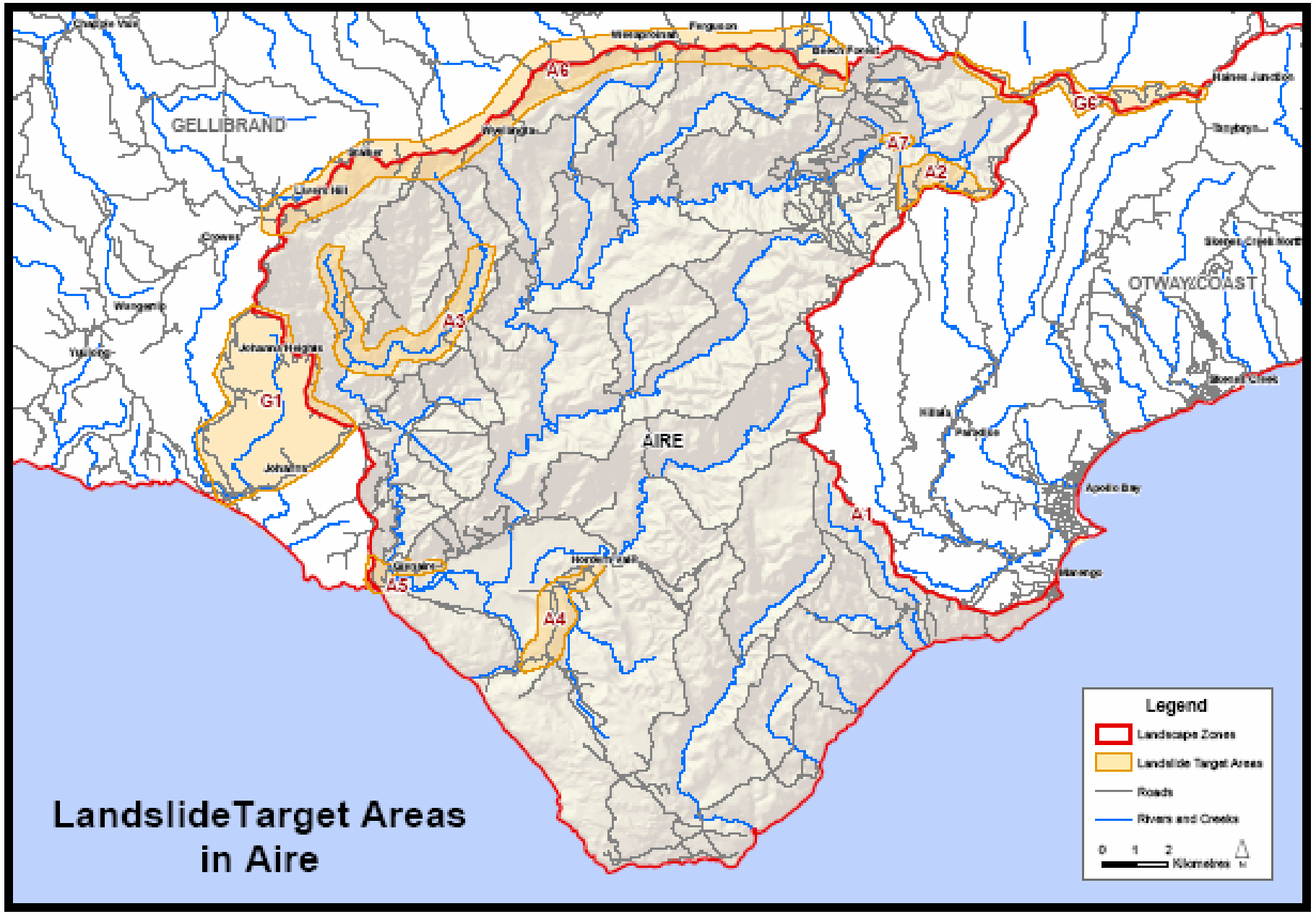
MacEwan R.J. (2003) Soil Health Strategy for Corangamite Region (discussion paper) Centre for Land protection: Department of Primary Industries.

Appendix A

Locations of Target Areas for Erosion and Landslides


Location of Selected Target Areas
for Erosion and Landslides
Ballarat
Bacchus Marsh
Melbourne
Werribee
Geelong
Colac
Torquay
Lorne
Port Campbell
Apollo Bay
Legend
Landscape Zones
AIRE
BELLARINE
CURDIES
GELLIBRAND
HOVELLS
LEIGH
LISMORE
MID BARWON
MOORABOOL
MURDEDUKE
OTWAY COAST
STONY RISES
THOMPSONS
UPPER BARWON
WOADY YALOAK
Target Area Locations
OC1 Landslide Target Area
UB3 Erosion Target Area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OTWAY COAST
AIRE
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A2
A3
A4
A5
A6
A7
G1
G6
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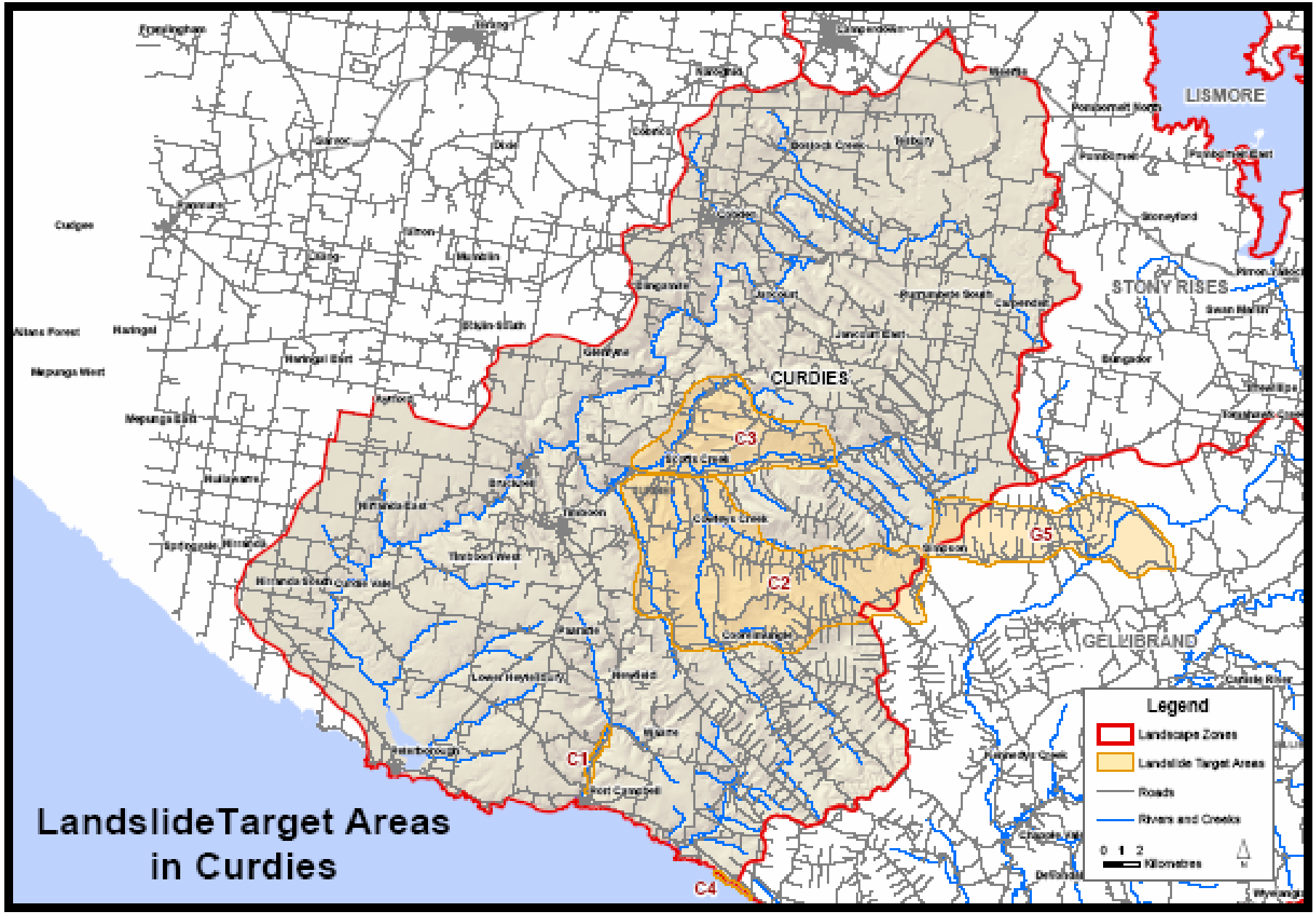
Landscape Zones
Landslide Target Areas
Roads
Rivers and Creeks
0 1 2
Kilometres
Landslide Target Areas
in Aire


LISMORE
STONY RISES
CURDIES
GELLIBRAND
C1
C2
C3
C4
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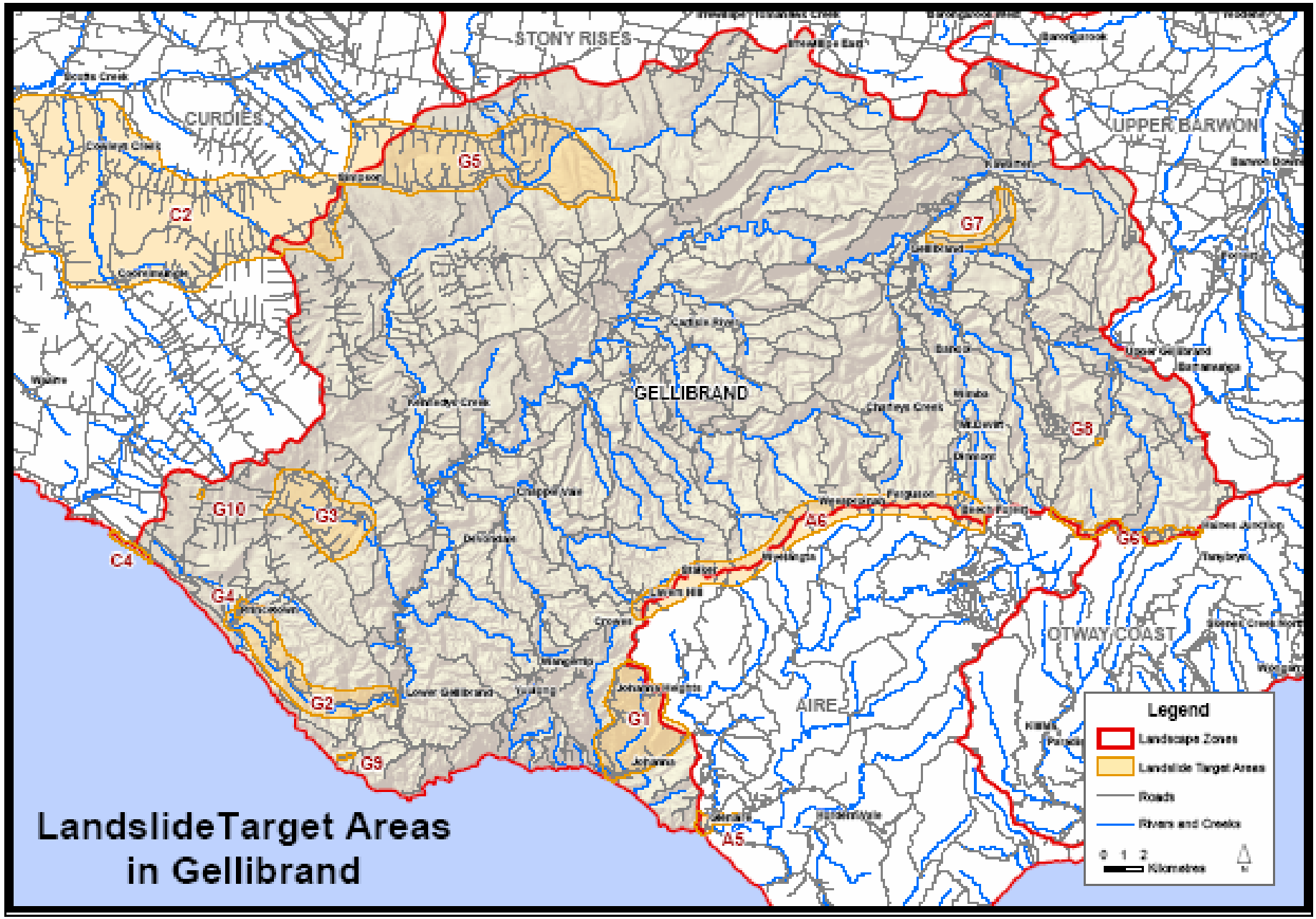
Landscape Zones
Landslide Target Areas
Roads
Rivers and Creeks
0 1 2
Kilometres
Landslide Target Areas in Curdies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CURDIES
UPPER BARWON
GELLIBRAND
OTWAY COAST
AIRE
C2
C4
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10
A5
A6
Legend
Landscape Zones
Landslide Target Areas
Roads
Rivers and Creeks
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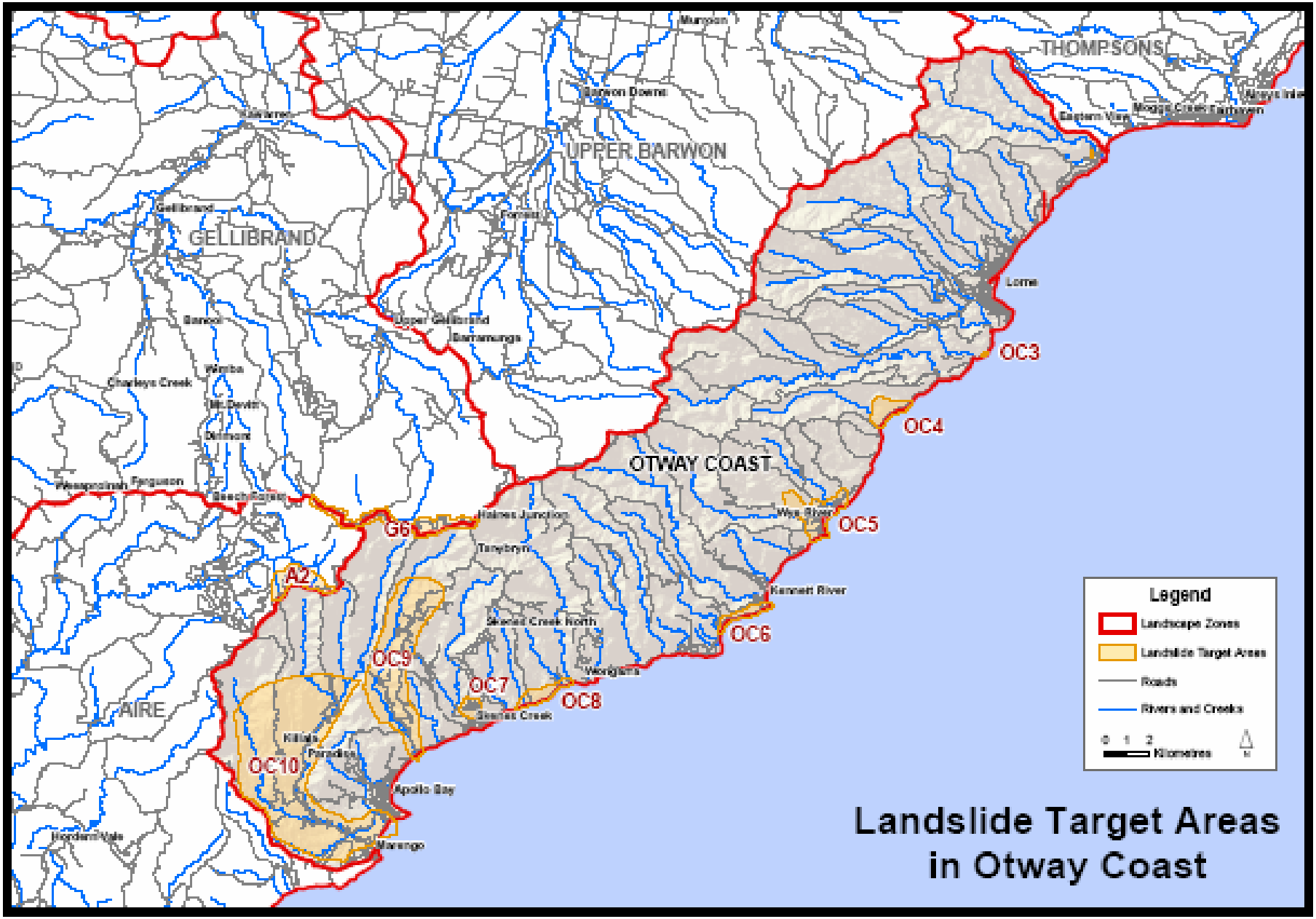
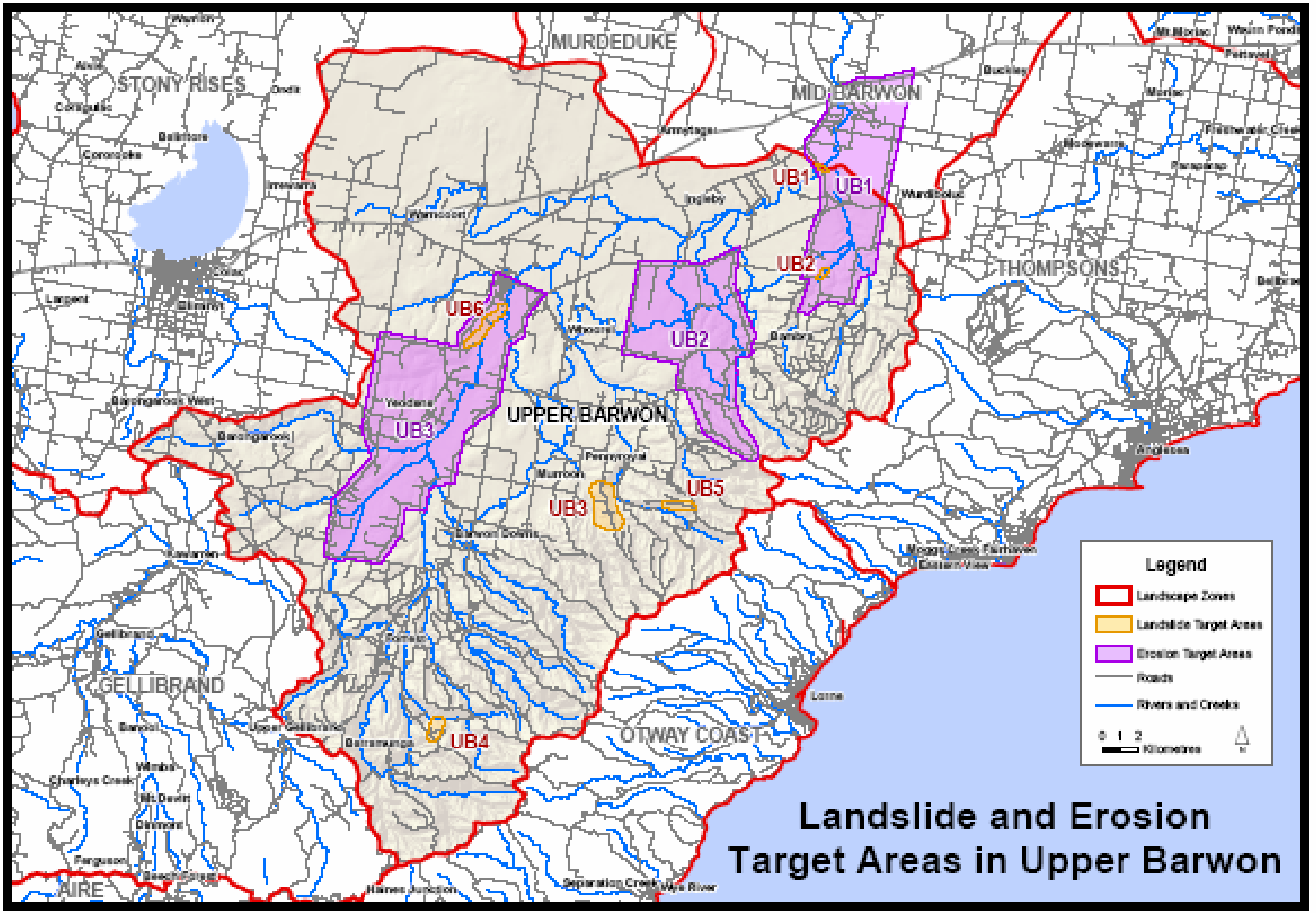
Kilometres
LandslideTarget Areas
in Gellibrand


Landslide Target Areas
in Otway Coast
Legend
Landscape Zones
Landslide Target Areas
Roads
Rivers and Creeks
0 1 2
Kilometres
THOMPSONS
UPPER BARWON
GELLIBRAND
OTWAY COAST
AIRE
Murroon
Barwon Downs
Kawarren
Gellibrand
Forrest
Upper Gellibrand
Barramunga
Banool
Wimba
Charleys Creek
Mt. Devitt
Dirimont
Weeaproinah
Ferguson
Beech Forest
Haines Junction
Tanybryn
Skenes Creek North
Skenes Creek
Wongarra
Kennett River
Wye River
Lorne
Eastern View
Moggs Creek
Fairhaven
Aireys Inlet
Killiala
Paradise
Apollo Bay
Marengo
Hordern Vale
G6
A2
OC3
OC4
OC5
OC6
OC7
OC8
OC9
OC10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MID BARWON
THOMPSONS
UPPER BARWON
GELLIBRAND
OTWAY COAST
AIRE
UB1
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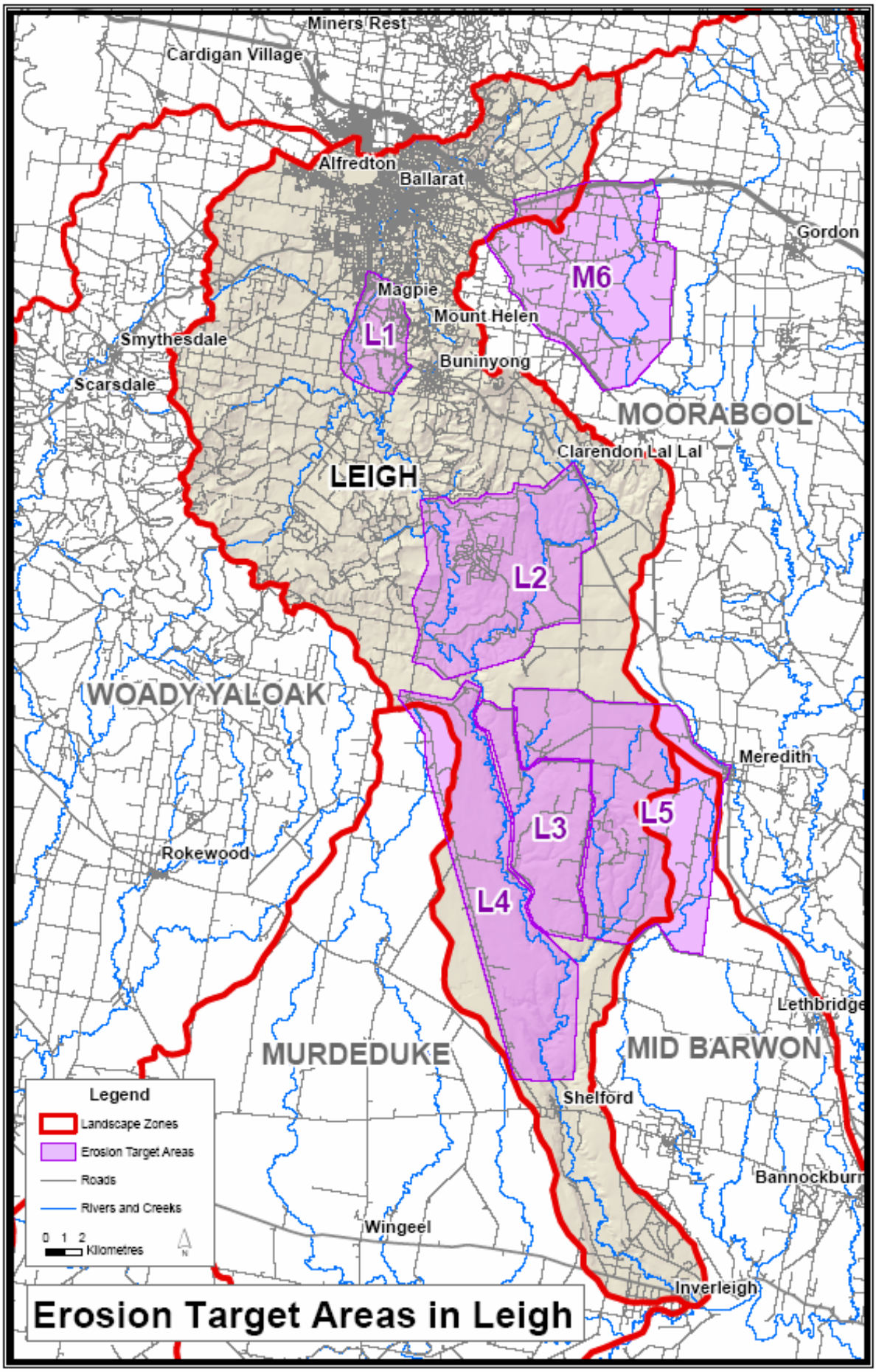
UB4
UB5
UB6
Legend
Landscape Zones
Landslide Target Areas
Erosion Target Areas
Roads
Rivers and Creeks
0 1 2
Kilometres
Landslide and Erosion
Target Areas in Upper Barwon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Cardigan Village
Alfredton
Ballarat
Gordon
M6
Magpie
Mount Helen
L1
Smythesdale
Buninyong
Scarsdale
MOORABOOL
Clarendon Lal Lal
LEIGH
L2
WOADY YALOAK
Meredith
L3
L5
Rokewood
L4
Lethbridge
MURDEDUKE
MID BARWON
Shelford
Bannockburn
Wingeel
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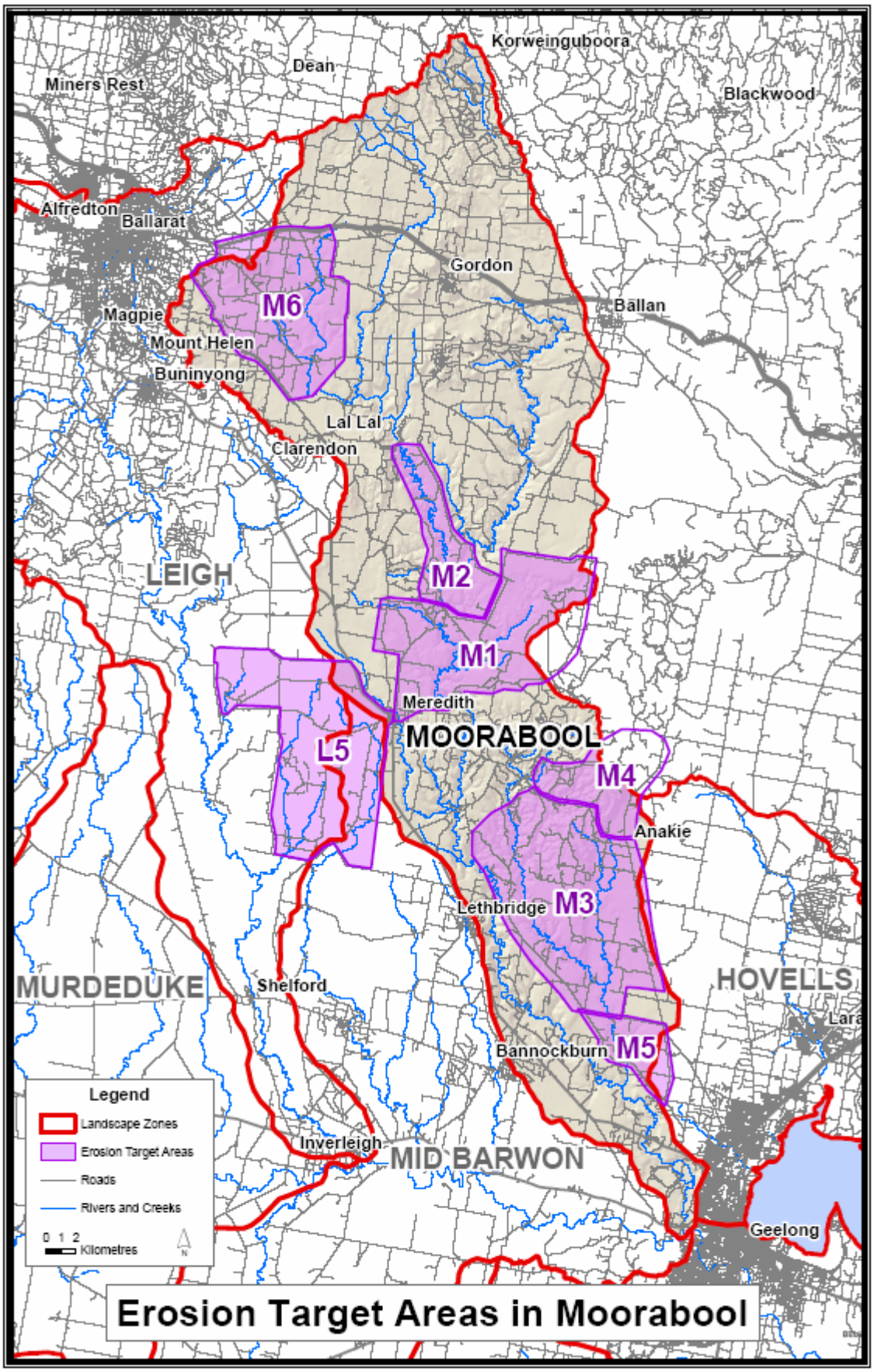
Legend
Landscape Zones
Erosion Target Areas
Roads
Rivers and Creeks
0 1 2
Kilometres
Erosion Target Areas in Leigh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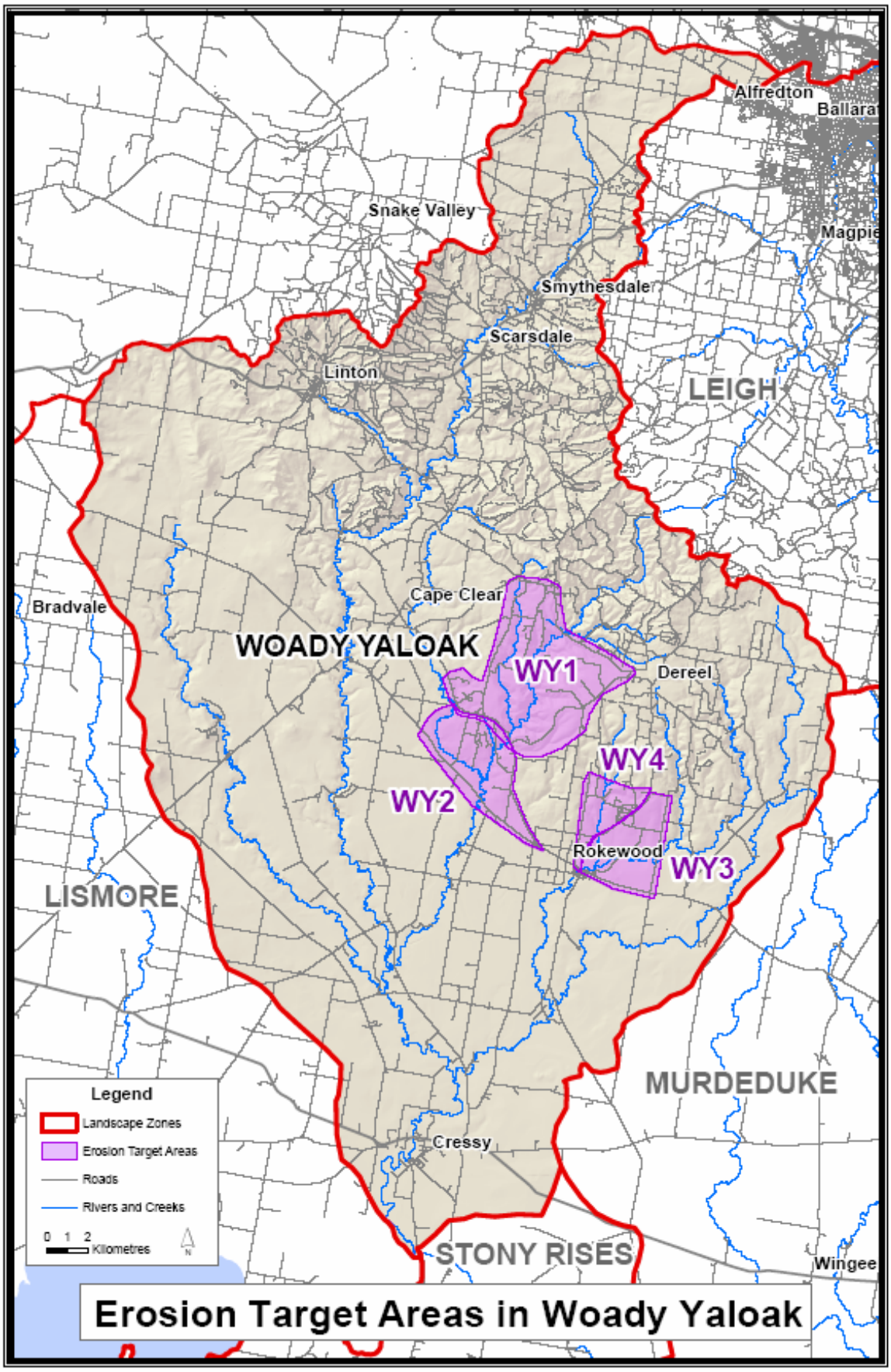
Dean
Miners Rest
Blackwood
Alfredton
Ballarat
Gordon
Ballan
M6
Magpie
Mount Helen
Buninyong
Lal Lal
Clarendon
LEIGH
M2
M1
Meredith
MOORABOOL
L5
M4
Anakie
M3
Lethbridge
MURDEDUKE
Shelford
HOVELLS
Bannockburn
M5
Legend
Landscape Zones
Erosion Target Areas
Roads
Rivers and Creeks
0 1 2
Kilometres
Inverleigh
MID BARWON
Geelong
Erosion Target Areas in Moorabool


Alfredton
Ballara
Magpie
Snake Valley
Smythesdale
Scarsdale
Linton
LEIGH
Bradvale
Cape Clear
WOADY YALOAK
WY1
Dereel
WY4
WY2
Rokewood
WY3
LISMORE
MURDEDUKE
Cressy
STONY RISES
Wingee
Legend
Landscape Zones
Erosion Target Areas
Roads
Rivers and Creeks
0 1 2
Kilometres
N
Erosion Target Areas in Woady Yaloak

Appendix B

Example of the Field Verification Sheet

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area **Site I.D.**

Target Area Location

Date and Data Collector

What might happen?

How likely is it?

What damage, impact or injury may result?

How important is it (sensitivity)?

What can be done about it?

Describe the Danger:

Asset Class:

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4X	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

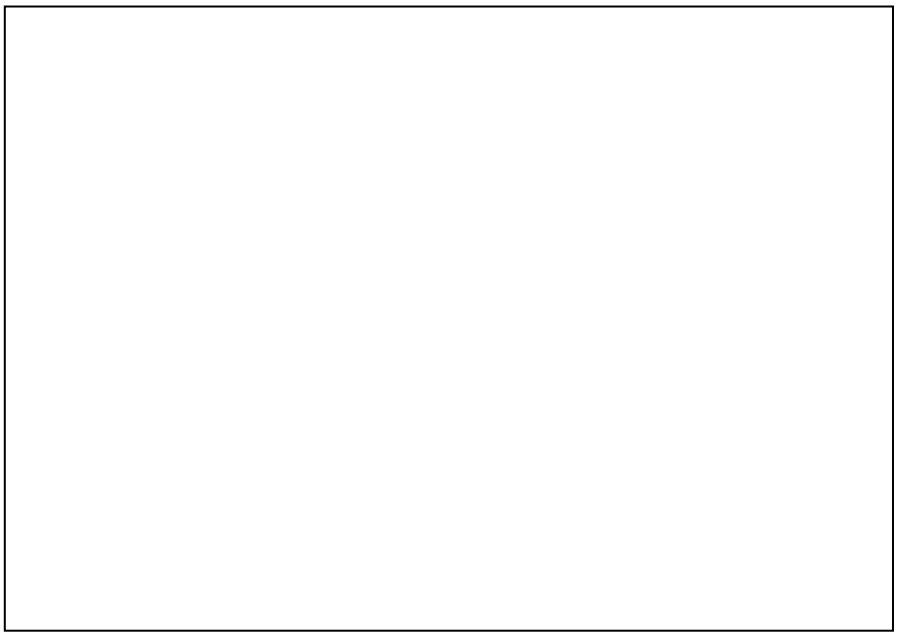
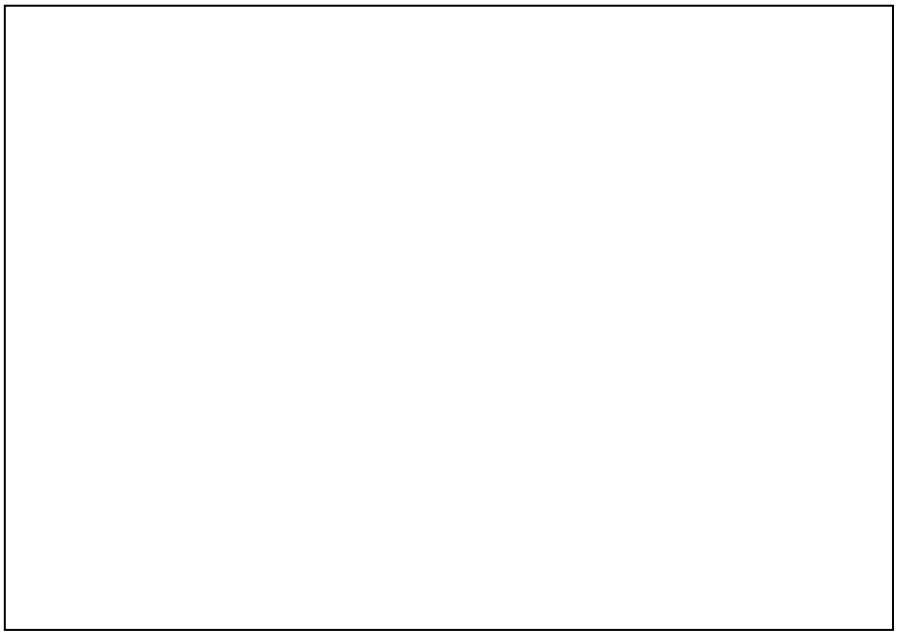


Photo 2



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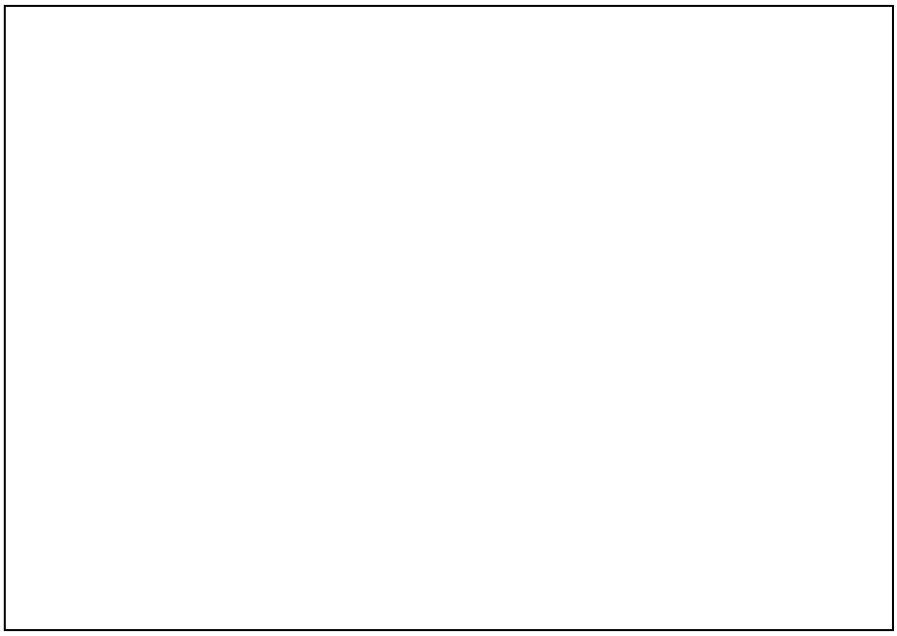

Appendix C

Field Inspection Details and Field Sheets

Landslide Target Areas

Aire

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Aire **Site I.D.** **A1**

Target Area Location Great Ocean Rd just out of Marengo (MGA E 725563, N 5706885)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Small sized landslides has caused damage to road and retaining structure.

How likely is it? Certain event ahs occurred.

What damage, impact or injury may result? Damage to road causing partial closure and need for new stabilisation structure

How important is it (sensitivity)? Significant due to the proximity to a major tourist road. Some potential for impact to stream below but minimal

What can be done about it? Stabilisation required.

Risk Analysis

Describe the Danger: Small volume slide moving up to a metre

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road and possible human life

Likelihood	Consequence				
	1	2	3	4	5
AX	VH	VH	H	HX	MX
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Aire **Site I.D.** **A2**

Target Area Location Bins Rd heading towards Beech Forest

Date and Data Collector Tony Miner 1st August 2006

What might happen? Small to medium sized landslides could occur as a result of logging activities

How likely is it? Possible to likely depending on logging practices.

What damage, impact or injury may result? Sediment inputs into waterways

How important is it (sensitivity)? Could be moderate if significant sediment or rivers were blocked which ahs been observed elsewhere in the Otways

What can be done about it? Strict adherence to appropriate Forestry practice.

Risk Analysis

Describe the Danger: Small to medium volume slide moving a few metres

Asset Class:

Environment

Asset Descriptions

Waterways

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	MX	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Aire **Site I.D.** **A5**

Target Area Location Great Ocean Rd near Glenaire and Castle Cove (MGA E 710980, N 5704621)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Small to medium sized landslides occurring in Gellibrand Marl moving up to a few metres (previous WF2374)

How likely is it? Almost certain with ongoing reactivations possible to likely.

What damage, impact or injury may result? Disruption to farm track and ag land but generally minimal.

How important is it (sensitivity)? Minor consequence

What can be done about it? Attention to site drainage and possible re-plough in area to avoid water infiltration.

Risk Analysis

Describe the Danger: Small to medium volume slide moving a few metres

Asset Class:

Land

Asset Descriptions

Agricultural use and some damage to track

Likelihood	Consequence				
	1	2	3	4X	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Gellibrand

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G1

Target Area Location Junction of Gt Ocean Rd and Red Johanna Rd (MGA E 710130, N 5709476)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Wide small to medium sized translational slides on the lower sections of the slopes have formed in the Narrawaturk marls. Slides can move a few to tens of meters

How likely is it? Likely to certain with strong potential for reactivation.

What damage, impact or injury may result? Damage might result to agricultural land but not much else.

How important is it (sensitivity)? Minor consequences

What can be done about it? Attention to surface drainage and re-ploughing may avoid further infiltration.

Risk Analysis

Describe the Danger: Small to medium translational slide moving a few metres

Asset Class:

Land use

Asset Descriptions

Agricultural land

Likelihood	Consequence				
	1	2	3	4X	5X
A	VH	VH	H	H	M
BX	VH	H	H	M	LX
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G1.1

Target Area Location Blue Johanna Rd (MGA E 706020, N 5708493)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Shallow translational failures are progressively occurring on slope below a dwelling on the ridge.

How likely is it? Likely to certain with potential for reactivation under adverse conditions.

What damage, impact or injury may result? Immediate disruption to agricultural land but may impact dwelling at some stage.

How important is it (sensitivity)? Relatively minor to house but consequence may increase if the slides progressively fail upslope

What can be done about it? Attention to surface drainage and monitor.

Risk Analysis

Describe the Danger: Shallow small to medium translational slides moving a few metres

Asset Class:

Land use and

Asset Descriptions

Agricultural land

Likelihood	Consequence				
	1	2	3X	4X	5
A	VH	VH	H	H	M
BX	VH	H	HX	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Infrastructure

Asset Descriptions

Dwelling

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
CX	H	H	MX	L	L
DX	H	M	LX	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G1.2

Target Area Location Blue Johanna Rd (MGA E 705606, N 5708852)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Small landslide below road in possible drainage line.

How likely is it? Certain as it has already happened and caused damage

What damage, impact or injury may result? Part of road has been undermined and possible failure of previous stabilisation works.

How important is it (sensitivity)? Moderately important as any further damage will block the road

What can be done about it? Stabilisation now required via a retaining wall

Risk Analysis

Describe the Danger: Small volume slide below road moving up to a metre

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road

NB Consequence is probably lower due to minor status of the road

Likelihood	Consequence				
	1	2	3	4	5
AX	VH	VH	H	HX	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G2

Target Area Location Old Ocean Rd adjacent to Gellibrand River (MGA 695269, N 5711310)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Steep cutting may fail onto road plus potential for sheet erosion.

How likely is it? Likely.

What damage, impact or injury may result? Minor deposition of materials on road with possible future wash into river.

How important is it (sensitivity)? Minor consequence given small amounts involved

What can be done about it? Monitor and scale back cutting if required.

Risk Analysis

Describe the Danger: Small volume slide moving up to a metre and some sediment

Asset Class:

Infrastructure and Environment

Asset Descriptions

Road and possibly the Gellibrand River

Likelihood	Consequence				
	1	2	3	4X	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G2.2

Target Area Location Upper end of Old Ocean Rd near Princetown (MGA E 688467, N 5715447)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Small sized landslides have occurred on the steeper flanks of the creek banks.

How likely is it? Likely with movements of up to a metre or so

What damage, impact or injury may result? Possibility for some sediment input into the creeks and streams.

How important is it (sensitivity)? Moderate consequence given high conservation value of the estuary

What can be done about it? Creek bank stabilisation.

Risk Analysis

Describe the Danger: Small volume slide moving up to a metre

Asset Class:

Water Quality

Asset Descriptions

Creek

Likelihood	Consequence				
	1	2	3	4X	5X
A	VH	VH	H	H	M
BX	VH	H	H	MX	LX
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G3

Target Area Location Wiridjil and Valley View Rds (old WF 3712)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Shallow translational slides on gentle slopes.

How likely is it? Likely.

What damage, impact or injury may result? Disruption to agricultural land but little else.

How important is it (sensitivity)? Relatively minor with more disruption to the South west

What can be done about it? Possibly surface drainage works and some re vegetation programs.

Risk Analysis

Describe the Danger: Shallow translational slides travelling metres

Asset Class:

Land Use

Asset Descriptions

Agricultural land

Likelihood	Consequence				
	1	2	3	4X	5X
A	VH	VH	H	H	M
BX	VH	H	H	MX	LX
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G4

Target Area Location Great Ocean Rd at Princetown Post Office

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Small to medium sized landslide below road travelling a metre or so.

How likely is it? Certain as it ahs already occurred but surrounding areas show multiple old slides and flows.

What damage, impact or injury may result? Significant damage to the Gt Ocean Rd.

How important is it (sensitivity)? High importance due to major tourist rd

What can be done about it? Stabilisation required through major engineering works.

Risk Analysis

Describe the Danger: Small to medium volume slide moving a metre or so

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road

Likelihood	Consequence				
	1	2	3	4	5
AX	VH	VH X	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G6

Target Area Location Turton's track

Date and Data Collector Tony Miner 28th July 2006

What might happen? Small landslides have caused damage to both the road and retaining structures

How likely is it? Likely to almost certain given major events have occurred over the past few years

What damage, impact or injury may result? Continued damage to retaining walls will continue to undermine the road and can add small amounts of sediment to the catchment

How important is it (sensitivity)? Significant given the importance this has a major tourist route

What can be done about it? Ongoing stabilisation is required as not much can be done to alter alignment or change drainage patterns

Risk Analysis

Describe the Danger: Small volume slides and flows moving a few metres

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
BX	VH	H	HX	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small flows travelling down to streams

Asset Class

Environment water quality

Asset Descriptions

Streams

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	LX
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Gellibrand **Site I.D.** G10

Target Area Location Simpson Princetown Rd (Bouwmans) (MGA 685705, N 5721526)

Date and Data Collector Tony Miner 2nd August 2006

What might happen? Medium sized translational landslides have caused extensive damage to buildings and road. Slides has moved metres initially and now is moving cms

How likely is it? Certain with reactivation likely

What damage, impact or injury may result? Significant damage to buildings and the road. Possibility for injury due to poor road state.

How important is it (sensitivity)? High given it is the first known instance of total destruction of a dwelling due to landslide

What can be done about it? Needs further drainage works and possible engineering works.

Risk Analysis

Describe the Danger: Reactivation of medium to large slide

Asset Class:

Infrastructure

Asset Descriptions

Roads and building incl dwelling

Likelihood	Consequence				
	1X	2X	3	4	5
A	VH X	VH	H	H	M
BX	VH X	H X	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Ongoing movement of slide under the road or the order of cms

Asset Class

Human Life

Asset Descriptions

Injury and or loss of life

Likelihood	Consequence				
	1	2	3	4X	5
AX	VH	VH	H	HX	M
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Curdies

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Curdies **Site I.D.** **C1.0**

Target Area Location Pt Campbell Cobden Rd (MGA 674206, N 5725421)

Date and Data Collector Tony Miner 3rd August 2006

What might happen? Shallow translational slides causing damage to the Rd.

How likely is it? Likely to almost certain as damage has occurred and probably will continue to occur

What damage, impact or injury may result? Damage resulted in significant disruption to the road surface and some displacement below road in fields.

How important is it (sensitivity)? Moderate to high given the road is a high tourist traffic route

What can be done about it? Ongoing maintenance and stabilisation plus signage.

Risk Analysis

Describe the Danger: Shallow slides reactivating and moving cms

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
BX	VH	H	H X	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Curdies **Site I.D.** **C1.1**

Target Area Location Pt Campbell Cobden and Eastern Creek Rds (WF3701)

Date and Data Collector Tony Miner 3rd August 2006

What might happen? Shallow translational slides.

How likely is it? Likely to continue

What damage, impact or injury may result? Minor disruption to agricultural land.

How important is it (sensitivity)? Minor consequence given on private asset

What can be done about it? Drainage and re work of slopes to avoid infiltration.

Risk Analysis

Describe the Danger: Shallow translational slides travelling a few metres

Asset Class:

Land use

Asset Descriptions

Agricultural land

Likelihood	Consequence				
	1	2	3	4X	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Curdies **Site I.D.** **C1.2**

Target Area Location Cnr Pt Campbell Cobden Rd and Alsops Rd (MGA E 675832 N 5731621)

Date and Data Collector Tony Miner 3rd August 2006

What might happen? Shallow slides travelling a few meters into drainage lines (typical landscapes).

How likely is it? Likely to possible depending on conditions.

What damage, impact or injury may result? Disruption to drainage lines but not much damage to anything else some possibility of sediment loading to streams.

How important is it (sensitivity)? Generally only a minor consequence of this type of occurrence

What can be done about it? Revegetation works would help.

Risk Analysis

Describe the Danger: Shallow slides travelling a few metres

Asset Class:

Land Use and Environment

Asset Descriptions

Agricultural land and water quality

NB Can be disruptive when land is taken out of production

Likelihood	Consequence				
	1	2	3	4X	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	L
C X	H	H	M	LX	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Curdies **Site I.D.** C2

Target Area Location Guys Rd off Cooriemungle Rd (MGA E 686139, N5733727)

Date and Data Collector Tony Miner 3rd August 2006

What might happen? Medium sized landslide has travelled metres and broken up.

How likely is it? Likely to almost certain to continue.

What damage, impact or injury may result? Significant damage to pastures has meant land is useless and now out of production.

How important is it (sensitivity)? Even though it I son private property still considered moderately important due to the hardship of such a loss.

What can be done about it? Possible extensive earthworks and drainage but difficult to fully assess. It appears to be groundwater driven given the fluid nature of the failure. Site currently fenced off

Risk Analysis

Describe the Danger: Medium volume slide moving a few metres and breaking up

Asset Class:

Land Use

Asset Descriptions

Agricultural land

Likelihood	Consequence				
	1	2X	3	4	5
AX	VH	VH X	H	H	M
BX	VH	H X	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Curdies **Site I.D.** C2.2

Target Area Location Williams Rd (MGA E681650 N 5737630)

Date and Data Collector Tony Miner 3rd August 2006

What might happen? Tension crack at top of embankment may have been a prelude to major collapse.

How likely is it? Now unlikely due to stabilisation works.

What damage, impact or injury may result? Could disrupt road and injury passer by

How important is it (sensitivity)? Minor to moderate importance depending if injury or loss of life is involved.

What can be done about it? Upkeep on stabilisation works.

Risk Analysis

Describe the Danger: Translational or slab type failure travelling meters onto roads

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
DX	H	M	L X	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Curdies **Site I.D.** C3

Target Area Location Scotts Creek around Murfits Rd (E 680693, N 5746016)

Date and Data Collector Tony Miner 3rd August 2006

What might happen? Small to medium sized landslides occurring high on slopes at the groundwater seep line

How likely is it? Likely.

What damage, impact or injury may result? Disruption to agricultural land with a potential for increased erosion into streams.

How important is it (sensitivity)? Minor to moderate but some areas have had sheds destroyed.

What can be done about it? Possible deep drainage and redirection of surface water but difficult to remediate other than revegetate.

Risk Analysis

Describe the Danger: Small to medium volume slide moving a few metres

Asset Class:

Land use

Asset Descriptions

Agricultural and dairying lands

Likelihood	Consequence				
	1	2	3	4X	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Otway Coast

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.** **OC1**

Target Area Location Clarkes Slide on the Great Ocean Road at Fairhaven (Near WF2332 and WF2330)

Date and Data Collector Tony Miner 1st of August 2006

What might happen? Large landslide exists at the site and could reactivate under adverse conditions.

How likely is it? Movement has been noted at the headscarp within the last 20 years and is possible to likely.

What damage, impact or injury may result? Whilst houses in the centre of the slide may undergo limited damage those around the rim could be severely damaged. Large movements could impact Gt Ocean Rd

How important is it (sensitivity)? Any loss of property would be significant. Large movements on the road would be significant and could disrupt tourism and cause possible injury and even death

What can be done about it? Large scale drainage works to control groundwater pressures. Monitoring would be a good risk management treatment

Risk Analysis

Describe the Danger: Large slide reactivating and moving cms

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Dwelling and roads

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	MX	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Large slide reactivating and moving metres

Asset Class

Infrastructure

Asset Descriptions

Dwellings and roads

Likelihood	Consequence				
	1	2x	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
Dx	H	Mx	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway coast **Site I.D.** **OC2**

Target Area Location Road embankment on the Great Ocean Road just beyond Grassy Creek near L10 marker (MGA E240514, N5736466)

Date and Data Collector Tony Miner 1st August 2006

What might happen? Continued failure of fill embankment and further rockfalls and slides on high side of road.

How likely is it? This event ahs already occurred and further falls are likely. Likelihood of fill embankment failure reduced due to stabilisation...

What damage, impact or injury may result? Very significant road stabilisation required. Possibility of injury or death given steep slopes below road.

How important is it (sensitivity)? Very important for loss of life, tourism would be disrupted and could induce some minor environmental effects on Grassy Creek

What can be done about it? Maintain stabilisation works and monitor.

Risk Analysis

Describe the Danger: Small to medium volume slides and rockfalls (assess Before O and After X)

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road

Likelihood	Consequence				
	1	2 O X	3	4	5
A	VH	VH	H	H	M
BO	VH	HO	H	M	L
C	H	H	M	L	L
DX	H	MX	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slides and rockfalls (assess Before O and After X)

Asset Class

Infrastructure and public benefit

Asset Descriptions

Injury or loss of life

Driver could lose control and end up in creek

Likelihood	Consequence				
	1	2	3O X	4	5
A	VH	VH	H	H	M
BO	VH	H	H O	M	L
C	H	H	M	L	L
DX	H	M	L X	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.**OC2.1 (additional site)

Target Area Location Great Ocean Road –typical section out of Lorne near Cherry Creek just before St George River MGA E759660, N5728370)

Date and Data Collector Tony Miner 1st August 2006

What might happen? Reactivation of major landslides and debris flows/slides and rockfalls.

How likely is it? Likely to possible under adverse conditions.

What damage, impact or injury may result? Event could destroy road in worse case. Might also cause injury and or kill driver

How important is it (sensitivity)? Very important due to potential for loss of life and disruption to tourism

What can be done about it? Continue to monitor and observe especially after heavy rains.

Risk Analysis

Describe the Danger: Reactivation of large slides and debris slides/flows moving metres

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Roads

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H X	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres and rockfalls

Asset Class

Human Life

Asset Descriptions

Injury or death

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
CX	H	HX ←	MX	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.** **OC7**

Target Area Location Skenes creek including Beacon point (MGA E 740121, N 5712398)

Date and Data Collector Tony Miner 28th July 2006

What might happen? Multiple slides and wedge failures on road. Failure in embankment at Beacon Pt.

How likely is it? New failures occur every few years and are likely to continue.

What damage, impact or injury may result? Deposition of materials on roads and in one case closure. Some potential for injury to drivers.

How important is it (sensitivity)? Very important given this is a major tourist road and some potential for injury exists off the road.

What can be done about it? Ongoing cleanups and maintenance. Drainage issues above site can be addressed and possible stabilisation required in parts.

Risk Analysis

Describe the Danger: Small cutting failures travelling up to a metre onto the road

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Roads

Likelihood	Consequence				
	1	2	3	4X	5
AX	VH	VH	H	HX	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Embankment Failure below Beacon PT

Asset Class

Infrastructure

Asset Descriptions

Dwelling below and road

Likelihood	Consequence				
	1	2X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
CX	H	HX	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres within Villa complex

Asset Class

Infrastructure and public

Asset Descriptions

Dwellings and possible injury to residences

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
CX	H	H	MX	L	L
DX	H	M	LX	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.** **OC3**

Target Area Location Windy Point on the Great Ocean Road (MGA E759055, N5727214)

Date and Data Collector Tony Miner 1st August 2006

What might happen? Large volume translational slide could block road again

How likely is it? Possible to unlikely after stabilisation work

What damage, impact or injury may result? Damage to road and possible loss of life. Impact on tourism

How important is it (sensitivity)? Extremely important for life and tourism

What can be done about it? Stabilisation has controlled movement but requires ongoing monitoring.

Risk Analysis

Describe the Danger: Large Volume translational slide moving a few metres

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Road

Likelihood	Consequence				
	1X	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	HX	H	M	L	L
DX	H	MX	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Large Volume translational slide moving a few metres

Asset Class

Human Life

Asset Descriptions

Human life

Likelihood	Consequence				
	1	2X	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
CX	H	HX	MX	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Ongoing rockfalls

Asset Class

Human Life

Asset Descriptions

Human Life (Drivers)

Impact could be on inside road lane

Likelihood	Consequence				
	1	2	3X	4	5
A	VH	VH	H	H	M
BX	VH	H	HX	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.** **OC4**

Target Area Location General section of Great Ocean Rd Lorne to Wye River (MGA E759055, N5727214)

Date and Data Collector Tony Miner 1st August 2006

What might happen? Rockfalls common along this section from both natural rock faces and landslide debris materials

How likely is it? Small falls are almost certain and require maintenance crews to clean up on a regular basis.

What damage, impact or injury may result? There is minimal travel distance but still could hit a car

How important is it (sensitivity)? Extremely important for life and tourism

What can be done about it? Possible rock scaling or shotcreteing but this would destroy visual amenity. New guard rail acts as barrier to increase safety on down slope side of road.

Risk Analysis

Describe the Danger: Small rocks and cobbles travelling onto inside lane

Asset Class:

Human Life

Asset Descriptions

Drivers

Likelihood	Consequence				
	1X	2 X	3X	4X	5
AX	VHX	~~VH~~	~~H~~	HX	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Ongoing rockfalls

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.** **OC5**

Target Area Location Township of Wye River (General comment)

Date and Data Collector Tony Miner 1st August2006

What might happen? Township exists in an area of numerus large and medium sized landslides. Smaller slides and debris flows are possible especially on cuts and fills.

How likely is it? Extremely variable but ranging from Unlikely to likely.

What damage, impact or injury may result? Again consequences are variable but mainly in the minor to moderate range

How important is it (sensitivity)? Issues are important given they involve Council approvals and there is an increasing build up of development and residences in the area

What can be done about it? Good planning, sound foundation design and ongoing maintenance of council facilities such as roads and culverts

Risk Analysis

Describe the Danger: Small to medium volume slide moving a few mms to a few metres (variable)

Asset Class:

Infrastructure

Asset Descriptions

Dwellings roads and retaining walls

Likelihood	Consequence				
	1	2 X	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H X	MX	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Small volume slides on cuts moving up to a metre maximum

Asset Class

Infrastructure

Asset Descriptions

Dwellings drives and roads

Likelihood	Consequence				
	1	2	3	4X	5
A	VH	VH	H	H	M
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger medium volume slide reactivating and moving a few metres

Asset Class

Infrastructure

Asset Descriptions

Dwellings

Likelihood	Consequence				
	1	2X	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
CX	H	HX	MX	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.** **OC6**

Target Area Location General section from Kennett River to Grey River

Date and Data Collector Tony Miner 1st August 2006

What might happen? A major landslides ahs occurred along this section and the resulting landslide debris is a source fro future slides flows and rockfall

How likely is it? Likely to almost certain in parts

What damage, impact or injury may result? Minimal infrastructure damage to road but could impact driver or vehicle. The hazard exists mainly on cuts. silts and clays will wash onto roads

How important is it (sensitivity)? Moderately for small slides and flows but could cause a drive to lose control

What can be done about it? Ongoing clean ups and observation but may require some stabilisation

Risk Analysis

Describe the Danger: Small to medium volume slides moving up to a metre, debris flows and rockfalls

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Roads and possibly drivers

Risks are moderate to high

Likelihood	Consequence				
	1	2	3	4X	5X
AX	VH	VH	H	HX	MX
BX	VH	H	H	MX	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Otway Coast **Site I.D.** **OC10**

Target Area Location General fro Barham valley and Killala Rd

Date and Data Collector Tony Miner 1st August 2006

What might happen? Large old slides may reactivate under extreme conditions. Smaller slides are more common.

How likely is it? Large slides are probably unlikely but smaller slides are definitely possible to likely.

What damage, impact or injury may result? Large slides could cause catastrophic damage to houses and block river. Smaller slides could also cause significant damage to house and even deaths.

How important is it (sensitivity)? Obviously important given life is involved

What can be done about it? Not much can be done economically for the large slides but smaller ones can be controlled though good planning and design.

Risk Analysis

Describe the Danger: Small shallow slide moving a metre or so

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Dwelling and some potential for injury

and death

Likelihood	Consequence				
	1	2	3X	4X	5
A	VH	VH	H	H	M
BX	VH	H	HX	MX	L
C X	H	H	MX	LX	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger Large volume slide moving many metres

Asset Class

Infrastructure and environment

Asset Descriptions

Dwellings, creeks and rivers

Likelihood	Consequence				
	1X	2X	3X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
DX	HX	MX	LX	L	VL
E	M	L	L	VL	VL

Describe the Danger Small to medium volume slide moving a few metres

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Upper Barwon

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Landslides in the Upper Barwon

Target Area Location

Target Area 2

WF3958 Colac Murroon Road

WF3959 Yeodene Birregurra Rd (Philips)

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Landslides could move tens of ms

How likely is it?

Possible to likely

How important is it (sensitivity)?

Philips could block the Barwon River and Ag loss is likely

What can be done about it?

Surface Drainage and revegetation

Risk Analysis

Tens of ms

Asset Class

Water Quality

Asset Descriptions

Barwon River

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H X	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

ms up to ten ms

Asset Class

Agriculture Production

Asset Descriptions

Sheep / beef grazing

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B X	VH	H	H	M X	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

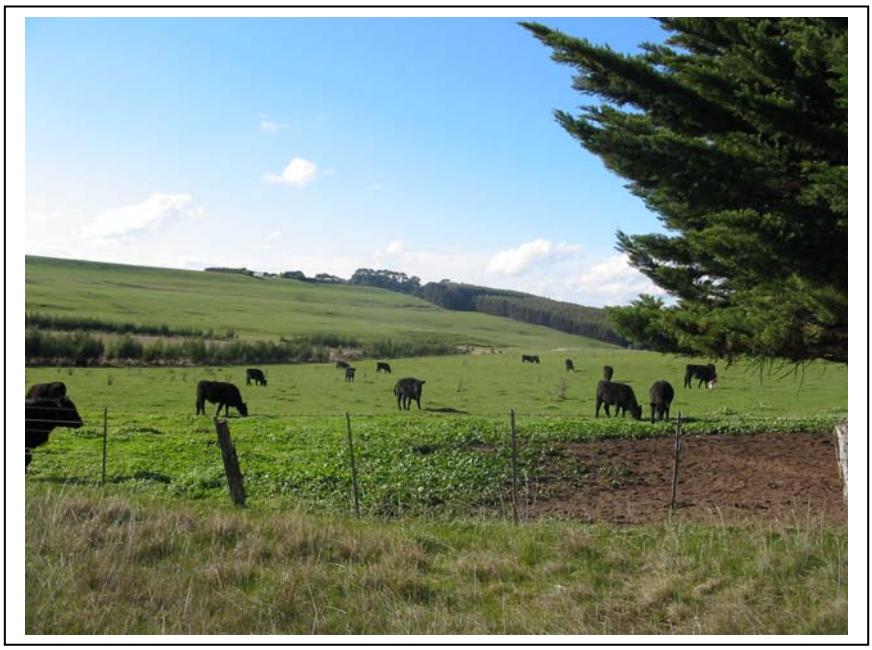

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Landslides in the Upper Barwon

Target Area Location

Murroon Rd and Penny Royal Rd (General, covers a number of landslides in the area)

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Large slides may cause impact to ag land and possible impact to minor waterways.

How likely is it?

Big landslides possible

How important is it (sensitivity)?

Not much impact on Ag land

Not much impact on significant waterway

What can be done about it?

Nothing

Risk Analysis

Landslides 10s of metres

Asset Class

Water quality

Asset Descriptions

Pennyroyal creek

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
DX	H	M	L X	L	VL
E	M	L	L	VL	VL

Asset Class

Agricultural Production

Asset Descriptions

Cattle grazing

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M X	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Landslides in the Upper Barwon

Target Area Location

WF554

Deans March Road Crossing Barwon River

Date and Data Collector

Troy Clarkson & Tony Miner 27/07/06

What might happen?

Landslides may flow into the Barwon River

Toe Erosion at the river may undermine the landslide activating it.

How likely is it?

Likelihood of moving and impacting grazing land is high.

Likelihood of moving more then ten metres and covering the Barwon River is unlikely.

How important is it (sensitivity)?

Very important if the landslide blocks the river as it can alter flows and contribute large loads of sediment to the waterway.

What can be done about it?

Growing perennial pastures to stabilise soils and increase water use.

Risk Analysis

Landslides moves tens of metres

Asset Class

Water Quality

Asset Descriptions

Barwon River

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M X	L	L	VL
E	M	L	L	VL	VL

Landslides moves tens of metres

Asset Class

Biodiversity

Asset Descriptions

Remnant riparian vegetation along the Barwon River

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	L X	L	VL
E	M	L	L	VL	VL

Landslides moves up to 1m

Asset Class

Agriculture production

Asset Descriptions

Grazing sheep

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	L X	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Landslides in the Upper Barwon

Target Area Location

WF565

Coalmine Road X Scrub Creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Landslides may cover the creek and cause sedimentation and divert flows

How likely is it?

Possible

How important is it (sensitivity)?

Landslides is likely to move slightly, and possible to an extent where it covers the creek

What can be done about it?

Revegetation and land class fencing

Risk Analysis

Landslides moving 10s of meters

Asset Class

Water quality

Asset Descriptions

Scrubby Creek, which flows into the Barwon River

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H X	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Landslide moves up to 1 m

Asset Class

Agriculture Production

Asset Descriptions

Grazing land for sheep

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M X	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area Upper Barwon **Site I.D.** **UB4**

Target Area Location East Barwon Water Supply Channel and Kings Creek Siphon (E 738270, N 5734740 to E 739380, N 5736210)

Date and Data Collector Tony Miner 28th July 2006

What might happen? Small to medium sized landslides have caused damage to both the support structures for the siphon and sections of the concrete lined water supply channel.

How likely is it? Damage has already occurred at the Siphon and in at least two sections of the channel and future slides are considered possible under adverse conditions.

What damage, impact or injury may result? Damage resulted in leakage from the siphon and breaches in the channel requiring disruption to water supply schedules.

How important is it (sensitivity)? Given this channel supplies water from West Barwon dam to Wurdee Boluc it is very important and any long term loss of the channel would be critical to Geelong's overall water supply system

What can be done about it? Remedial repairs to the siphon and channel, relining of the channel and ongoing observation and management of this section.

Risk Analysis

Describe the Danger: Small to medium volume slide moving a few metres

Asset Class:

Infrastructure and public benefit

Asset Descriptions

Water supply channel and siphon

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H X	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Photo 1

Photo 2

Photo 3

Erosion Target Areas

Woady Yalloak

Sheet for Targeted Areas under the

Corangamite Soil Health Strategy.

Site 1

Priority Area: Erosion in the Woady Yalloak

Target Area Location

Along Paddy Gully Road (CFA 418 34 Lat / 08 Long) Erosion codes included:2604, 2599, 4933, 2606, 2605, 2603, 2600, 2597, 4931. 2601, 2602, 4714.

Date and Data Collector

Troy and Shari 2/08/06

What might happen?

- gully erosion active along creek lines,
- slumping into gullies
- bare soil exposed to sheet/rill erosion.
- finger gullies leading into main gullies.

How likely is it?

Some areas are active, others have stabilised.

What damage, impact or injury may result?

Loss of agriculture land, sedimentation of creek, which is a tributary of the Woady Yaloak.

Some loss of remnant vegetation.

How important is it (sensitivity)?

Sedimentation risk and loss of agriculture land are main issues.

What can be done about it?

Combination of drainage, earthworks and fencing and revegetation. Sections could be fixed but the whole area may be difficult.

Risk Analysis

Describe the Danger

Asset Class

Sedimentation

Asset Descriptions

Tributary of the Woady Yaloak

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
BX	VH	H	HX	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Loss of Agriculture Land

Asset Descriptions

Sheep grazing

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B X	VH	H	H X	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Remnant Vegetation

Asset Descriptions

Mostly gum trees

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M	L X	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Site 3

Priority Area: Erosion in the Woady Yalloak

Target Area Location

Cars Boyle Road

Along Carrs Road (A creek of the Woady Yaloak, north of Rokewood) Map CFA 481 39 lat /02 long. WF4727, WF2657, WF 2655.

Date and Data Collector

Troy and Shari 2/08/06

What might happen?

- gully erosion active along creek lines, (3 m deep)
- slumping into gullies
- bare soil exposed to sheet/rill erosion.
- finger gullies leading into main gullies.

How likely is it?

Very likely, currently active.

What damage, impact or injury may result?

Loss of agriculture land, sedimentation of creek, which is a tributary of the Woady Yaloak.

Some loss of remnant vegetation.

How important is it (sensitivity)?

Sedimentation risk and loss of agriculture land are main issues.

What can be done about it?

some areas already revegetated, further fencing and revegetation is needed

Risk Analysis

Describe the Danger

Asset Class

Water quality

Asset Descriptions

Tributary of the Woady Yaloak

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
BX	VH	H X	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Loss of Agriculture Land

Asset Descriptions

Sheep grazing

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M X	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Remnant Vegetation

Asset Descriptions

Mostly red gum trees

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M	L X	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Moorabool

Sheet for Targeted Areas under the

Corangamite Soil Health Strategy.

Site 5

Priority Area: Erosion in the Moorabool

Target Area Location

Eclipse Creek, Whinray Rd, Vic Rd Map 77 D6.

Sheet – WF289, WF 498, WF5020, WF500, WF497. Gully – WF 499, WF4885, WF289, WF4886.

Date and Data Collector

Troy and Shari 3/08/06

What might happen?

Sheet erosion along Eclipse Creek, small to large bare patches. May add sediment to Eclipse Creek.

How likely is it?

Possible to cause sedimentation.

Likely to impact on ag land.

How important is it (sensitivity)?

High importance as it may be one of the main sources of sediment to the Moorabool, which provides water for a WSPA.

What can be done about it?

Revegetation & fencing.

Earthworks options if impacting on road

Risk Analysis

Describe the Danger

Asset Class

Water quality

Asset Descriptions

Sedimentation into Eclipse Creek

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H X	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

\

Describe the Danger

Asset Class

Ag production

Asset Descriptions

Grazing land

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B X	VH	H	H X	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Remnant Vegetation

Asset Descriptions

Trees/shrubs along the creeks
Grazing land

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	L	L X	VL
E	M	L	L	VL	VL

Sheet for Targeted Areas under the

Corangamite Soil Health Strategy.

Site 4

Priority Area: Erosion in the Moorabool

Target Area Location

Lynches Rd

WF2758

Vic Roads map 77 E8

Date and Data Collector

Troy and Shari 3/08/06

What might happen?

Sheet small patches on hill sides leading into Sutherland Ck. Gully along one side of Sutherland ck.

How likely is it?

Currently occurring

Possibly cause sedimentation of creek.

No major loss of Ag land

Sutherland Ck is not flowing, full of rushes.

Gully may impact on Lynchs Rd if increases

How important is it (sensitivity)?

Sutherland Creek runs into the Moorabool which runs into a WSPA.

Ag land has limited capacity and only suitable for grazing.

Road only services private 3-4 houses

What can be done about it?

Revegetation

Earthworks options if impacting on road

Risk Analysis

Describe the Danger

Asset Class

Water quality

Asset Descriptions

Sedimentation into Sutherland Creek

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	LX	L	VL
E	M	L	L	VL	VL

\

Describe the Danger

Asset Class

Infrastructure

Asset Descriptions

Lynches Road

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M X	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Remnant Veg X

Ag production O

Asset Descriptions

Trees/shrubs along the creeks
Grazing land

Likelihood	Consequence				
	1	2	3	4 X O	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C O	H	H	M	L O	L
D X	H	M	L	L X	VL
E	M	L	L	VL	VL

Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Site 3

Priority Area: Erosion in the Moorabool

Target Area Location

Steiglitz & Demotts Rd

WF4689, WF4688

Vic Roads map 77 C7

Date and Data Collector

Troy and Shari 3/08/06

What might happen?

Sheet erosion on slopes above tributary into the Moorabool.

How likely is it?

Possible impact on water quality and likely impact on ag land.

How important is it (sensitivity)?

Moderate importance to ag land.

Low-mod impact on water quality

What can be done about it?

Risk Analysis

Describe the Danger

Asset Class

Water quality

Asset Descriptions

Eclipse Creek

Tributary of the Moorabool

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H X	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

\

Describe the Danger

Asset Class

Loss of Agriculture Land

Asset Descriptions

Sheep grazing,

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B X	VH	H	H	M X	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Site 1

Priority Area: Erosion in the Moorabool

Target Area Location

Schefferie Rd Vic Roads Map 77 C6

WF 4701

Date and Data Collector

Troy and Shari 3/08/06

What might happen?

Gully – slight loss of agriculture land tributary to the Moorabool.

How likely is it?

Possible effects on agriculture land.

Unlikely to cause sedimentation.

What damage, impact or injury may result?

Sedimentation of tributary of the Leigh

How important is it (sensitivity)?

Low importance foe sedimentation & moderate importance doe ag production.

What can be done about it?

Risk Analysis

Describe the Danger

Asset Class

Water quality

Asset Descriptions

Tributary of the Moorabool

which leads into a WSPA

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M X	L	L	VL
E	M	L	L	VL	VL

\

Describe the Danger

Asset Class

Loss of Agriculture Land

Asset Descriptions

Sheep grazing,

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M X	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Sheet for Targeted Areas under the

Corangamite Soil Health Strategy.

Site 2

Priority Area: Erosion in the Moorabool

Target Area Location

Cnr Ballarat Rd and Ballan - Meredith Rd. Eclipse Creek. Vic Rds Map 77 06

Gullies WF389, EF 390, Sheet WF380, WF381.

Date and Data Collector

Troy and Shari 3/08/06

What might happen?

Gully and sheet erosion around Eclipse Creek. Sedimentation of creek, tributary of the Moorabool.

How likely is it?

Likely sedimentation of Eclipse Creek.

Likely impact on Ag. Land.

How important is it (sensitivity)?

Relatively important as it adds sediment into the Moorabool.

What can be done about it?

Risk Analysis

Describe the Danger

Asset Class

Water quality

Asset Descriptions

Eclipse Creek

Tributary of the Moorabool

lead into the WSPA

Likelihood	Consequence				
	1	2 X	3	4	5
A	VH	VH	H	H	M
B X	VH	H X	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

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Describe the Danger

Asset Class

Loss of Agriculture Land

Asset Descriptions

Sheep grazing,

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B X	VH	H	H X	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Lal Lal Yendon

Leigh

Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Site 1

Priority Area: Erosion in the Leigh

Target Area Location

Cnr of Sand Road and Priors Road. 46, 45, 176, 4756, 220.

Date and Data Collector

Troy and Shari 2/08/06

What might happen?

Gully 2 m deep not highly active.

How likely is it?

Current, moderate levels of active sheet and gully erosion

What damage, impact or injury may result?

Loss of ag land.

Sedimentation of tributary of the Leigh (Williamson Creek.

How important is it (sensitivity)?

Moderate importance – Leigh River Sedimentation.

What can be done about it?

Combination of treatment options.

Risk Analysis

Describe the Danger

Asset Class

Water quality

Asset Descriptions

Williamson Ck, Trib of the Leigh

Likelihood	Consequence				
	1	2	3 X	4	5
A	VH	VH	H	H	M
B X	VH	H	H X	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Loss of Agriculture Land

Asset Descriptions

Sheep grazing,

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B X	VH	H	H	M X	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Describe the Danger

Asset Class

Remnant Vegetation

Asset Descriptions

Shrubs & tree along creek lines

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M	L X	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

9 May 2002 12:11

Magpie

Upper Barwon

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Gully Erosion in the Upper Barwon

Target Area Location

Target Area 1

WF 563 Wurdale Road X with small unnamed creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Gully erosion and slumping into the waterway may cause sedimentation to the creek.

How likely is it?

Possible

How important is it (sensitivity)?

Only small volumes of sediment

What can be done about it?

It already has thick pastures on it so is stable, so keeping stock of the site is the best management.

Risk Analysis

Slumping Involving small volumes

Asset Class

Water quality

Asset Descriptions

Little Creek name unknown

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M	L X	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Gully Erosion in the Upper Barwon

Target Area Location

Target Area 1

WF 568

Coalmine Road X Scrub Creek

Date and Data Collector

Troy Clarkson and Tony Miner

What might happen?

Erosion may cause minimal sedimentation to waterways and may disturb some remanent riparian vegetation

How likely is it?

Erosion is ver likely

How important is it (sensitivity)?

Minimal impact on water quality and vegetation

What can be done about it?

Fence of according to land class and add vegetation.

Risk Analysis

Asset Class

Water quality

Asset Descriptions

Scrubby Creek

Likelihood	Consequence				
	1	2	3	4	5 X
A	VH	VH	H	H	M
B X	VH	H	H	M	L X
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Biodiversity

Asset Descriptions

Some native scrub and trees

Likelihood	Consequence				
	1	2	3	4	5 X
A	VH	VH	H	H	M
B X	VH	H	H	M	L X
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Erosion in the Upper Barwon

Target Area Location

Cape Otway Road crossing Scrubby Creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Gully erosion may cause sedimentation to waterways and disturb vegetation

This erosion site has been rehabilitated by land class fencing and introducing trees and rubs in the past 12 months.

How likely is it?

Very certain

Rehabilitation has decreased the likelihood significantly and has prevented further degradation of agriculture land.

How important is it (sensitivity)?

Erosion is certainly causing sedimentation to the waterway

What can be done about it?

Site has already been rehabilitated with vegetation and fencing.

Risk Analysis

X before rehabilitation

O after rehabilitation

Asset Class

Water Quality

Asset Descriptions

Scrub Creek

Flows into the Barwon River

Likelihood	Consequence				
	1	2 X O	3	4	5
A X	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D O	H	M O	L	L	VL
E	M	L	L	VL	VL

Asset Class

Biodiversity

Asset Descriptions

Some native grasses and shrubs

Likelihood	Consequence				
	1	2	3	4 X O	5
A	VH	VH	H	H	M
B X	VH	H	H	M X	L
C	H	H	M	L	L
D O	H	M	L	L X	VL
E	M	L	L	VL	VL

Asset Class

Agriculture Production

Asset Descriptions

Grazing, land sheep

Likelihood	Consequence				
	1	2	3 X O	4	5
A X	VH	VH	H X	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D O	H	M	L O	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Gully Erosion in the Upper Barwon

Target Area Location

Target Area 1

WF 563 Wurdale Road X with small unnamed creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Gully erosion and slumping into the waterway may cause sedimentation to the creek.

How likely is it?

Possible

How important is it (sensitivity)?

Only small volumes of sediment

What can be done about it?

It already has thick pastures on it so is stable, so keeping stock of the site is the best management.

Risk Analysis

Slumping Involving small volumes

Asset Class

Water quality

Asset Descriptions

Little Creek name unknown

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C X	H	H	M	L X	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Gully Erosion in the Upper Barwon

Target Area Location

Target Area 1

WF 568

Coalmine Road X Scrub Creek

Date and Data Collector

Troy Clarkson and Tony Miner

What might happen?

Erosion may cause minimal sedimentation to waterways and may disturb some remanent riparian vegetation

How likely is it?

Erosion is ver likely

How important is it (sensitivity)?

Minimal impact on water quality and vegetation

What can be done about it?

Fence of according to land class and add vegetation.

Risk Analysis

Asset Class

Water quality

Asset Descriptions

Scrubby Creek

Likelihood	Consequence				
	1	2	3	4	5 X
A	VH	VH	H	H	M
B X	VH	H	H	M	L X
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Biodiversity

Asset Descriptions

Some native scrub and trees

Likelihood	Consequence				
	1	2	3	4	5 X
A	VH	VH	H	H	M
B X	VH	H	H	M	L X
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Erosion in the Upper Barwon

Target Area Location

Cape Otway Road crossing Scrubby Creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Gully erosion may cause sedimentation to waterways and disturb vegetation

This erosion site has been rehabilitated by land class fencing and introducing trees and rubs in the past 12 months.

How likely is it?

Very certain

Rehabilitation has decreased the likelihood significantly and has prevented further degradation of agriculture land.

How important is it (sensitivity)?

Erosion is certainly causing sedimentation to the waterway

What can be done about it?

Site has already been rehabilitated with vegetation and fencing.

Risk Analysis

X before rehabilitation

O after rehabilitation

Asset Class

Water Quality

Asset Descriptions

Scrub Creek

Flows into the Barwon River

Likelihood	Consequence				
	1	2 X O	3	4	5
A X	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D O	H	M O	L	L	VL
E	M	L	L	VL	VL

Asset Class

Biodiversity

Asset Descriptions

Some native grasses and shrubs

Likelihood	Consequence				
	1	2	3	4 X O	5
A	VH	VH	H	H	M
B X	VH	H	H	M X	L
C	H	H	M	L	L
D O	H	M	L	L X	VL
E	M	L	L	VL	VL

Asset Class

Agriculture Production

Asset Descriptions

Grazing, land sheep

Likelihood	Consequence				
	1	2	3 X O	4	5
A X	VH	VH	H X	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D O	H	M	L O	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Erosion in the Upper Barwon

Target Area Location

Target Area 2

WF628 Cape Otway Road X Retreat Creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Minor sedimentation to the waterway from slumping and erosion

How likely is it?

Likely if no vegetation, unlikely with vegetation.

How important is it (sensitivity)?

may add some sediment if active

What can be done about it?

fence of and revegetation

Risk Analysis

X non vegetation

O vegetation

Asset Class

Water Quality

Asset Descriptions

Retreat Creek

Likelihood	Consequence				
	1	2	3	4 X O	5
A	VH	VH	H	H	M
B X	VH	H	H	M X	L
C	H	H	M	L	L
D O	H	M	L	L O	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Erosion in the Upper Barwon

Target Area Location

Target Area 2

WF598 Cape Otway Road X Yang Yang Girt Creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Stream bank erosion

How likely is it?

Unlikely

How important is it (sensitivity)?

Sedimentation of waterway

What can be done about it?

Revegetation and fencing already completed

Risk Analysis

Water Quality

Asset Class

Yang Yang Girt Creek

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	L	L X	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Erosion in the Upper Barwon

Target Area Location

Target Area 2

WF628 Cape Otway Road X Retreat Creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Minor sedimentation to the waterway from slumping and erosion

How likely is it?

Likely if no vegetation, unlikely with vegetation.

How important is it (sensitivity)?

May add some sediment if active

What can be done about it?

Fence of and revegetation

Risk Analysis

X non vegetation

O vegetation

Asset Class

Water Quality

Asset Descriptions

Retreat Creek

Likelihood	Consequence				
	1	2	3	4 X O	5
A	VH	VH	H	H	M
B X	VH	H	H	M X	L
C	H	H	M	L	L
D O	H	M	L	L O	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Erosion in the Upper Barwon

Target Area Location

Target Area 2

WF598 Cape Otway Road X Yang Yang Girt Creek

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Stream bank erosion

How likely is it?

Unlikely

How important is it (sensitivity)?

Sedimentation of waterway

What can be done about it?

Revegetation and fencing already completed

Risk Analysis

Water Quality

Asset Class

Yang Yang Girt Creek

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	L	L X	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Thompson

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Sheet/rill erosion in the Thompsons

Target Area Location

End of Black gate Road

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Salt scald may be susceptible to wind erosion and sheet erosion

How likely is it?

Likelihood low

How important is it (sensitivity)?

Importance is low as it is unlikely to impact biodiversity in the area

What can be done about it?

Nothing

Risk Analysis

Sheet erosion

Asset Class

Biodiversity

Asset Descriptions

Significant salt tolerant remnant vegetation.

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	L	L X	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Field Verification Sheet for Targeted Areas under the Corangamite Soil Health Strategy.

Priority Area

Sheet/rill erosion in the Thompsons

Target Area Location

End of Black gate Road

Date and Data Collector

Troy Clarkson and Tony Miner 27/07/06

What might happen?

Salt scald may be susceptible to wind erosion and sheet erosion

How likely is it?

Likelihood low

How important is it (sensitivity)?

Importance is low as it is unlikely to impact biodiversity in the area

What can be done about it?

Nothing

Risk Analysis

Sheet erosion

Asset Class

Biodiversity

Asset Descriptions

Significant salt tolerant remnant vegetation.

Likelihood	Consequence				
	1	2	3	4 X	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D X	H	M	L	L X	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL

Asset Class

Asset Descriptions

Likelihood	Consequence				
	1	2	3	4	5
A	VH	VH	H	H	M
B	VH	H	H	M	L
C	H	H	M	L	L
D	H	M	L	L	VL
E	M	L	L	VL	VL