



Property of David and Alison Sellars  
**1149 Honikiwi Road**  
**Otorohanga**

Land Use Capability Assessment  
and  
Soil Conservation Recommendations

February 2015

G O Eyles  
See the Proof

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## 1 Introduction

This 15 ha property, located at <sup>1149 Honikahi Rd</sup> ~~85 Tapuae Rd~~, Otorohanga, and owned by David and Alison Sellars, was mapped at the request of Waikato Regional Council, and with the approval of the owner. Field work was carried out on February 10<sup>th</sup> 2015. Areas of the property were visited, on foot, with map units being identified. For each of these map units the rock type, soil unit, slope, erosion and land cover were recorded using the standard LUC mapping techniques. Mapping was compiled onto an ortho rectified colour image of the property at the 1:5,000 scale.

Due to the very steep relief the survey boundary has been replaced by the owner and neighbour with a boundary of convenience. This gives a practical area of 15.9 ha. This boundary is what was used in this report. For details of the remaining areas see the Farm Plan Report for Tony and Teresa Tarr.

This property covers the source of one of the sub catchments of the Turitea Stream. The House sits on the western side of the catchment boundary above the Tapuae Rd and the eastern boundary takes in the western catchment boundary, much of which has been retired from grazing to protect an area of native bush.

Rainfalls are between 1500 and 1700 mm p.a., with pasture growth at a minimum during late June and early July.

The block is dominated by the 5 ha area of retired native bush with most of the remainder being easy hill country.

The field mapping was undertaken as part of the adjacent property which provided sufficient information to enable a broad assessment of the land use capability to be identified. This assessment can be used for many different purposes by the owner and could provide valuable guidance for future sustainable development. For further information refer to the appropriate staff at the Waikato Regional Council.

## 2 The Land Resource Assessment

### What is a Land Use Capability Assessment?

*A Land Use Capability Assessment is a systematic arrangement of the different types of land according to those properties that effect its capacity for long term and sustained production, taking into account the physical limitations, management requirements and soil conservation needs.*

### How does it work?

The assessment is based on a national land classification system used by soil conservators for farm planning since the 1950s. A detailed description of the system can be obtained from the *Land Use Capability Survey Handbook*, a 3<sup>rd</sup> edition of which was published in 2009.

The Land Use Capability assessment system has three parts:

**1 A physical resource inventory of the property.** This inventory identifies areas with similar rock type, soil, slope, erosion types and degree and vegetation cover. Where any one of these factors changes significantly a boundary is drawn and a new map unit created. Thus the property is completely covered by mapped units which identify areas having similar physical attributes.

**2 The land use capability assessment.** Based on this physical inventory, together with an understanding of climate and the effects of past land use, an assessment is made of each unit's capacity for long term sustained use. The classification is in three parts:

- The LUC class

The capability class is the broadest grouping in the classification, identifying the general **degree of limitation** to use. It comprises 8 classes. Classes 1 to 4 are classified on their suitability for cultivation for cropping, with class 1 being the most versatile with few limitations to use through to LUC class 4 which has limitations so severe it is marginal for cultivation for cropping. Classes 5 to 7 are not suitable for cultivation for cropping but are suitable for non-cropping uses such as pastoral farming, tree crops or forestry. Physical limitations increase from LUC class 5 to 7. LUC class 8 has such severe physical limitations it is not suited for any commercial farming system and is considered suitable only for retirement and protection use.

- The LUC subclass

The LUC class is subdivided into one of four subclasses, depending on the **major physical limitation to use**. There are four limitations; **erodibility (e), wetness (w), soil (s), and climate (c)**. They are denoted by the small letter e, w, s or c after the LUC class number. For example, an area of land suitable for pastoral farming but limited by moderate erosion is shown as Class 6e.

- The LUC unit

The third and most detailed level of classification is the LUC unit. The unit groups areas that require the same kind of management, the same kind and intensity of soil conservation treatment, and are suited to the same kinds of crops, pasture or forestry spp which require specific conservation measures and management practices to achieve similar yields.

For example, LUC class 6e becomes 6e1, or 6e2, and so on depending on the detailed management requirements needed.

**Table 1: Land Use Capability**

Increasing limitations to use ↓	Class	Cropping Suitability	Pastoral & Production Forestry Suitability	General Suitability	Decreasing Versatility ↓
	1	High	High	Multiple Use land	
	2				
	3	Medium			
	4	Low			
	5	Unsuitable	Medium (some units have low suitability)	Pastoral or Forestry Land	
	6				
	7				
	8		Unsuitable	Retirement & Protection land	

**3 Land management interpretations.** Based on the inventory and the LUC assessment a variety of interpretations can be made which provide the farmer with options for sustainable development.

### 3. The Land Resource Inventory

When mapping the property the first action was to prepare the physical resource inventory of the property. This inventory identifies areas with similar rock type, soil, slope, erosion types and degree and vegetation cover. Where any one of these factors changed significantly a boundary was drawn and a new map unit created. The property is covered by 39 separate map units.

Except where stated otherwise the classifications used were from the Land Use Capability Survey Handbook (3<sup>rd</sup> ed.).

All areas except one were viewed from the ground.

#### Rock types

The near surface geology comprises sandstone with a mantle of volcanic tephra (ashes - ranging from Mairoa ashes to the older Hamilton ashes) on all slopes except the steepest. The steepest slopes occur on either side of the valleys. The valley bottom is covered by collapse structures from the sides. The steep slopes have very shallow soils and many areas of bare rock.

The dominant rock types are recorded using the following symbols:

- Mo Ashes older than Taupo Ash (includes Mairoa to Hamilton ashes)
- Af Fine alluvium

- Mo + Af Two distinct rock types occurring too close to separate, e.g., an area containing slope mantled with ashes older than Taupo and areas with fine alluvium.
- Sm Massive sandstone



Fig 1: Sm. Massive sandstone. An outcrop of sandstone on a ridge crest.

### Soils

The soils listed do not comprise a soil survey. They are the soils which best fitted the landscape and were interpreted from the relevant Worksheet of the New Zealand Land Resource Inventory as no detailed soil survey was available from which to interpret. Profiles were viewed and briefly described as appropriate. Soil symbols and names are from 'A General Survey of the Soils of North Island, New Zealand' (Soil Bureau Bulletin 5). For accurate soils information please refer to Landcare Research in Hamilton.

### Soils Recorded

- 60 Te Kuiti silt loam  
 60dH Tumutumumu silt loam and sandy clay loam, hill soil  
 108 Piako peaty loam and loamy peat  
 117c Mokau sandy loam

The assumptions made from observing profiles in the field were that on the rolling terrain the flat to undulating surfaces had sufficient Mairoa ash to be classified as Te Kuiti silt loam (60). As the slope increased this less weathered ash, with its poorer structure, had eroded off to varying degrees creating a mosaic of soils formed in Mairoa and Hamilton ashes. These soils were not differentiated. On the very steep slopes the ashes were either very thin or entirely removed with the soils being formed in the tertiary sandstones. These soils were recorded as Mokau sandy loam (117c).

The waterway draining the long valley is ephemeral, only running for part of the year. The lower half is through a wetland the soils of which were recorded as Piako peaty loam and loamy peat (108). The springs on the eastern side of the property drain through wetlands and these have also been recorded as soil Piako peaty loam.



**Fig 2:** Soil recorded as Te Kuiti silt loam (60). Very friable topsoil, prone to sheet, rill or wind erosion when cultivated.



**Fig 3:** Steepland soil on sandstone, recorded as Mokau sandy loam (117c).

## Slope

Slope groupings were identified as the dominant slope in the mapped unit. It was assessed in the field using a Sunto clinometer. Where the slope varied the dominant slope group in the map unit was recorded.

A	0-3°	Flat to gently undulating
B	4-7°	Undulating
C	8-15°	Rolling
D	16-20°	Strongly rolling
E	21-25°	Moderately steep
F	26-35°	Steep
G	>35°	Very steep

## Erosion

Very little present erosion was observed on the property. On south facing slopes deep stock tracking indicates that erosion will occur with heavy stock accessing steep slopes when the soil is saturated.

- Sh Sheet. This is the removal of thin layers of soil particles across the ground by water, wind or gravity. It also represents turf moving downslope when the stock tracks become unstable.
- G Gully. In this situation the gully forms in a waterway caused by the degrade of the bed forming a gully head which can then move upstream destabilizing the waterway and surrounding slopes.

The severity of the erosion was assessed on the basis of 'difficulty of repair' with a 0 to 5 ranking.

- 0 Negligible erosion
- 1 Slight
- 2 Moderate
- 3 Severe
- 4 Very severe
- 5 Extreme.

## Vegetation Cover

The vegetation was assessed visually in the field with up to three types recorded in each map unit.

Grazing on the property is contracted to a neighbour who grazes light cattle, with no cultivation undertaken.

Native forest covers the headwaters of the sub catchment. It is retired and protected by an electric fence. Animal pest control is in place and bird life indicates the environment is very healthy.

The land cover classification used was as follows:

- Grass
  - gI Improved pasture
  - gS Semi improved pasture



- Scrub \* indicates vegetation is scattered

sM Manuka, Kanuka  
sX Mixed indigenous scrub  
sG Gorse  
sK Blackberry  
sP Privet

- Forest

fO Lowland Podocarp broadleaf forest

- Herbaceous

hW Wetland vegetation



**Fig 4:** Mapped as lowland podocarp broadleaf forest (fO) providing quality catchment protection.



**Fig 5:** A mix of semi improved pasture and scattered exotic scrub on LUC unit 6e1 on the far hill face. Note some sheet erosion along the fence line and willow in the drainage line (LUC unit 7w1).



**Fig 6:** A mix of semi improved and improved pasture spp on LUC unit 6e1 on the side slopes, with LUC unit 4e3 in the lower valley areas.

**Table 2: Physical Resource Inventory**

The following table lists the dominant land use capability, rock type, soils slope groups erosion types and degree and land cover in each map unit. The number listed under Unit refers to the map unit on the accompanying map.

Unit	LUC Unit	Rock Type	Soil	Slope	Erosion Type	Erosion Degree	Land Cover
1	6e1	Mo / Sm	60	D	-	-	gl
2	4e3	Mo + Af	60	B	-	-	gl
3	7w1	Mo + Af	60 + 108	A	-	-	hW, gS
4	6e1	Mo / Sm	60	E	Sh	1	gS
5	6e8	Mo / Sm	117c	G	Sh	1	gS, sG*
6	6e1	Mo / Sm	60	D	-0	0	gS, sG*
7	4e3 + 6e1	Mo / Sm	60	C + E	-	-	gS, sX, cG
8	6e8	Mo/Sm	60	E	Sh	2	gS, sG*, sE*
9	8s1 + 6e8	Sm	117c	G + F	-	-	fO
10	6e1	Mo / Sm	60	D	-	-	gS
11	6e1	Mo / Sm	60	E + D	Sh	1	gS, sG*, sE
12	7w1	Mo + Af	108	A'	-	-	fP, hW, sE
13	6e1	Mo / Sm	60	D + E	Sh	1	gS, sE*
14	6e1	Mo / Sm	60dH	E	Sh	1	gS, sE*, sX
15	<u>Unclassified</u>						



**Fig 6:** A mix of semi improved and improved pasture spp on LUC unit 6e1 on the side slopes, with LUC unit 4e3 in the lower valley areas.

**Table 2: Physical Resource Inventory**

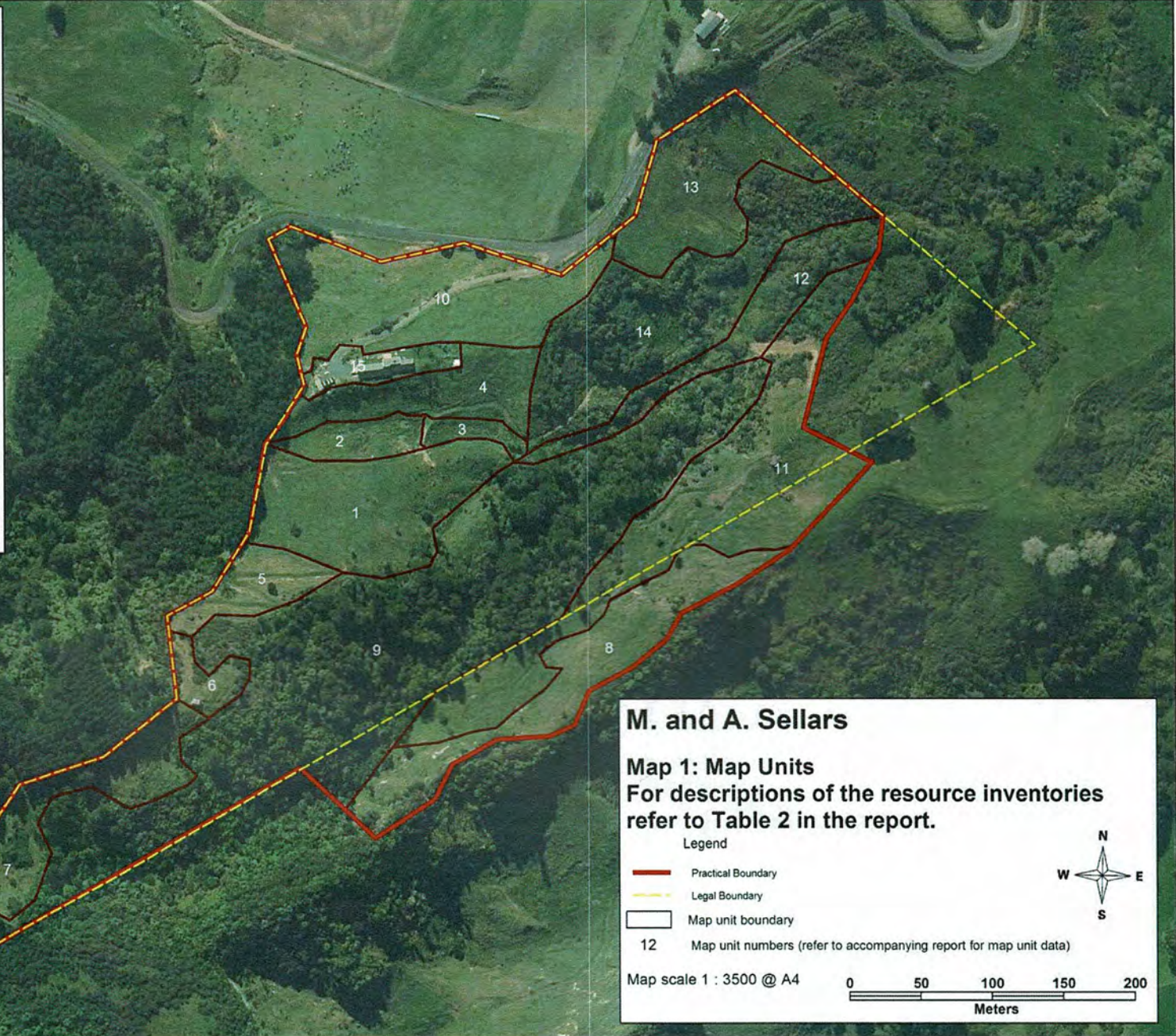
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Unit	LUC Unit	Rock Type	Soil	Slope	Erosion Type	Erosion Degree	Land Cover
1	6e1	Mo / Sm	60	D	-	-	gl
2	4e3	Mo + Af	60	B	-	-	gl
3	7w1	Mo + Af	60 + 108	A	-	-	hW, gS
4	6e1	Mo / Sm	60	E	Sh	1	gS
5	6e8	Mo / Sm	117c	G	Sh	1	gS, sG*
6	6e1	Mo / Sm	60	D	-0	0	gS, sG*
7	4e3 + 6e1	Mo / Sm	60	C + E	-	-	gS, sX, cG
8	6e8	Mo/Sm	60	E	Sh	2	gS, sG*, sE*
9	8s1 + 6e8	Sm	117c	G + F	-	-	fO
10	6e1	Mo / Sm	60	D	-	-	gS
11	6e1	Mo / Sm	60	E + D	Sh	1	gS, sG*, sE
12	7w1	Mo + Af	108	A'	-	-	fP, hW, sE
13	6e1	Mo / Sm	60	D + E	Sh	1	gS, sE*
14	6e1	Mo / Sm	60dH	E	Sh	1	gS, sE*, sX
15	<u>Unclassified</u>						

Unit	%	Ha
1	7%	1.1
2	1%	0.2
3	1%	0.1
4	4%	0.6
5	2%	0.3
6	1%	0.2
7	5%	0.9
8	7%	1.1
9	30%	4.8
10	8%	1.3
11	12%	2.0
12	4%	0.6
13	6%	0.9
14	10%	1.6
15	1%	0.2
(unclassified)		
<b>Total</b>		<b>15.9</b>

Field Work and Compilation: G Eyles, February 2015  
 Map Preparation: Waikato Regional Council, March 2015

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#### **4 Description of Land Use Capability Units**

The Land Use Capability (LUC) units used for this property are based on those used in the *New Zealand Land Resource Inventory, Waikato Region Land Use Capability Classification*. (Ministry of Works and Development 1970s). This national survey was undertaken to provide standards for LUC mapping. It was carried out at the 1:63,360 scale with 10 regional classifications covering the North Island and one for the South Island. The Waikato Region extends from Pukekohe south to the southern boundary of the Mokau River and from the coast eastwards to where the Taupo ashes become significant. Descriptive bulletins were prepared for most regions, but not for the Waikato. The definitions of the regional LUC units can be found in the '*Waikato Region: Land Use Capability Extended Legend*'.

For this farm plan the relevant LUC units have been identified and applied at the 1:5,000 mapping scale.

The LUC units used on the property are summarised in Table 3 and soil conservation measures in Table 4. The following is a brief description of each LUC unit identified on the property arranged in order of landform.

##### **Land suitable for cultivation for cropping**

The property has only minimal areas of croppable land. The areas are either on the ridge tops or in the valley bottom upslope of the wetlands.

LUC unit 4e3 (1.1 ha). (See Fig 6). Rolling to strongly rolling slopes with a deep mantle of ashes. These units are very productive under pasture. They can be cultivated for cropping but the risk of soil loss is high due to the potential for sheet and rill erosion. Minimum tillage or, at least, cultivation on the contour with grass strips each 100 m is needed with cultivation preferably only as part of a pasture renewal rotation. Fodder crops such as maize are suitable in a rotation.

In this property map unit 2 has been included as a 'best fit'. It can be cultivated but will be susceptible to sheet and rill erosion from overland flow from up slope. This could be minimised if a cut off drain was developed at the junction with the LUC unit 6e1 with the outlet into the wetland.

##### **Land Not Suited to Cultivation for Cropping**

This property is mainly unsuitable for cultivation for cropping

Four LUC units, 6e1, 6e8, 7w1 and 8s1 have been mapped as being not suitable for cultivation.

LUC Unit 6e1 (7.7 ha). (See Figs 5 and 6). Moderately steep hill country slopes, too steep for cropping, but with a relatively deep mantle of ashes. The unit contains steeper sections usually in the form of small valleys which may have seepage zones or springs at their head. Stock tracking occurs on slopes steeper than 20°. Soils are recorded as Te Kuiti silt loam and Tumutumumu silt loam. Exotic scrub spp such as privet and gorse reduce carrying capacities.

The unit has been mapped as 6e1 rather than 5e due to degree of dissection of the slopes and the presence of seepages.

LUC Unit 6e8 (6.2 ha). Very steep to steep slopes with ash over massive sandstone. Currently, this unit is under native forest which has been retired. If developed, it would be susceptible to sheet and slip erosion. Slips remove all the ash leaving a hard sandstone surface which takes a long time to regenerate. See Fig 4 which identifies LUC unit 8s1 forming bluffs with LUC unit 6e8 forming the valley sides.

LUC Unit 7w1 (0.7 ha). Wet drainage lines, wetlands and waterway, currently with wetland vegetation and some grazed with cattle. Willows clog up parts of the drainage line. These need to be removed and replaced with native vegetation. Where the wetland areas are dominated by wetland vegetation there is a quality nutrient stripping environment. See Fig 5 which identifies the LUC unit 7w1 waterway clogged with willows immediately above the dam wall.

LUC Unit 8s1. Near vertical bluffs with no significant agricultural values, and mapped as a complex with LUC unit 6e8. The bluffs provide a refuge for native scrub and possibly rare vegetation types. See Fig 4 in which a sandstone bluff can be seen through the trees.

**Table 3: Summary of Land Use Capability Units on the property**

LUC Unit	Unit Description	Rock type	Soil	Slope	Erosion
4e3 1.1 ha	Rolling downland slopes with a deep ash mantle and Te Kuiti soils. Increased slope increases the risk when cultivating making this practice marginal.	Mo. Ashes older than Taupo. Deep ash cover.	60 Te Kuiti silt loam	C, D. Rolling to strongly rolling slopes.	Negligible erosion under pasture. Severe risk of sheet, rill and wind erosion when cultivated. Sheet erosion when turf is disturbed.
6e1 7.7 ha	Moderately steep, hill country slopes, too steep for cropping, but with a relatively deep mantle of ashes, providing fertile soils	Mo. Ashes older than Taupo  Deep ash cover	60 Te Kuiti silt loam 60dh Tumutumu silt loam	E, D. Moderately steep slopes.	Stock tracking begins at about 20 -22°, otherwise there is little indication of soil loss. Care is needed, especially on south slopes, not to graze with heavy stock when soils are wet.
6e8 6.2 ha	Steep to very steep slopes with ash over sandstone. Slips could develop with intensification.	Mo / Sm. Mairoa and Hamilton ashes over massive sandstone.	60dh. Tumutumu silt loam.	G, G + F, F + G. Steep to very steep slopes in the sides of the valley.	Sheet erosion.
7w1 .7 ha	Drainage line, and wetland. Currently the area around the wetland grazed.	Af. Fine alluvium	108. Piako peaty loam and loamy peat.	A. Flat or gently sloping.	No erosion under current management.
8s1	Bluffs	Sandstone	Br	G	Only occurs in the retired native bush area.

Table 4: Summary of Recommended Soil Conservation Measures.

LUC Unit	Current Land Use	Recommended Land Use	Recommended Soil Conservation Measures	General Comments
4e3	Pastoral	Pastoral	If cultivating for cropping use minimum tillage techniques to minimise runoff. Cultivate on the contour. Use grass strips to reduce runoff lengths.	Maintain a healthy grass cover to minimise sediment movement into the wetlands.
6e1	Pastoral	Pastoral with space planted trees.	Minimise the grazing of heavy animals during wet periods. Retire any springs and seepage areas rather than draining them. Space plant erosion control trees especially above and below the access tracks. A mix of deciduous trees will not only protect the soil but will provide shade for stock and vary the aesthetics during the seasons.	An arboretum type tree planting would suit. Deciduous trees ensure grass is maintained all year round. These will need to be individually protected from stock browse. The removal of the present weed scrub / trees is recommended together with any gorse, privet, blackberry etc.
6e8	Pastoral	Pastoral	Manage grazing to ensure no bare ground is created and stock tracking is controlled. Remove all scrub weeds (which will be a continuing task).	Control runoff from the track to ensure gullying does not occur. Trees need to be deciduous to ensure ground cover is maintained. In the retired native bush area remove any exotic scrub spp or trees. Replace the electric fence with a permanent 8 wire fence.
7w1	Pastoral/Retired	Retirement	Ensure the dams do not silt up and that native wetland plants such as <i>Carex secta</i> are planted round the margins. Try for about 50% open water. Maintain cover over dam walls. In the retired waterways remove all exotic trees and weeds. Clear willows. In the length not retired remove all the exotic scrub spp and retire. If there is a bank erosion problem plant flax ( <i>Phormium tenax</i> ) and/or carexes.	
8s1	-	Retirement		



## 5 Recommendations

Table 4 provides a list of actions that will improve the sustainability of the lifestyle block. The following are additional notes and suggestions.

The contract grazing needs to minimise the impacts on slope stability. This especially applies to the steeper south facing slopes downstream of the house where tracking can be a potential problem.

The forest area provides a beautiful backdrop to the house. The electric fence surrounding this forest is doing its job at the moment but for long term protection a more permanent fence needs to be planned. Looking even further ahead to a time when the property could be sold this block would benefit from being protected by a QE11 Covenant. It would be sad if the next owner did not have the same ethic as the current owner.

Seepage areas and springs are great nutrient stripping sites. If these were fenced their value would be enhanced and the risk of earthflows developing above the spring reduced.

The access across the dam wall to the true right bank needs to be carefully maintained to minimise sediment runoff and maintenance.

Whether grazing continues on the true right bank needs to be considered. Current management results in gorse and other weeds prospering and poor quality grass management. If maintained in pasture the slope would benefit from improved management.

The LUC 6e1 unit in front of the house, across which the access road passes, needs to be space planted in deciduous trees to ensure stability of access. Any seepage areas or areas likely to move need to be retired and planted. Careful selection is needed to ensure the long term views from the house are not impeded.

## 6 References

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