



ADVICE TO THE MINISTER

AMENDMENTS TO ENVIRONMENTAL OUTCOMES ASSESSMENT METHODOLOGY

Chapter 6 *Soil Assessment* and

Appendix B

Management Actions Specified by the Clearing Module of the Land and Soil Capability Tool for Assessed Land Degradation Hazards to Pass the Improve or Maintain Test

December 2006

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1 Introduction

In November 2006 the Minister for Natural Resources (the Minister) formally requested advice from the Natural Resources Commission (NRC) on amendments to management actions in the Land and Soil Capability (LSC) Tool. The amendments include modification to Chapter 6 *Soil Assessment* and replacement of the contents of Appendix B *Management Actions Specified by the Clearing Module of the Land and Soil Capability Tool for Assessed Land Degradation Hazards to Pass the Improve or Maintain Test, within the Native Vegetation Regulation 2005 Environmental Outcomes Assessment Methodology* (the Assessment Methodology). This report is the NRC's formal advice to the Minister regarding the proposed amendments to the Assessment Methodology.

The NRC believes that the revised management actions are an improvement on the existing actions contained in Appendix B and that the work undertaken during this LSC Expert Panel review has positively contributed to the enhancement of the Assessment Methodology.

To maximise this contribution we recommend that:

- The revised management actions should be published as supplementary guidance material supporting the Assessment Methodology, and should not be included as changes to the Assessment Methodology itself. This approach is recommended because the high level of detail in the revised management actions would lead to an unnecessary degree of prescription within the Assessment Methodology, potentially diminishing the effectiveness of the LSC Tool.
- Appendix B of the Assessment Methodology should be updated to ensure consistency with the actions to be included in supplementary guidance, and should not be replaced in entirety.
- The proposed steps to improve consideration of land use type should also be incorporated into Appendix B of the Assessment Methodology, and the proposed amendments to Chapter 6 of the Assessment Methodology regarding land use types should not be implemented.

In developing our advice we have drawn on submissions from stakeholders and internally reviewed the proposed amendments to determine whether the amendments proposed by the LSC Expert Panel will lead to better environmental outcomes than the current Assessment Methodology.

Clause 25 of the *Native Vegetation Regulation 2005* sets out the formal procedure for amending the Assessment Methodology. Consistent with these requirements, the following process is currently being undertaken before any changes are made to Chapter 6 of the Assessment Methodology:

1. The LSC Expert Panel undertook a review and recommended a series of amendments to the Minister regarding Chapter 6 and Appendix B of the Assessment Methodology.
2. The Minister proposed amending Chapter 6 and Appendix B of the Assessment Methodology in line with the recommendations of the LSC Expert Panel, and requested the advice of the NRC.
3. The NRC has undertaken an independent review of the proposed amendments and is now providing formal advice to the Minister regarding the LSC Expert Panel's recommendations (this report). The NRC's review has been informed by consultation with stakeholders.

4. The Minister will consider the NRC's advice and seek the concurrence of the Minister for the Environment and the Minister for Primary Industries where amendments relate to assessment of biodiversity in deciding to amend the Assessment Methodology.
5. Amendments agreed by the Minister will be formally made to the Assessment Methodology and gazetted.

In this report:

- Chapter 2 describes the review process that that the NRC has adopted to develop our advice
- Chapter 3 summarises the LSC Expert Panel's proposed amendments
- Chapter 4 summarises the issues raised in submissions received
- Chapter 5 presents the NRC's advice and recommendations on the proposed amendments to the Assessment Methodology.

2 Review process

In reviewing the LSC Expert Panel's proposed amendments to the Assessment Methodology, the NRC has:

1. participated as an observer in three telephone conferences that provided the NRC with updates on the progress of the review
2. attended a briefing presented by the LSC Expert Panel which provided an overview of the proposed amendments
3. posted the proposed amendments on the NRC website and invited comment from key stakeholders which included agencies, CMAs, and environment and landholder groups
4. internally reviewed the proposed amendments and submissions
5. consulted the Secretariat of the Ministerial Review Committee to obtain feedback received about implementation of the LSC Tool.

It was not necessary for the NRC to undertake a scientific review in this instance because the review of Chapter 6 of the Assessment Methodology and of the LSC management actions did not incorporate the logic or science that underpins the LSC Tool.

3 Summary of LSC Expert Panel's proposed amendments

The amendments proposed by the LSC Expert Panel include three changes to pages 48, 49 and 50 of Chapter 6 of the Assessment Methodology. These changes have been proposed to ensure that land use type is considered in relation to management actions. No changes have been made to the science that underpins the LSC Tool.

Additionally, a suite of management actions have been proposed to replace the existing Appendix B of the Assessment Methodology. These actions include management actions for the clearing and establishment of particular activities and for the ongoing management of land once an activity is underway. These actions are proposed for industries including horticulture/viticulture, irrigation, development infrastructure, dry land cropping and grazing.

The proposed amendments to Chapter 6 and Appendix B of the Assessment Methodology are included in Attachment 1 of this report.

4 Summary of submissions

In developing our advice we have considered submissions from various stakeholders. The submissions are available on the NRC website.

Three submissions were received during the NRC review period from Lower Murray Darling CMA, NSW Farmers Association and Department of Primary Industries (DPI). The submission from Lower Murray Darling CMA identified positive aspects of the proposed amendments. The submissions from NSW Farmers Association and DPI generally voiced opposition for the inclusion of rigid management actions within the Assessment Methodology.

The submission from Lower Murray Darling CMA was supportive of the proposed changes. Specifically, Lower Murray Darling CMA believes that the changes would assist in maintaining transparency of the process and promote greater landholder understanding.

NSW Farmers Association has acknowledged that the many of the proposed amendments would be advantageous in ideal circumstances, however it was concerned about some of the proposed amendments. Generally, NSW Farmers Association was unsupportive of using approaches that prescribe management actions that would limit a landholder's flexibility to adapt to changing conditions. It was concerned that some of the proposed management actions are inappropriate and do not correlate with best management practices and that others are financially unviable for many farmers. In addition, it objected to additional requirements to develop various management plans, particularly when guidance is not provided to support preparation, approval, reporting and review requirements for the plans.

DPI considered that the proposed amendments were based on best practice and reflected the advice of the experts consulted during the review. However, it considers that the proposed amendments are overly prescriptive and that an approach which provided for more flexibility to landholders would be better suited to improving or maintaining environmental outcomes. DPI suggested that the provision of good guidance material would help CMAs work with landholders to select appropriate management responses.

5 Consideration of amendments to the Assessment Methodology

5.1 Revised management actions in LSC Tool

The NRC believes that the revised management actions are an improvement on the existing actions contained in Appendix B and that the work undertaken during this review is a positive step forward. However, we do not agree with the proposed method for incorporating the revised management actions into the Assessment Methodology. We consider that the Assessment Methodology needs to remain outcomes focussed where possible to allow maximum flexibility for individual land management decisions.

We recommend that the revised management actions be used as supplementary guidelines to support the Assessment Methodology rather than incorporated directly into Appendix B. The NRC acknowledges that the revised management actions have been developed by an informed process and through collaboration with experts from the required fields.

Our approach is recommended because:

- the small number of concerns raised about the Appendix B management actions to date indicates that a review may not be required at this time
- the revised management actions contain a high level of detail, which may deter landholders from engaging with the PVP process
- the current Appendix B management actions provide a level of flexibility that allows landholders to actively engage in the PVP process
- adopting the revised management actions as guidelines for the Assessment Methodology allows for a simplified revision and update process.

To date, the management actions included in Appendix B of the Assessment Methodology have not been the focus of stakeholder concern, and the need for a review of the management actions in the LSC Tool may not be justified at this stage. This is evidenced by the lack of comment received from stakeholders relating to the management actions. The Secretariat for the Ministerial Review Committee advised that no issues specifically related to the LSC Tool and its management actions were raised with the Committee by stakeholders over the last 12 months. Additionally, information provided by the Department of Natural Resources (DNR) indicates that 0.01% of all issues raised about the PVP Developer were related to the LSC Tool. Further review of the way that management actions are addressed as part of the Assessment Methodology should occur in response to the identification of problems, as is required by the adaptive management approach currently adopted for the native vegetation system.

The few submissions received by the NRC as part of this review generally comment that the addition of more prescriptive management actions within the Assessment Methodology may be onerous for some landholders and could deter landholders from engaging with the PVP process. Some comments have also suggested that several of the revised management actions do not represent best practice management. Concern was also raised in relation to requirements to develop additional management plans. If management plans were mandatory requirements, it is essential to ensure that compliance mechanisms can be sustained and that the plans are effectively implemented. Using the revised management actions as a supplementary guide for CMAs would

maintain a level of flexibility within the Assessment Methodology and ensure that landholders are not confined by prescriptive requirements.

The NRC supports the improvement of management actions to better inform the development of Property Vegetation Plan (PVP) agreements. The existing Appendix B management actions provide flexibility for landholders when developing PVP agreements and the NRC suggests that Appendix B should be retained and updated. The NRC has reviewed both the revised management actions and the existing Appendix B of the Assessment Methodology. It is clear that most of the existing Appendix B management actions have been incorporated into the revised management actions. It is also clear that the revised management actions provide improved and more detailed guidelines for the management of soils. The existing Appendix B should be retained in its current form and updated, for example, by removing the obsolete actions omitted from the revised management actions and by clarifying the meaning of others. This would ensure consistency with the revised management actions and would retain flexibility. In addition, the approach would provide extra guidance and more flexibility for CMAs when developing PVP agreements with landholders.

Using the revised management actions as supplementary guidelines to the Assessment Methodology would allow for a simplified review and update process and negate the need for referral of proposed amendments to the Minister. This would enable the management actions to be easily updated to ensure that they are consistent with emerging best management practices.

5.2 Land use type

The NRC recognises the benefits of distinguishing management actions for specific land use types, but does not consider that the proposed amendments to pages 48, 49 and 50 of Chapter 6 of the Assessment Methodology should be implemented.

The amendments have been proposed to ensure that land use type is taken into consideration when applying the management actions. The NRC considers that this could be better achieved by further addressing land use type within Appendix B rather than Chapter 6 itself.

5.3 Natural resource management governance

By publishing the revised management actions as guidance, rather than as a requirement of the Assessment Methodology, the NRC considers that the risk of poor natural resource management (NRM) is not likely to be increased.

The governance structures within the regional NRM model are likely to correct any inappropriate management action proposed. CMAs provide support to landholders developing PVPs, and are unlikely to approve PVPs that do not contribute to natural resource targets included in catchment action plans (CAPs). CMAs, supported by DNR, are developing environmental monitoring to evaluate the success of management actions, including those undertaken as part of PVPs. In addition, the NRC will audit CMA work to review both the implementation of CAPs and the contribution of management actions towards the state-wide natural resource targets.

6 NRC recommendations

Based on our review, the NRC recommends that:

- the revised management actions should be published as supplementary guidance material supporting the Assessment Methodology, and should not be included as changes to the Assessment Methodology itself
- Appendix B of the Assessment Methodology should be updated to ensure consistency with the actions to be included in supplementary guidance, and should not be replaced in entirety
- the proposed steps to improve consideration of land use type should also be incorporated into Appendix B of the Assessment Methodology, and the proposed amendments to Chapter 6 of the Assessment Methodology regarding land use types should not be implemented.

Attachment 1 LSC Expert Panel Proposed Amendments to Chapter 6 and Appendix B of the Assessment Methodology

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Y06/1735

Dr John Williams
Commissioner
Natural Resources Commission
GPO Box 4206
SYDNEY NSW 2001

- 2 NOV 2006

Dear Dr Williams

I am writing to seek the advice of the Natural Resources Commission on amendments to the Environmental Outcomes Assessment Methodology that have been proposed by the Department of Natural Resources. I am seeking the Commission's advice in accordance with clause 25(1)(a) of the Native Vegetation Regulation 2005.

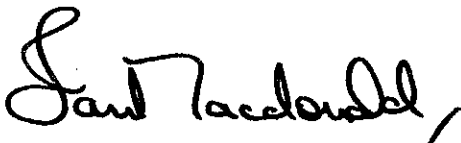
The Department coordinated a review of the management actions in the Land and Soil Capability Tool over a four month period. I have included for your information a copy of the Terms of Reference for the review (Attachment 1) as well as the process and personnel, including a description of their expertise, involved (Attachment 2).

The proposed amendments recommended by my Department consist of modification to pages 48, 49 and 50 of Chapter 6 Soil Assessment and the replacement of the contents of Appendix B within the Environmental Outcomes Assessment Methodology as set out in Attachment 1.

In accordance with clause 25(1)(c) of the Native Vegetation Regulation 2005, please provide your advice in the form of a formal recommendation to me. I request this advice be provided by 15 December 2006 but I would be grateful if you could provide your recommendation as soon as possible. Please note that as required by the Native Vegetation Regulation 2005, your advice on this matter is required to be made public.

Thank you for your assistance in this matter.

Yours sincerely



IAN MACDONALD MLC

Attachment 3

LSC Tool Management Actions Review: Changes to EOAM by replacing the following text marked in “Yellow” on pages 48, 49 and 50 and a new version of Appendix B below.

6 Soil Assessment

6.1 Introduction

This Environmental Outcomes Assessment Methodology defines the circumstances in which broadscale clearing is to be regarded as improving or maintaining environmental outcomes for land degradation under the *Native Vegetation Act 2003* including for the purposes of agreeing to a Property Vegetation Plan.

The Land and Soils Capability (LSC) tool assesses the following land degradation hazards:

- areas that are very susceptible to environmental harm arising from clearing of native vegetation;
- water erosion;
- wind erosion;
- earth mass movement;
- acid sulfate soils;
- salinity (see Chapter 4);
- shallow and rocky soils; or
- soil structure.

The Land and Soils Capability class that any associated hazards fall within determines whether a proposal is considered to improve or maintain environmental outcomes:

- Land and Soils Capability classes 1 & 2: the proposal is regarded as improving or maintaining environmental outcomes;
- Land and Soils Capability classes 3 to 6: will not improve or maintain environmental outcomes unless the on-site management actions specified for various land use types in Appendix B or Appendix C for each applicable hazard and class are undertaken;
- Land and Soils Capability classes 7 & 8: will not improve or maintain environmental outcomes and the impacts cannot be offset by management actions.

The process for assessing clearing and offset proposals in respect of land degradation is the same, except where otherwise stated.

The Land and Soils Capability Tool also assesses biodiversity, salinity or water quality offset proposals that involve soil disturbance in order to determine whether the offsets will improve or maintain environmental outcomes in relation to land degradation.

Where a proposal has several hazards the decision as to whether clearing or offset proposals will improve or maintain environmental outcomes is based on the most significant land degradation risk arising from the proposal, ie the hazard with the highest class.

6.2 Land and soil capability classification

The land and soil capability classification is based on the Rural Land Capability system defined by Emery (1985). However, the proposed land and soil capability system places additional emphasis on soil limitations and explicitly incorporates them into the classification.

All parts of the landscape are classified within eight capability classes, designated by numerals 1 to 8, the sequence indicating progressively greater land and soil limitations. These limitations usually restrict the type and diversity of land use activities that can be undertaken without significant land and soil degradation occurring. Although this system is intended primarily to address agricultural activities, it can be used to provide a general indication of the capability of the land for other land use practices, including forestry and urban development. Increasing the degree of constraint imposed by specific limitations,

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which progressively limit the range of alternative land uses and management practices that are practicable and appropriate, achieves this.

6.3 The improve or maintain test for land degradation

The Land and Soils Capability Tool requires 5 key actions:

- identify the land and soils capability zone; these are areas of land that have relatively uniform physical characteristics in relation to slope, rockiness, soil type, soil drainage, landform or salt outbreak;
- identify the relevant catchment hazard area;
- select the land use type;
- establish slope; and
- establish rainfall.

6.3.1 Identify Land and Soils Capability Zone

Land and soils capability zones are areas of land that have relatively uniform physical characteristics in relation to slope, rockiness, soil type, soil drainage, landform or salt outbreak. The proposal must improve or maintain environmental outcomes for all Land and Soils Capability zones it includes in order to pass the 'improve or maintain' test.

6.3.2 Identify the relevant Catchment Hazard Area

To simplify the assessment process, Catchment Management Authority areas have been divided into Catchment Hazard Areas based on common climatic, soil and geomorphic characteristics. These Catchment Hazard Areas are shown in Figure 6.1.

Figure 6.1: Map of Catchment Hazard Areas (No change)

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In some catchment hazard areas certain hazards are not significant and are deemed to improve or maintain environmental outcomes. For example, acid sulfate soils are only assessed for coastal plains. The hazards assessed for each area are shown in Table 6.1.

Table 6.1 Required Hazard Assessment by Catchment Hazard Areas (No change)

6.3.3 Select land use

Land use is not a factor which determines LSC class. However, it is used to filter the management actions in Appendix B for LSC classes 3 to 6, so that only management actions that are appropriate to the proposed land use are specified by the LSC tool.

6.3.4 Slope

Slope is used to assess water erosion hazard and mass movement hazard. Average slope may be either:

- estimated visually in the field by experienced landscape assessors;
- measured using an Abney level or clinometer; or
- estimated from a topographic map or Digital Elevation Model.

The slope classes available as options in the Land and Soils Capability Tool vary between different Catchment Areas to reflect local conditions and the specific criteria required for hazard assessments.

6.3.5 Rainfall

Rainfall is one factor used to assess water erosion hazard, wind erosion hazard, soil structure decline and earth mass movement hazard. Average annual rainfall requires the selection of the appropriate 100mm class using information provided by the Australian Bureau of Meteorology. This must relate to the

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Please note that in final the formatting of the EOAM some page numbers may change resulting repagination of the Contents page.

Appendix B

Review of Management Actions Prescribed by the Land and Soil Capability Tool in the PVP Developer

Industry Descriptions:

Industry	Description of Industry
Horticulture/Viticulture (Permanent Plantings)	<p>Industries include:</p> <ul style="list-style-type: none"> • Permanent and long term plantings (whether irrigated or not) of grapevines, citrus, stone and other fruit trees, nut crops (trees or bushes), and berries.
Irrigation	<p>Industries include:</p> <ul style="list-style-type: none"> • Irrigated pastures • Irrigated field crops – Furrow irrigated crops (eg. cotton, maize, etc), Rice • Irrigated annual horticultural crops (eg vegetables, etc) <p>Irrigation methods included:</p> <ul style="list-style-type: none"> • Surface irrigation by furrows and basins/bays • Centre pivot and other mobile sprinkler or spray irrigation techniques • Fixed and semi fixed systems such as subsurface drip, dripline and sprayline systems.
Development/Infrastructure	<p>Industries include:</p> <ul style="list-style-type: none"> • Clearing for development that may or may not require Shire Council development approval. Examples are clearing for construction of infrastructure such as powerlines to dwellings and subdivision also construction of dual occupancy dwellings, quarries, tourist cabins etc. <p>Does not include:</p> <ul style="list-style-type: none"> • Permitted or excluded clearing for development under the NV Act (see Info Sheet 4)
Dryland Cropping	<p>Dryland cropping for cereals, oilseeds, legume and fodder crops. This is frequently, but not always carried out in rotation with pasture phases of improved pastures that include sown legume and grass species, or in some cases volunteer pasture phases including native pasture species. Some areas maybe cropped continuously using rotations of different crops to control diseases and weeds. Dryland cropping is confined to land where it is possible to till the soil adequately to sow annual crops and the cropping practices used will be determined by the capability of the land.</p>
Grazing	<p>Grazing can occur under improved pasture and native pasture. Grazing can be carried out on a broad range of land, but the intensity of grazing and the grazing practices used will be determined by the capability of the land.</p> <ul style="list-style-type: none"> • In many areas, dryland cropping and grazing are conducted as a mixed farming operation, with land being rotated between dryland cropping and pastures on a regular rotation. • Where grazing is being used in rotation which cropping the management actions for the grazing and cropping must be applies in the PVP.

Development of Management Action Details (MADs)

The PVP process involves the development of Management Action Details (MADs) statements which further define and clarify the management actions generated by the LSC tool. The MADs will specify the details of the management that is agreed between the landholder and the PVP officer. MADs must comply with the SMARTA principles. That is, they will be:

- Specific
- Measurable
- Appropriate
- Realistic
- Time bound and
- Agreed

The MADs statements are an important component of ensuring the PVP satisfies the "improve or maintain" test for environmental outcomes. Parameters such as specific minimum levels of groundcover will need to be defined by the MADs for each hazard where relevant.

The MADs allow the PVP to be tailored to the management practices of the locality, industry and the landholders management program as far as practical while still meeting the improve or maintain test.

To ensure MADs are developed appropriately the LSC Management Actions review panel will write guidelines for PVP staff in the development of MADs.

Horticulture/Viticulture Management Actions

Horticulture/Viticulture Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p>Water Erosion</p> <p><i>Under horticulture or viticulture the major risk of water erosion occurs with the exposure of bare soil to high intensity storms and highly erosive rainfall, with resultant sheet and rill erosion. A further concern is concentrated water flow where the erosive power of the water can cause rill erosion and then gully erosion.</i></p>	<p><u>Clearing and establishment</u></p> <p>The landholder is to prevent water erosion in the clearing and establishment phase by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate water erosion management techniques to be used on site • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Stabilising existing erosion • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent sheet and rill erosion • Maintaining a permanent sward/groundcover between rows and on all headlands <p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p><u>Clearing and Establishment</u></p> <p>The landholder is to prevent water erosion in the clearing and establishment phase by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate water erosion management techniques to be used on site • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Stabilising existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining a permanent sward on headland areas • Maintaining adequate groundcover to prevent sheet and rill erosion • Maintaining cover crop or permanent groundcover between rows • Maintaining mulch under rows <p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p><u>Clearing and Establishment</u></p> <p>The landholder is to prevent water erosion in the clearing and establishment phase by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate water erosion management techniques to be used on site • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Stabilising existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining adequate groundcover to prevent sheet and rill erosion, specifically: <ul style="list-style-type: none"> ○ Maintaining cover crop or permanent groundcover between rows ○ Maintaining mulch under rows, ○ Maintaining permanent sward on headland areas • Applying adequate fertiliser to low fertility soils to maintain soil fertility for ground cover <p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p><u>Clearing and Establishment</u></p> <p>The landholder is to prevent water erosion in the clearing and establishment phase by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate water erosion management techniques to be used on site • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Stabilising existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining adequate groundcover to prevent sheet and rill erosion, specifically: <ul style="list-style-type: none"> ○ Maintaining adequate groundcover between rows to prevent sheet and rill erosion ○ Maintain mulch under rows ○ Maintain permanent sward on headland areas • Applying adequate fertiliser to low fertility soils to maintain soil fertility for ground cover

Horticulture/Viticulture Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p>Wind Erosion</p> <p><i>The main risk with horticulture / viticulture is the exposure of bare soil for extended periods with high wind erodibility to strongly erosive winds. Soils with high wind erodibility are largely sandy soils, but in some circumstances loams and clays can also be highly erodible. Loosely tilled soils with no cover are especially susceptible to wind erosion. Constantly bare soil under tree crops, lack of wind breaks, and frequent soil disturbance can exacerbate the severity of wind erosion.</i></p>	<p>Clearing and Establishment</p> <p>The landholder is to prevent wind erosion in the clearing and establishment phase by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate wind erosion management techniques to be used on site • Ensuring orchard/vineyard is laid out to mitigate high wind erosion hazard • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate groundcover between rows • Maintaining roughness of bare surface soil <p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p>Clearing and Establishment</p> <p>The landholder is to prevent wind erosion in the clearing and establishment phase by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate wind erosion management techniques to be used on site • Ensuring orchard/vineyard is laid out to mitigate high wind erosion hazard • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Revegetating bare soil areas • Protecting or sheltering the soil from high wind speed <p>Ongoing Management</p> <p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent wind erosion, specifically: <ul style="list-style-type: none"> ○ Maintaining groundcover between rows ○ Maintaining mulches under rows ○ Maintaining permanent sward on headland areas • Maintaining roughness of bare surface soil • Protecting or sheltering the soil from high wind speed <p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p>Clearing and Establishment</p> <p>The landholder is to prevent wind erosion in the clearing and establishment phase by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate wind erosion management techniques to be used on site • Ensuring orchard/vineyard is laid out to mitigate high wind erosion hazard • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Revegetating bare soil areas • Protecting or sheltering the soil from high wind speed <p>Ongoing Management</p> <p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent wind erosion, specifically: <ul style="list-style-type: none"> ○ Maintaining cover crop or permanent groundcover between rows ○ Maintaining mulches under rows ○ Maintaining permanent sward on headland areas • Maintaining roughness of bare surface soil • Protecting or sheltering the soil from high wind speed 	
<p>Salinity</p> <p><i>Salinity is not covered in this review as salinity management actions and</i></p>				

Horticulture/Viticulture Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<i>offsets are determined by the Salinity Benefits Index Tool or the Salt Mobilisation Tool.</i>				
<p>Shallow & Rocky Soils</p> <p><i>The main risk is that shallow and rocky soils will have insufficient water storage capacity and nutrient levels to sustain ground cover, to provide adequate support for crops and cover crops, and to allow necessary management practices to be safely undertaken.</i></p>		<p>Clearing and Establishment The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate erosion management techniques to be used on site • Minimising soil and rock disturbance and maintaining groundcover as far as possible during clearing and construction operations . • Revegetating bare soil areas • Avoiding disturbance of poorly drained areas <p>Ongoing Management The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining adequate groundcover to prevent soil erosion, specifically: <ul style="list-style-type: none"> ○ Maintaining groundcover between rows ○ Maintaining mulches under rows ○ Maintaining permanent sward on headland areas <p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p>Clearing and Establishment The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate erosion management techniques to be used on site • Minimising soil and rock disturbance and maintaining groundcover as far as possible during clearing and construction operations . • Revegetating bare soil areas • Avoiding disturbance of poorly drained areas <p>Ongoing Management The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining adequate groundcover to prevent soil erosion, specifically: <ul style="list-style-type: none"> ○ Maintaining groundcover between rows ○ Maintaining mulches under rows ○ Maintaining permanent sward on headland areas <p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p>Clearing and Establishment The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Developing a plan identifying appropriate erosion management techniques to be used on site • Minimising soil and rock disturbance and maintaining groundcover as far as possible during clearing and construction operations • Revegetating bare soil areas • Avoiding disturbance of poorly drained areas • Ensuring rows are orientated and spaced to mitigate high shallow or rocky soil hazard <p>Ongoing Management The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining adequate groundcover to prevent soil erosion, specifically: <ul style="list-style-type: none"> ○ Maintaining groundcover between rows ○ Maintaining mulches under rows ○ Maintaining permanent sward on headland areas • Applying adequate fertiliser to low fertility soils to maintain soil fertility for ground cover
Earth mass movement	Clearing and Establishment The landholder is to prevent earth mass			Clearing and Establishment The landholder is to prevent earth mass

Horticulture/Viticulture Management Actions			
Hazards	LSC Class 3	LSC Class 4	LSC Class 5
<p><i>Under horticulture / viticulture the main risk is that water use will be insufficient to prevent deep drainage and the accumulation of water in the substrate, deeper soil profile and regolith. This could concentrate seepage, increasing water where mass movement is likely to occur. The objective is to maximise water use in susceptible areas by establishing perennial pastures.</i></p>	<p>movement in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Preventing the concentration of seepage flows • Preventing disturbance of unconsolidated substrates • Minimising establishment activity during periods of high rainfall or prolonged wet weather • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations <p>Ongoing Management The landholder is to prevent earth mass movement by maintaining ground cover on the LSC zone.</p>		<p>movement in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Developing an engineering plan for the orchard/vineyard development on the site that includes management of existing and potential mass movement, seepage, unconsolidated substrates and high rainfall events. Requires engineering inspection and design, with appropriate geomechanical testing and best practice implementation • Preventing the concentration of seepage flows • Preventing disturbance of unconsolidated substrates • Minimising traffic when soil is wet • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations <p>Ongoing Management The landholder is to prevent earth mass movement by:</p> <ul style="list-style-type: none"> • Maintaining ground cover and • Monitoring regolith saturation and stability and maintaining engineering works
<p>Soil Structure <i>Under horticulture / viticulture the main risk is the degradation of soil structure that will lead to surface crusting, loss of soil organic matter, soil compaction and a soil in poor soil structural condition. Such a structurally degraded soil will be difficult to manage, cause problems with germination and emergence of cover crops, slower infiltration and</i></p>	<p>Clearing and Establishment The landholder is to prevent soil structural decline in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage <p>Ongoing Management The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining groundcover and biomass to protect soil surface 	<p>Clearing and Establishment The landholder is to prevent soil structural decline in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Minimising establishment works when soil is wet <p>Ongoing Management The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining groundcover and biomass to protect soil surface • Minimising traffic when soil is wet • Avoiding the use of irrigation water with salinity, alkalinity or sodium levels that will exacerbate soil structural problems • Using soil ameliorants to reduce dispersion 	<p>Clearing and Establishment The landholder is to prevent soil structural decline in the clearing and establishment phase of the orchard/vineyard by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Minimising traffic when soil is wet <p>Ongoing Management The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Maintaining groundcover and biomass to protect soil surface • Minimising traffic when soil is wet • Avoiding the use of irrigation water with salinity, alkalinity or sodium levels that will exacerbate soil structural problems • Using soil ameliorants to reduce dispersion

Horticulture/Viticulture Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p><i>drainage resulting in increased runoff and erosion, restricted root growth and generally lead to environmental degradation and a loss of productivity.</i></p>	<p>In some circumstances due to the specific nature of the crop to be grown it may not be practicable to achieve all of the above requirements. Exceptions are specified in the management action details column.</p>	<p>to protect soil surface</p> <ul style="list-style-type: none"> Minimising traffic when soil is wet <p>Avoiding the use of irrigation water with salinity, alkalinity or sodium levels that will exacerbate soil structural problems</p>	<ul style="list-style-type: none"> Applying fertiliser where necessary to maintain groundcover and biomass 	
<p>Acid Sulfate Soil</p> <p><i>The main risk is that acid sulfate soils will oxidise and release sulfuric acid causing on- and off-site impacts. The effect of horticultural / viticultural practices on watertable depth and the quality of drainage water can be pronounced. Consequently, significant limits apply to the depth of drains and the disturbance of acid sulfate materials by horticulture / viticulture to protect watertables and the quality of drainage water.</i></p>	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> Minimising soil disturbance or drainage changes below 3m depth, below 1 m Australian Height Datum (AHD) , or below local high tide level, whichever is the higher level. If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> Minimising soil disturbance or drainage changes below 1m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> Minimising soil disturbance or drainage changes below 0.5m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	

Intensive / extensive irrigation (excluding Permanent Horticulture & Viticulture) Management Actions

Intensive / extensive irrigation (excluding Permanent Horticulture & Viticulture) Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p>Water Erosion</p> <p><i>Under irrigation the major risk of water erosion occurs with the exposure of bare soil to high intensity storms and highly erosive rainfall, with resultant sheet and rill erosion. A further concern is concentrated irrigation water flow, where the erosive power of the water can cause sheet and rill erosion and then gully erosion.. Irrigation application/flow rates in excess of the soil infiltration capability can also result in soil erosion.</i></p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent water erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Stabilising any existing erosion • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent sheet and rill erosion • Managing irrigation water application rates to suit the soil type, infiltration capacity and fall/slope of the land <p>Surface irrigation by furrows and basins/bays is not permitted.</p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent water erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Stabilising any existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent sheet and rill erosion • Minimising soil disturbance and tillage • Managing irrigation water application rates to suit the soil type, infiltration capacity and fall/slope of the land <p>Surface irrigation by furrows and basins/bays is not permitted.</p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent water erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Stabilising any existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent sheet and rill erosion • Minimising soil disturbance and tillage • Managing irrigation water application rates to suit the soil type, infiltration capacity and fall/slope of the land <p>Surface irrigation by furrows and basins/bays is not permitted.</p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent water erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Stabilising any existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining high levels of ground cover at all times to prevent sheet and rill erosion, except in occasional situations where necessary to sow/establish perennial pastures or crops. • Not cultivating or tilling except occasionally for the purpose of sowing improved or perennial pastures <p>Irrigation is not permitted except for irrigation of perennial pastures or a perennial crop which provides adequate groundcover</p>
<p>Wind Erosion</p> <p><i>Under irrigation the major risk is the exposure of bare soil with high wind erodibility to strongly erosive winds. Soils with high wind erodibility are largely sandy soils, but some loams and clays can also be highly erodible in some circumstances.</i></p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent wind erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Revegetating bare soil areas <p><u>Ongoing Management</u></p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent wind erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Revegetating bare soil areas <p><u>Ongoing Management</u></p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent wind erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Revegetating bare soil areas <p><u>Ongoing Management</u></p>	<p><u>Clearing and Development</u></p> <p>The landholder is to prevent wind erosion in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and development operations • Revegetating bare soil areas <p><u>Ongoing Management</u></p>

Intensive / extensive irrigation (excluding Permanent Horticulture & Viticulture) Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p><i>Loosely tilled soils with no cover are especially susceptible to wind erosion. Irrigation of perennial pastures or perennial crops can facilitate better management of this hazard.</i></p>	<p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate ground cover • Minimising soil disturbance and tillage 	<p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate ground cover • Minimising soil disturbance and tillage • Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) 	<p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining adequate ground cover • Minimising soil disturbance and tillage • Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) 	<p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining high levels of ground cover at all times except in occasional situations where necessary to sow/establish perennial pastures or crops. • Not cultivating or tilling except occasionally for the purpose of sowing improved or perennial pastures • Irrigation is not permitted except for irrigation of perennial pastures or a perennial crop which provides adequate groundcover to prevent wind erosion.
<p>Salinity</p> <p><i>Salinity is not covered in this review as salinity management actions and offsets are determined by the Salinity Benefits Index Tool or the Salt Mobilisation Tool.</i></p>				
<p>Shallow & rocky soil</p> <p><i>The main risk is that shallow and rocky soils will have insufficient water storage capacity and nutrient levels to sustain ground cover, to provide adequate support for crops and pasture, and to allow necessary management practices. Under irrigation another major risk of shallow and rocky soils is excessive recharge.</i></p>		<p>Clearing and Development</p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil and rock disturbance and maintaining groundcover as far as possible during clearing and development • Revegetating bare soil areas • Avoiding disturbance of poorly drained areas <p>Ongoing Management</p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Not cultivating or tilling except 	<p>Clearing and Development</p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil and rock disturbance and maintain groundcover as far as possible during clearing and establishment operations • Revegetating bare soil areas • Avoiding disturbance of poorly drained areas <p>Ongoing Management</p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Not cultivating or tilling except 	<p>Clearing and Development</p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil and rock disturbance and maintain groundcover as far as possible during clearing and establishment operations • Revegetating bare soil areas • Avoiding disturbance of poorly drained areas <p>Ongoing Management</p> <p>To prevent adverse environmental impacts due to shallow and rocky soil hazard the landholder is not permitted to cultivate or till the soil.</p>

Intensive / extensive irrigation (excluding Permanent Horticulture & Viticulture) Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
		<p>occasionally for the purpose of sowing improved or perennial pastures</p> <p>Irrigation is only permitted on perennial pastures and only in coastal situations where excessive recharge is not likely to cause adverse environmental impacts.</p>	<p>occasionally for the purpose of sowing improved or perennial pastures</p> <p>Irrigation is only permitted on perennial pastures and only in coastal situations where excessive recharge is not likely to cause adverse environmental impacts.</p>	<p>Irrigation is only permitted on perennial pastures and only in coastal situations where excessive recharge is not likely to cause adverse environmental impacts.</p>
<p>Earth mass movement</p> <p><i>Irrigation increases the risk of deep drainage and accumulation of water in the substrate, deeper soil profile and regolith. This could concentrate seepage, increasing water in those parts of the landscape where mass movement is likely to occur. The management objective is to maximise water use in susceptible areas by establishing perennial pastures but irrigation could exacerbate the concentration of water.</i></p>	<p>Clearing and Development</p> <p>The landholder is to prevent earth mass movement in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Avoiding the concentration of seepage flows or disturbance of unconsolidated substrates • Minimising development activities when soils are wet <p>Ongoing Management</p> <p>The landholder is to prevent earth mass movement in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Not cultivating or tilling where slopes are less than 25% except for occasional tillage for the purpose of sowing improved or perennial pastures • Not cultivating or tilling where slopes are 25% or greater. • Where slopes are 25% or greater establish perennial pastures by broadcast seeding if necessary • Maintaining a high level of ground cover <p>Irrigation is only permitted where it can be closely controlled to prevent excessive recharge which may saturate the substrate.</p>			<p>Irrigation is not permitted</p>
<p>Soil Structure</p> <p><i>Under irrigation the major risk is the degradation of soil structure that will lead to surface crusting, loss of soil organic matter, soil compaction and a soil in poor soil structural</i></p>	<p>Clearing and Development</p> <p>The landholder is to prevent soil structural decline in the clearing and irrigation development phase by minimising soil disturbance and tillage.</p> <p>Ongoing Management</p> <p>The landholder is to prevent soil structural</p>	<p>Clearing and Development</p> <p>The landholder is to prevent soil structural decline in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Minimising traffic when soil is wet <p>Ongoing Management</p>	<p>Clearing and Development</p> <p>The landholder is to prevent soil structural decline in the clearing and irrigation development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and tillage • Minimising traffic when soil is wet <p>Ongoing Management</p> <p>The landholder is to prevent soil structural decline in the ongoing management of the</p>	

Intensive / extensive irrigation (excluding Permanent Horticulture & Viticulture) Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p><i>condition. Such a structurally degraded soil will be difficult to manage, cause problems with germination and emergence, slower infiltration and drainage result in increased runoff and erosion, restrict root growth and generally lead to environmental degradation and a loss of productivity.</i></p>	<p>decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Retaining crop residues and stubble as much as practicable to maintain organic matter levels • Minimising the period when soil is bare • Sowing crops by direct drilling or cultivating only to the extent necessary for seed germination/plant establishment • Using soil ameliorants (eg lime) to maintain soil pH in a range suitable for crop/pasture establishment and growth (maximise biomass). 	<p>The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Retaining crop residues and stubble as much as practicable to maintain organic matter levels • Minimising the period when soil is bare • Sowing crops by direct drilling or cultivating only to the extent necessary for seed germination/plant establishment • Using soil ameliorants (eg lime) to maintain soil pH in a range suitable for crop/pasture establishment and growth (maximise biomass). • Using soil ameliorants (eg gypsum) to ensure good establishment of new pastures (maximise biomass). • Using irrigation methods and/or layouts which avoid or minimise saturation and hence prevent slaking/dispersion of topsoil (not applicable to rice). • Avoiding the use of irrigation water with salinity, alkalinity or sodium levels that will exacerbate soil structural problems. 	<p>LSC zone by:</p> <ul style="list-style-type: none"> • Retaining crop residues and stubble as much as practicable to maintain organic matter levels • Minimising the period when soil is bare • Sowing crops by direct drilling or cultivating only to the extent necessary for seed germination/plant establishment • Using soil ameliorants (eg lime) to maintain soil pH in a range suitable for crop/pasture establishment and growth (maximise biomass). • Using soil ameliorants (eg gypsum) to ensure good establishment of new pastures (maximise biomass). • Using irrigation methods and/or layouts which avoid or minimise saturation and hence prevent slaking/dispersion of topsoil (not applicable to rice). • Avoiding the use of irrigation water with salinity, alkalinity or sodium levels that will exacerbate soil structural problems. 	
<p>Acid Sulfate Soil</p> <p><i>The main risk is that acid sulfate soils will oxidise and release sulfuric acid causing on- and off-site impacts. The effect of irrigation and drainage practices on watertable depth and the quality of drainage water can be pronounced. Consequently, significant limits and conditions apply to the use of irrigation, the depth of drains, and the disturbance of actual or potential acid sulfate materials.</i></p>	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising irrigation effects on the watertable by maximising water use efficiency of crops and/or pastures. • Preventing soil disturbance or drainage changes below 3m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising irrigation effects on the watertable by maximising water use efficiency of crops and/or pastures. • Preventing soil disturbance or drainage changes below 1m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising irrigation effects on the watertable by maximising water use efficiency of crops and/or pastures. • Preventing soil disturbance or drainage changes below 0.5m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. 	

Development/Infrastructure Management Actions

Note to be included in 'standard conditions' to the effect that where a MAD requires an engineering design or geomechanical testing and this requirement is covered later in DA conditions – the DA condition prevails.

Development/Infrastructure				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p>Water Erosion:</p> <p><i>There is a risk of on-site and off-site environmental damage by water erosion if soil disturbance and sedimentation caused by development or infrastructure construction is not adequately controlled. Soils may be exposed to this risk for long periods during construction activities, with the risk abating after completion and the successful revegetation of bare soil areas.</i></p>	<p>Clearing and Construction</p> <p>The landholder is to prevent water erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent erosion and sediment control measures • Revegetating bare soil areas • Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site <p>Ongoing Maintenance</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining permanent erosion and sediment control measures. • Minimising soil disturbance and Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site 	<p>Clearing and Construction</p> <p>The landholder is to prevent water erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent erosion and sediment control measures • Revegetating bare soil areas • Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site <p>Ongoing Maintenance</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining permanent erosion and sediment control measures. • Minimising soil disturbance and • Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site 	<p>Clearing and Construction</p> <p>The landholder is to prevent water erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent erosion and sediment control measures • Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site <p>Ongoing Maintenance</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining permanent erosion and sediment control measures • Minimising soil disturbance and • Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site 	<p>Clearing and Construction</p> <p>The landholder is to prevent water erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent erosion and sediment control measures • Revegetating bare soil areas • Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site <p>Ongoing Maintenance</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining permanent erosion and sediment control measures • Minimising soil disturbance and • Maintaining adequate groundcover to prevent sheet and rill erosion on undeveloped parts of the site
<p>Wind Erosion</p> <p><i>The main risk with construction activities for development / infrastructure is the exposure for prolonged periods of bare soil with a high wind erodibility to strongly erosive winds. Soils with high wind</i></p>	<p>Clearing and Construction</p> <p>The landholder is to prevent wind erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent 	<p>Clearing and Construction</p> <p>The landholder is to prevent wind erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent 	<p>Clearing and Construction</p> <p>The landholder is to prevent wind erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent 	<p>Clearing and Construction</p> <p>The landholder is to prevent wind erosion in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent

Development/Infrastructure				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p><i>erodibility are largely sandy soils, but some loams and clays can also be highly erodible in some circumstances. Frequent soil disturbance and extended fetch can exacerbate the severity of wind erosion.</i></p>	<p>erosion and sediment control measures</p> <ul style="list-style-type: none"> • Revegetating bare soil areas • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site <p>Ongoing Maintenance The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site 	<p>erosion and sediment control measures</p> <ul style="list-style-type: none"> • Revegetating bare soil areas • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site <p>Ongoing Maintenance The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) • Minimising soil disturbance and • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site 	<p>erosion and sediment control measures</p> <ul style="list-style-type: none"> • Revegetating bare soil areas • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site <p>Ongoing Maintenance The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) • Minimising soil disturbance and • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site 	<p>erosion and sediment control measures</p> <ul style="list-style-type: none"> • Revegetating bare soil areas • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site <p>Ongoing Maintenance The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) • Minimising soil disturbance and • Maintaining adequate groundcover to prevent wind erosion on undeveloped parts of the site
<p>Salinity</p> <p><i>Salinity is not covered in this review as salinity management actions and offsets are determined by the Salinity Benefits Index Tool or the Salt Mobilisation Tool.</i></p>				
<p>Shallow & rocky soil</p> <p><i>The main risk is that shallow and rocky soils will have insufficient water storage capacity and nutrient levels to maintain the required level of ground cover and to allow necessary erosion control practices to be safely undertaken.</i></p>		<p>Clearing and Construction The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent erosion and sediment control measures • Revegetating bare soil areas • Maintaining adequate groundcover to prevent soil erosion on undeveloped 	<p>Clearing and Construction The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Conserving topsoil • Installing temporary and permanent erosion and sediment control measures • Revegetating bare soil areas • Maintaining adequate groundcover to prevent soil erosion on undeveloped 	<p>Clearing and Construction The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations • Conserving topsoil • Installing temporary and permanent erosion and sediment control measures • Revegetating bare soil areas • Maintaining adequate groundcover to prevent soil erosion on undeveloped

Development/Infrastructure				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
		<p>parts of the site</p> <p>Ongoing Maintenance The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining permanent erosion and sediment control measures • Minimising soil disturbance and • Maintaining adequate groundcover to prevent soil erosion on undeveloped parts of the site 	<p>parts of the site</p> <p>Ongoing Maintenance The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining permanent erosion and sediment control measures • Minimising soil disturbance and • Maintaining adequate groundcover to prevent soil erosion on undeveloped parts of the site 	<p>parts of the site</p> <p>Ongoing Maintenance The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Maintaining permanent erosion and sediment control measures • Minimising soil disturbance and • Maintaining adequate groundcover to prevent soil erosion on undeveloped parts of the site
<p>Earth mass movement</p> <p><i>The major risk is that during the construction phase soil water use will be insufficient to prevent deep drainage and the accumulation of water in the substrate, deeper soil profile and regolith. This could concentrate seepage, increasing water in those parts of the landscape where mass movement is likely to occur. The management objective is to divert surface water flow and seepage away from susceptible areas and maximise water use by establishing perennial groundcover.</i></p>	<p>Clearing and Construction The landholder is to prevent earth mass movement in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Avoiding the concentration of seepage flows (eg by diversion structures) • Minimising traffic when soil is wet <p>Ongoing Maintenance The landholder is to prevent earth mass movement in the ongoing management of the development by:</p> <ul style="list-style-type: none"> • Maintaining water seepage control structures • Maintaining groundcover on undeveloped parts of the site 			<p>Clearing and Construction The landholder is to prevent earth mass movement in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Developing an engineering design for site that includes management of seepage, of unconsolidated substrate and high rainfall events – engineering design with appropriate geomechanical testing to best practice except where DA requires the same. • Avoiding the concentration of seepage flows (eg by diversion structures) • Minimising traffic when soil is wet <p>Ongoing Maintenance The landholder is to prevent earth mass movement in the ongoing management of the development by:</p> <ul style="list-style-type: none"> • Maintaining water seepage control structures • Maintaining groundcover on undeveloped parts of the site
<p>Soil Structure</p> <p><i>The risk with infrastructure / development is that the degradation of soil structure caused by</i></p>	<p>Clearing and Construction The landholder is to prevent soil structural decline in the clearing and construction phase of the development by minimising soil disturbance or compaction outside the development</p>	<p>Clearing and Construction The landholder is to prevent soil structural decline in the clearing and construction phase of the development by minimising soil disturbance or compaction outside the development</p>	<p>Clearing and Construction The landholder is to prevent soil structural decline in the clearing and construction phase of the development by:</p> <ul style="list-style-type: none"> • Minimising construction activities when soils are wet • Minimising soil disturbance and/or compaction outside the development site. • Remediating with appropriate soil ameliorants (eg lime, gypsum) where necessary 	

Development/Infrastructure				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p><i>machinery will lead to surface crusting, loss of soil organic matter, soil compaction and a soil in poor soil structural condition. Such a structurally degraded soil will be difficult to manage, cause problems with germination and emergence, slower infiltration and drainage resulting in increased runoff and erosion, restricted root growth and generally lead to environmental degradation. This is not usually a significant problem on the immediate construction site as most surface soil is removed, but it can become an environmental management issue for adjoining areas which are to be rehabilitated and revegetated.</i></p>	<p>site.</p>	<p>site.</p> <p><u>Ongoing Maintenance</u> The landholder is to prevent soil structural decline in the ongoing management of the development by:</p> <ul style="list-style-type: none"> • Maintaining water diversion and erosion control structures. 	<p><u>Ongoing Maintenance</u> The landholder is to prevent soil structural decline in the ongoing management of the development by:</p> <ul style="list-style-type: none"> • Maintaining water diversion and erosion control structures. 	
<p>Acid Sulfate Soil <i>The main risk is that acid sulfate soils will oxidise and release sulfuric acid causing on- and off-site impacts. The effect of construction activities on watertable depth and the quality of drainage water can be pronounced. Consequently, significant limits and conditions apply to the depth of drains, the disturbance of actual or potential acid sulfate materials, and the treatment and use of spoil.</i></p>	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 3m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 1m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or drainage change below 0.5m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level.. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	

Dryland Cropping Management Actions

Dryland Cropping Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p>Water Erosion</p> <p><i>Under dryland cropping the major risk is the exposure of bare soil to high intensity storms and highly erosive rainfall with resultant sheet and rill erosion. A further concern is in areas of concentrated water flow where the erosive power of the water can cause rill erosion and then gully erosion.</i></p>	<p><u>Clearing and establishment</u> The landholder is to prevent water erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining ground cover as far as possible during clearing operations • Stabilising any existing erosion • Revegetating bare soil areas <p><u>Ongoing Management</u> The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ○ Water erosion management techniques to be used on site ○ Techniques to stabilise any existing water erosion • Adopting farming practices for the control of water erosion including: <ul style="list-style-type: none"> ○ Minimising soil disturbance and tillage ○ Maintaining adequate groundcover to prevent sheet and rill erosion • Installing erosion control earthworks where required. 	<p><u>Clearing and establishment</u> The landholder is to prevent water erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Stabilising any existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p><u>Ongoing Management</u> The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan – identifying: <ul style="list-style-type: none"> ○ Water erosion management techniques to be used on site and ○ Techniques to stabilise any existing water erosion • Adopting farming practices for the control of water erosion including: <ul style="list-style-type: none"> ○ Minimising soil disturbance and tillage ○ Maintaining adequate groundcover to prevent sheet and rill erosion • Installing erosion control earthworks where required. 	<p>Cultivating or tilling the soil is not permitted except in occasional situations where necessary to sow/establish perennial pastures or crops</p>	<p>Cultivation or tillage is not permitted</p>
<p>Wind erosion hazard</p> <p><i>Under dryland cropping the major risk is the exposure to strong erosive winds of bare soil with high wind erodibility. Soils with high wind erodibility are largely sandy soils, but some loams and clays can also be highly erodible in some circumstances. Loosely tilled soils with no cover are especially susceptible to wind erosion.</i></p>	<p><u>Clearing and establishment</u> The landholder is to prevent wind erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Revegetating bare soil areas 	<p><u>Clearing and establishment</u> The landholder is to prevent wind erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintaining groundcover as far as possible during clearing and construction operations. • Revegetating bare soil areas 	<p>Cultivating or tilling the soil is not permitted except in occasional situations where necessary to sow/establish perennial pastures or crops.</p>	<p>Cultivation or tillage is not permitted</p>

Dryland Cropping Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
	<p>Ongoing Management The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing an erosion control plan identifying: <ul style="list-style-type: none"> ○ Wind erosion management techniques to be used ○ Techniques to stabilise existing water erosion • Adopting farming practices for the control wind erosion including: <ul style="list-style-type: none"> ○ Minimising soil disturbance and tillage ○ Managing and maintaining ground cover ○ Maintaining roughness of bare surface soil ○ Maintaining soil aggregation • Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) 	<p>Ongoing Management The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing an erosion control plan – identifying: <ul style="list-style-type: none"> ○ Wind erosion management techniques to be used on site and ○ Techniques to stabilise existing water erosion • Adopting farming practices for the control wind erosion including: <ul style="list-style-type: none"> ○ Minimising soil disturbance and tillage ○ Managing and maintaining ground cover ○ Maintaining roughness of bare surface soil ○ Maintaining soil aggregation • Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) 		
<p>Salinity hazard <i>Salinity is not covered in this review as management actions and offsets for LSC classes 3-6 are determined by the Salinity Benefits Index Tool or the Salt Mobilisation Tool.</i></p>				
<p>Shallow & rocky soil hazard <i>Under dryland cropping the major risk is that rock outcrop will prevent tillage operations and that shallow soils will not provide sufficient water storage capacity and nutrient levels to sustain ground cover under cropping land use.</i></p>		<p>Cultivating or tilling is not permitted except occasionally for the purpose of sowing improved or perennial pastures</p>	<p>Cultivating or tilling is not permitted except occasionally for the purpose of sowing improved or perennial pastures</p>	<p>Cultivation or tillage is not permitted</p>
<p>Earth mass movement hazard <i>Under dryland cropping the major risk is that water use will be insufficient to prevent deep drainage and the</i></p>	<p>Clearing and Establishment The landholder is to prevent earth mass movement in the clearing and development phase by:</p>			<p>Clearing and Establishment The landholder is to prevent earth mass movement in the clearing and development phase by:</p>

Dryland Cropping Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p><i>accumulation of water in the substrate, deeper soil profile and regolith. This can concentrate seepage, increasing water in parts of the landscape where mass movement is likely to occur. The objective is to maximise water use in susceptible areas by establishing perennial pastures.</i></p>	<ul style="list-style-type: none"> • Avoiding the concentration of seepage flows or disturbance of unconsolidated substrates • Minimising establishment activity during periods of high rainfall or prolonged wet weather <p><u>Ongoing Management</u> The landholder is to prevent earth mass movement in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Not cultivating or tilling where slopes are less than 25% except for occasional tillage for the purpose of sowing improved or perennial pastures • Not cultivating or tilling where slopes are 25% or greater. • Where slopes are 25% or greater establishing perennial pastures by broadcast seeding if necessary • Maintaining a high level of ground cover 			<ul style="list-style-type: none"> • Avoiding the concentration of seepage flows or disturbance of unconsolidated substrates • Minimising establishment activity during periods of high rainfall or prolonged wet weather <p><u>Ongoing Management</u> The landholder is to prevent earth mass movement in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Not cultivating or tilling where slopes are less than 25% except for occasional tillage for the purpose of sowing improved or perennial pastures. • Not cultivating or tilling where slopes are 25% or greater. • Where slopes are 25% or greater establishing perennial pastures by broadcast seeding if necessary. • Avoiding actions which concentrate seepage flows • Avoiding disturbance of unconsolidated substrates • Maintaining a high level of ground cover
<p>Soil structure hazard <i>Under dryland cropping the major risk is the degradation of soil structure that will lead to surface crusting, loss of soil organic matter, soil compaction and a soil in poor soil structural condition. Such a structurally degraded soil will be difficult to manage, cause problems with germination and emergence, slower infiltration and drainage resulting in increased runoff and erosion, restricted root growth and generally lead to environmental degradation and a loss of productivity.</i></p>	<p><u>Clearing and Establishment</u> The landholder is to prevent soil structural decline in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or compaction <p><u>Ongoing Management</u> The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ○ Soil structure management techniques to be used on site and ○ Techniques to stabilise existing soil structure problems • Minimising soil disturbance and 	<p><u>Clearing and Establishment</u> The landholder is to prevent soil structural decline in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or compaction <p><u>Ongoing Management</u> The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ○ Soil structure management techniques to be used on site ○ Techniques to stabilise existing soil structure problems • Minimising soil disturbance and tillage 	<p>Not cultivating or tilling except occasionally for the purpose of sowing improved or perennial pastures</p>	

Dryland Cropping Management Actions				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
	tillage <ul style="list-style-type: none"> • Maintaining ground cover for most of the year • Maximising soil structural stability by maximising biomass production and maintaining organic carbon levels • Minimising soil disturbance and tillage • Minimising compaction due to machinery and livestock 	<ul style="list-style-type: none"> • Avoiding cultivation and trafficking of soils when wet. • Maintaining ground cover to protect the soil surface • Maximising soil structural stability by: <ul style="list-style-type: none"> ○ Maximising biomass production ○ Maintaining particulate organic carbon levels ○ Applying gypsum or lime to mildly sodic surface soils where appropriate • Minimising compaction by machinery and livestock 		
Acid sulfate soil <i>Under dryland cropping the major risk is that the acid sulfate soils will oxidise and release sulfuric acid, causing on- and off-site impacts. Although cropping soil disturbance is generally shallow (< 20 cm) the effect on watertable can be pronounced and extend to some depth. Consequently, there are significant limits on the depth of drains dug to facilitate cropping in acid sulfate soils as they can activate the oxidation of sulfate minerals and export acid products in drainwater.</i>	The landholder is to prevent oxidation of sulfides in acid sulfate soils by: <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 3m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	The landholder is to prevent oxidation of sulfides in acid sulfate soils by: <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 1m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	The landholder is to prevent oxidation of sulfides in acid sulfate soils by: <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 0.5m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	

Grazing Management Actions

Grazing	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p>Hazards</p> <p>Water Erosion hazard</p> <p><i>Under grazing the major risk is the exposure of bare soil to high intensity storms and highly erosive rainfall with resultant sheet and rill erosion. A further concern is in areas of concentrated water flow where the erosive power of the water can cause rill erosion and then gully erosion. In major flow lines and creeks streambank erosion can occur.</i></p>	<p>Clearing and establishment</p> <p>The landholder is to prevent water erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Stabilising any existing erosion • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ◦ Water erosion management techniques to be used ◦ Techniques to stabilise any existing water erosion • Maintaining adequate groundcover to prevent sheet and rill erosion • Installing erosion control earthworks where required. 	<p>Clearing and establishment</p> <p>The landholder is to prevent water erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Stabilising any existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ◦ Water erosion management techniques to be used ◦ Techniques to stabilise any existing water erosion • Maintaining adequate groundcover to prevent sheet and rill erosion • Installing erosion control earthworks where required 	<p>Clearing and establishment</p> <p>The landholder is to prevent water erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Stabilising any existing erosion • Avoiding disturbance of poorly drained areas • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan – identifying: <ul style="list-style-type: none"> ◦ Water erosion management techniques to be used on site and ◦ Techniques to stabilise any existing water erosion • Maintaining adequate groundcover to prevent sheet and rill erosion • Installing erosion control earthworks. 	<p>Clearing and establishment</p> <p>The landholder is to prevent water erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Stabilising any existing erosion • Avoiding disturbance of poorly drained areas • Using adequate fertiliser and appropriate pasture mixes to revegetate bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent water erosion in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ◦ Water erosion management techniques to be used ◦ Techniques to stabilise any existing water erosion • Maintaining adequate groundcover to prevent sheet and rill erosion • Not cultivating or tilling the soil. Pastures can be established using broadcast seeding • Installing erosion control earthworks.
<p>Wind erosion</p> <p><i>Under grazing the major risk is the exposure of bare soil with high wind erodibility to strong winds. Soils with high wind erodibility are largely sandy soils, but some loams and clays can also be highly erodible in some circumstances. Stocking pressure, pasture type and climatic / seasonal conditions are the main determinants of soil cover.</i></p>	<p>Clearing and establishment</p> <p>The landholder is to prevent wind erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p>	<p>Clearing and establishment</p> <p>The landholder is to prevent wind erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p>	<p>Clearing and establishment</p> <p>The landholder is to prevent wind erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p>	<p>Clearing and establishment</p> <p>The landholder is to prevent wind erosion in the clearing and development phase by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance and maintain ground cover as far as possible during clearing operations • Revegetating bare soil areas <p>Ongoing Management</p> <p>The landholder is to prevent wind erosion in the ongoing management of the LSC zone by:</p>

Grazing				
Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
	<ul style="list-style-type: none"> Developing an erosion control plan identifying: <ul style="list-style-type: none"> Wind erosion management techniques to be used Techniques to stabilise existing water erosion Adopting grazing management practices for the control of wind erosion including: <ul style="list-style-type: none"> Minimising soil disturbance and tillage Managing and maintaining ground cover Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) 	<ul style="list-style-type: none"> Developing an erosion control plan identifying: <ul style="list-style-type: none"> Wind erosion management techniques to be used Techniques to stabilise existing water erosion Adopting grazing management practices for the control of wind erosion including: <ul style="list-style-type: none"> Minimising soil disturbance and tillage Managing and maintaining ground cover Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) 	<ul style="list-style-type: none"> Developing an erosion control plan identifying: <ul style="list-style-type: none"> Wind erosion management techniques to be used Techniques to stabilise existing water erosion Adopting grazing management practices for the control of wind erosion including: <ul style="list-style-type: none"> Minimising soil disturbance and tillage Managing and maintaining ground cover Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) 	<ul style="list-style-type: none"> Developing an erosion control plan identifying: <ul style="list-style-type: none"> Wind erosion management techniques to be used Techniques to stabilise existing water erosion Maintaining adequate groundcover to prevent wind erosion Protecting or sheltering the soil from high wind speed (eg windbreaks, mulch) Not cultivating or tilling the soil.
<p>Salinity</p> <p><i>Salinity is not covered in this review as salinity management actions and offsets are determined by the Salinity Benefits Index Tool or the Salt Mobilisation Tool.</i></p>				
<p>Shallow & rocky soil hazard</p> <p><i>Under grazing the major risk is that rock outcrop will prevent tillage operations for pasture establishment and that shallow soils will not provide sufficient water storage capacity and nutrient levels to sustain ground cover under grazing land use.</i></p>		<p><u>Clearing and Establishment</u></p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and development phase by:</p> <ul style="list-style-type: none"> Minimising soil and rock disturbance and maintaining groundcover as far as possible during clearing and development operations Revegetating bare soil areas Avoiding disturbance of poorly drained areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> Not cultivating or tilling except 	<p><u>Clearing and Establishment</u></p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and development phase by:</p> <ul style="list-style-type: none"> Minimising soil and rock disturbance and maintaining groundcover as far as possible during clearing and development operations Revegetating bare soil areas Avoiding disturbance of poorly drained areas <p><u>Ongoing Management</u></p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> Not cultivating or tilling except 	<p><u>Clearing and Establishment</u></p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the clearing and development phase by:</p> <ul style="list-style-type: none"> Minimising soil and rock disturbance and maintaining groundcover as far as possible during clearing and establishment operations . Revegetating bare soil areas Avoiding disturbance of poorly drained areas Installing erosion control earthworks where necessary <p><u>Ongoing Management</u></p> <p>The landholder is to prevent adverse environmental impacts due to shallow and rocky soil hazard in the ongoing</p>

Grazing Hazards	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
		occasionally for the purpose of sowing improved perennial pastures <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent soil erosion 	occasionally for the purpose of sowing improved perennial pastures <ul style="list-style-type: none"> • Maintaining adequate groundcover to prevent soil erosion 	management of the LSC zone by: <ul style="list-style-type: none"> • Not cultivating or tilling the soil • Maintaining adequate groundcover to prevent soil erosion • Maintaining erosion control earthworks
Earth mass movement hazard <i>Under grazing the major risk is that the water use will be insufficient to prevent deep drainage and the accumulation of water in the substrate and deeper part of the soil profile and the regolith. This can have the affect of concentrating seepage increasing the amount of water in those parts of the landscape where mass movement is likely to occur. The objective is to maximise water use in susceptible areas by establishing perennial pastures.</i>	Clearing and Establishment The landholder is to prevent earth mass movement in the clearing and development phase by: <ul style="list-style-type: none"> • Avoiding concentration of seepage flows or disturbance of unconsolidated substrates • Minimising establishment activity during periods of high rainfall or prolonged wet weather • Minimising soil disturbance and maintaining ground cover as far as possible during clearing and development operations Ongoing Management The landholder is to prevent earth mass movement in the ongoing management of the LSC zone by: <ul style="list-style-type: none"> • Not cultivating or tilling where slopes are less than 25% except for occasional tillage for the purpose of sowing improved or perennial pastures • Not cultivating or tilling where slopes are 25% or greater. • Maintaining a high level of ground cover where seasonal conditions allow. 			Clearing and Establishment The landholder is to prevent earth mass movement in the clearing and development phase by: <ul style="list-style-type: none"> • Avoiding concentration of seepage flows or disturbance of unconsolidated substrates • Minimising establishment activity during periods of high rainfall or prolonged wet weather • Minimising soil disturbance and maintaining ground cover as far as possible during clearing and development operations Ongoing Management The landholder is to prevent earth mass movement in the ongoing management of the LSC zone by: <ul style="list-style-type: none"> • Not cultivating or tilling where slopes are less than 25% except for occasional tillage for the purpose of sowing improved or perennial pastures • Not cultivating or tilling where slopes are 25% or greater. • Maintaining a high level of ground cover • Avoiding actions which concentrate seepage flows • Avoiding disturbance of unconsolidated substrates
Soil structure hazard <i>Under grazing the major risk is the degradation of soil structure that will lead to surface crusting, loss of soil organic matter, soil compaction and a</i>	Clearing and Establishment The landholder is to prevent soil structural decline in the clearing and development phase by: <ul style="list-style-type: none"> • Minimising compaction and soil 	Clearing and Establishment The landholder is to prevent soil structural decline in the clearing and development phase by: <ul style="list-style-type: none"> • Minimising compaction and soil 	Clearing and Establishment The landholder is to prevent soil structural decline in the clearing and development phase by: <ul style="list-style-type: none"> • Minimising compaction and soil 	

Grazing	LSC Class 3	LSC Class 4	LSC Class 5	LSC Class 6
<p>Hazards</p> <p><i>soil in poor soil structural condition. Such a structurally degraded soil will be difficult to manage, cause problems with germination and emergence, resulting in high runoff and erosion, restricted root growth and generally lead to environmental degradation and a loss of productivity.</i></p>	<p>disturbance and maintaining ground cover as far as possible during clearing and development operations</p> <p>Ongoing Management The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ○ Soil structure management techniques to be used ○ Techniques to stabilise existing soil structure problems • Minimising soil disturbance and tillage • Maintaining ground cover to protect the soil surface • Maximising soil structural stability by: <ul style="list-style-type: none"> ○ Maximising biomass production ○ Maintaining organic carbon levels. ○ Minimising soil disturbance and tillage • Minimising compaction due to machinery and livestock 	<p>disturbance and maintaining ground cover as far as possible during clearing operations</p> <p>Ongoing Management The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Developing a plan identifying: <ul style="list-style-type: none"> ○ Soil structure management techniques to be used ○ Techniques to stabilise existing soil structure problems • Minimising soil disturbance and tillage. • Avoiding cultivation and trafficking of soils when wet. • Maintaining ground cover to protect the soil surface • Maximising soil structural stability by: <ul style="list-style-type: none"> ○ Maximising biomass production and particulate organic carbon levels ○ Applying gypsum or lime to mildly sodic surface soils where appropriate • Minimising compaction due to machinery and livestock 	<p>disturbance and maintaining ground cover as far as possible during clearing operations</p> <p>Ongoing Management The landholder is to prevent soil structural decline in the ongoing management of the LSC zone by:</p> <ul style="list-style-type: none"> • Not cultivating or tilling except occasionally for the purpose of sowing improved or perennial pastures • Maintaining a high level of ground cover to protect the soil surface • Maximising soil structural stability by: <ul style="list-style-type: none"> ○ Maximising biomass production and particulate organic carbon levels ○ Applying gypsum or lime to mildly sodic surface soils where appropriate • Minimising compaction due to machinery and livestock 	
<p>Acid sulfate soil</p> <p><i>Under grazing there is a risk that acid sulfate soils will oxidise and release sulfuric acid causing on- and off-site impacts. Although soil disturbance during pasture establishment for grazing is generally shallow (< 20 cm) the effect on the watertable can be pronounced due to changes in drainage and water use efficiency of vegetation. Consequently, there are significant limits on the depth of drains in acid sulfate soils as they can activate the oxidation of sulfate minerals and export acid products in drainwater.</i></p>	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 3m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 1m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	<p>The landholder is to prevent oxidation of sulfides in acid sulfate soils by:</p> <ul style="list-style-type: none"> • Minimising soil disturbance or drainage changes below 0.5m depth, below 1 m Australian Height Datum (AHD), or below local high tide level, whichever is the higher level. • If soil disturbance or drainage change will occur below this level an Acid Sulfate Soil Assessment and Management Plan is required and any material excavated must be neutralised with lime in accordance with the requirements of the NSW Acid Sulfate Soil Manual. 	