LEVEL 3

LAND AND ENVIRONMENT PLAN GUIDELINES

Resource Book 3

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BY FARMERS. FOR FARMERS

steps

PROPERTY MAP
Map features at a scale and accuracy suitable for farm calculations

LOCATE PRIORITY SITES
Locate priority sites and areas for land & environment management

RESOURCE INVENTORY
Inventory land resources using a national system

LMU'S & SWOT
Create Land Management units and assess Strengths, Weaknesses, Opportunities and Threats

NUTRIENT BUDGET
Farm nutrient budget by a qualified operator

YIELD GAP
Current vs potential pasture production estimate

WORKS PROGRAMME
Develop a response plan, annual budget, and works map

MONITORING
Set up three- yerar monitoring programme

IMPLEMENT
Carry out activities, monitor improvements, review and update

REVIEW
Review and update regularly to reflect progress and changes

Level 3 LEP guidelines

Level 3 guidelines aim to achieve a set of standards suitable for consideration towards quality assurance and other similar land and environment programmes.

The required steps are similar to those for LEP Level 2, but with a greater emphasis on specifications and methods used by professional farm planners:

- An accurate and up to date paddock-scale map showing features relevant to land and environmental management.
- A paddock-scale inventory describing the land resource according to published standards for either soil mapping or Land Use Capability (LUC).
- OVERSEER® farm nutrient budget prepared by a qualified operator.
- A Land and Environment Works Programme prepared with input from a resource management specialist.
- Achievements are recorded, and changes in freshwater quality, soil condition, and natural biodiversity (if relevant) are monitored at least once every three- years.

Reasons are given as to why these standards are important.

Am I ready for Level 3 LEPs?

Level 3 LEPs are least challenging when part of the standards are already being achieved, and a Level 2 LEP has already been prepared for the farm.

Successfully building a Level 3 LEP is also likely to require outside specialist input, and a greater emphasis on monitoring how the farm environment is improving.

Please contact you local Beef + Lamb New Zealand regional extension manager for assistance or further information. Contacts are provided on the back page.

By completing this Level 3 LEP you will be joining an increasing number of farmers using good management tools to future-proof their farms.

1) Prepare a Property Map

The Standard

An accurate up to date paddock-scale property map showing features relevant to land and environmental management

Mapping is undertaken on an orthocorrected aerial photo (orthophoto) with an accuracy no less than +/- 15 metres. Most commercially supplied orthophotos will easily achieve this level of accuracy, as will commercial GPS mapping. Accuracy levels will be specified in accompanying documentation.

Why? Accurate area and distance information is important for farm calculations. Many still rely on maps created using old aerial photos, or measures from crude surveying methods. Both are unreliable (e.g. uncorrected aerial photos for hill country can misrepresent paddock areas by 10-15%, and up to 40% in extreme cases). Modern orthophotos and GPS provide quality measurements for calculations, resource consent applications, nutrient budgeting, forestry considerations, grant applications, precision fertiliser application, performance benchmarking (e.g. production/ha), and farming in general.

Farm features are mapped at the paddock scale. Depending on farm size, this ranges between a scale of 1:5,000 for small intensive farms, through to a 1:30,000 scale for some large extensive high country farms.

Why? This specification aims to discourage the use of inappropriate farm mapping information sources, including regional scale (1:50,000 and less detailed) property boundaries, contours, waterways, and land resource inventories. Such information is perfectly suitable for regional-scale applications, but it becomes inaccurate and misrepresentative when enlarged for use at paddock scales.

The following features should be shown on the map:

- **Waterways (fenced & unfenced)**
- **Ephemeral flow paths**
- **Stock fords**
- **Dumps & offal holes**
- **Silage pits & stacks**
- **Yards**
- **Bridges & culverts**
- **Shelterbelts**
- **Woodlots & forestry**
- **Bush & scrub blocks**
- **Bores and water takes**
- **Laneways and farm tracks**
- **Fences**
- **Ponds, lakes and wetlands**
- **Residential & public areas within 50m of the boundary (including roads)**

Why? These features are most likely to be associated with environmental concerns and related legal obligations (e.g. waterway separation distances for fertiliser application). Existing environmental activities should also be recorded to recognise that work has already been done.

The map should have a north arrow, a scale bar and a legend.

Why? These minor specifications make it easier for other people to orientate themselves to your map.

How to obtain a Level 3 Property Map

Two choices are available if you do not already have a Level 3 Property Map:

1. Have a professional prepare your map. Farm mapping is now a widespread and readily available service.
2. Do it yourself. Instructions are provided on the opposite page, and an example of a completed Level 3 Property Map is included on pages 6.

Doing your own Level 3 Property Map will require access to mapping software. There are several options available, some of which are free.

Preparing your own Level 3 Property Map

1) Obtain a farm orthophoto

- Farm orthophotos can be obtained from a number of sources, some of which are free.
- The orthophoto should be supplied in a digital format for use in mapping software.
- Farm mapping systems using GIS or GPS are now widely available. Your regional council may be able to assist you.
- Make at least three copies of the farm orthophoto (unless you are confident of mapping features directly on the computer). Minimum size should be A3 (297 x 420 mm), but larger is always easier for farm mapping. Spanning the farm photo across two or three A3 size pages achieves a detailed scale but also retains manageability.
- Photography outlets, printers and desktop publishers can provide large format copies and resizing.

2) Map relevant features

- Mapping can be undertaken directly on the computer, or on a printed copy of the farm orthophoto (and digitised into the computer later).
- A common farm mapping procedure involves the following steps:

  1. Map out the farm boundary.
  2. Draw in fence lines.
  3. Identify areas of bush, scrub, or forestry.
  4. Map in any lakes, ponds or wetlands.
  5. Trace in significant waterways, shelterbelts and tracks.
  6. Add points of interest (e.g. dumps, offal holes).

- Refer to the list of features that should be marked on your map according to Level 3 standards (see previous page).
- Use symbols, lines, hatching and colour to differentiate features

3) Finalising the map

- Digitise the map into the computer if you haven't already done so. This will allow measurements to be made, outputs to be produced to a professional standard, and the sharing of digital files should you need to do so.
- Calculate useful farm measurements for later reference. Examples are given on the map over the page. How these are calculated will depend on the type of software being used.
- Prepare the map for final presentation and printing. Use appropriate symbology, and include a north arrow, scale bar and legend.

2) Locate land and environment priorities

Locate priority areas and sites

- Most key environmental issues will be known. Mark them on your map using appropriate symbols.
- A paddock-by-paddock approach can be useful:
  1. Pick a paddock and focus on it.
  2. Think about key issues, and whether or not they relate to the paddock in question. Do stock enter the creek? Where is runoff from the yards going? What if I fenced of that wetland? Consider the examples in the box below to help locate possible issues. If an issue is worth attention, then mark it on your map.
  3. Repeat the same exercise with the next paddock. The idea is to scan from paddock to paddock considering each in detail, until the whole farm has been covered.
- Create a list of issues as you go. Prioritise issues in order of most to least important. Record options for dealing with each issue (see the example list). This will be used later to help develop a response plan.
- At this stage the emphasis is on identifying obvious land and environment issues. Creating Land Management Units and undertaking a SWOT analysis will help tease out others.
- Consider enlisting some expert help. They will know the right questions to ask, what is and isn't important, and how various problems can be dealt with.

Examples of priority locations and existing works

Target areas

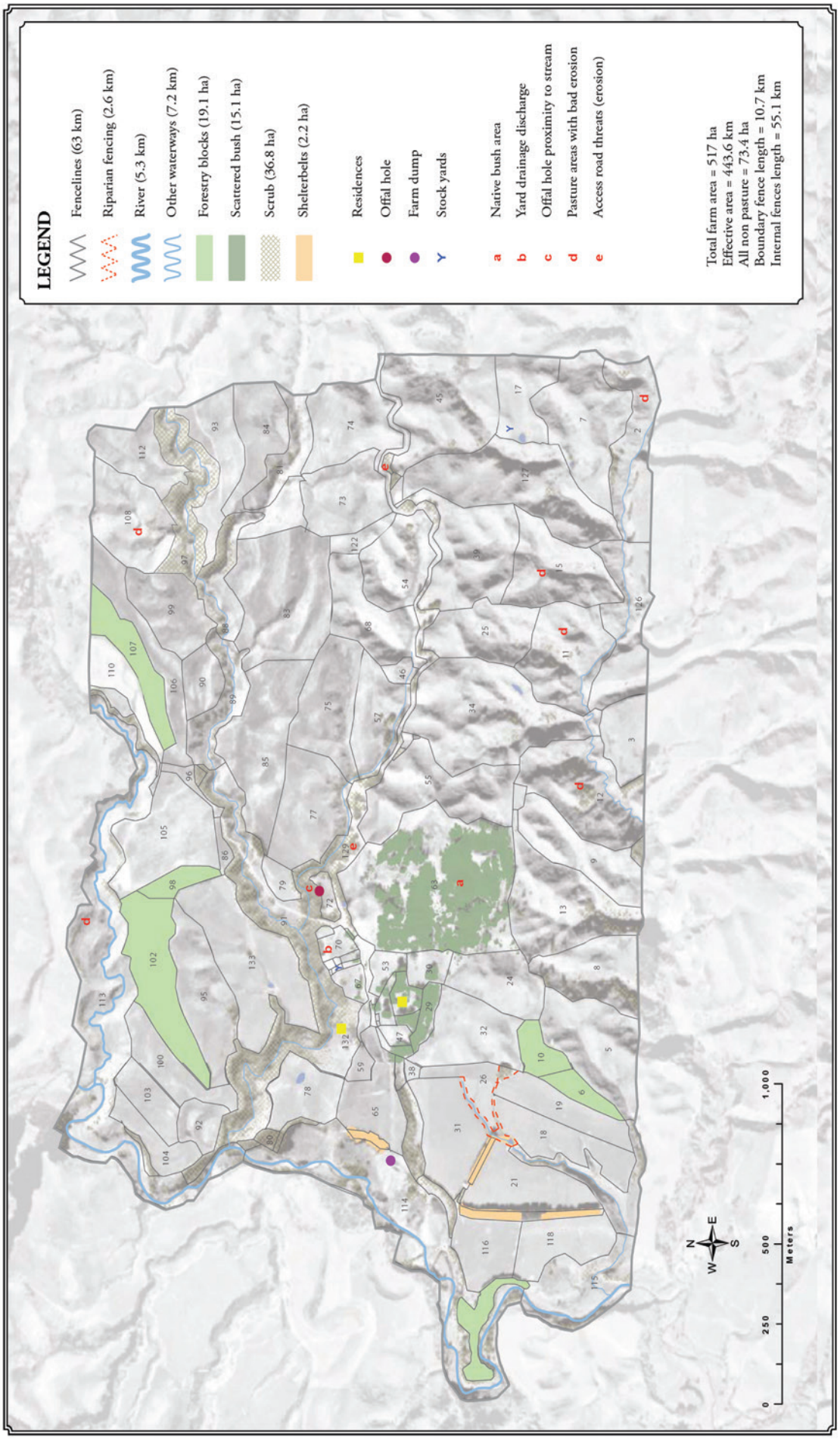
- Unprotected wetlands
- Areas susceptible to erosion
- Pugging risk
- Pest areas (eg scrub, gorse, ragwort, possums)
- Waterways and unprotected riparian areas
- Fragile soils
- Marginal production areas
- Unprotected bush remnants

Hotspots

- Stock fords
- Dumps
- Offal holes
- Chemical storage sheds
- Runoff points to water (dips, yards, tracks)

Existing works requiring maintenance

- Riparian zones
- Wetlands
- Fenced bush
- Shelterbelts
- Conservation trees
- Woodlots/ forestry
- Dams and other structures


LEGEND
Fencelines (63 km)
Riparian fencing (2.6 km)
River (5.3 km)
Other waterways (7.2 km)
Forestry blocks (19.1 ha)
Scattered bush (15.1 ha)
Scrub (36.8 ha)
Shelterbelts (2.2 ha)
Residences
Offal hole
Farm dump
Stock yards
a Native bush area
b Yard drainage discharge
c Offal hole proximity to stream
d Pasture areas with bad erosion
e Access road threats (erosion)
Total farm area = 517 ha
Effective area = 443.6 km
All non pasture = 73.4 ha
Boundary fence length = 10.7 km
Internal fences length = 55.1 km
0
250
500
1,000
Meters
N
E
S
W

PRIORITY AREAS AND SITES, Glenilliad farm, Puketapu				
Map Code	**Primary issue**	**Description**	**Priority rank**	**How the issue might be dealt with**
a	Biodiversity	Large area of native bush currently part of the grazing rotation. Good example locally, with some rimu and totara >500 years old. Extensive undergrowth damage, and provides a base for possums.	4	• QE 11 covenant? They pay for fencing and legal costs but it can no longer be used for grazing • Fences are already there, so perhaps it could just be retired and left to recover • Could subdivide to keep the best pasture areas, particularly those near the yards
b	Water quality	Yards are drained with novaflow, with the outlet exiting straight into the stream. Dip overflow and drainage effluent likely to be impacting on stream quality.	3	• Don't know. Without the drainage the yards and sheep became a mess when wet • Could install a proper drainage system but still have the problem of nowhere to discharge • Will ask around to see if anyone else has an idea. May even ask the council
c	Water quality	Apparently the offal hole is too close to the stream according to council rules, and decomposing animal leachate is likely to be reaching water.	1	• Existing offal hole has to be covered and new one bored further away from the stream
d	Erosion	Several parts of the farm where slipping is, and always has been, a problem.	5	• Forestry woodlots for the worst areas? Have already done this on other parts of the farm, and the Tasmanian Blackwoods are doing well • Retirement for worst areas? • Space planted poplars? Not my cup of tea but it seems to work • Do nothing? Other than the lost pasture & production the impacts can be dealt with. Council might have a different view with all the sediment ending up in the creek
e	Erosion	Two points above the main access road where the rock is very soft and sandy, and we have minor road blocks every two years or so from slipping. Potential that a big slip could take out the entire road.	2	• Have fenced off one small and planted with ake ake and the other shrubs bit doesn't seem to be holding. Larger trees like poplars have been recommended because of their rooting systems, but these would only increase the clean up problem if it did give way • Earthworks to put in terracing? • Retaining walls? • Horizontally bore in drainage pipes so the water can't build up?

3) Map the land resource

The standard

A paddock-scale inventory describing the land resource according to published standards for either soil mapping or Land Use Capability (LUC).

The inventory includes a Land Resource Map showing soils or LUC mapped at the paddock scale (1:5,000 to 1:30,000 depending on farm size and land use intensity).

Why? This specification aims to discourage the misuse of regional-scale soil and LUC information for farming purposes. Such information is readily obtainable, but it is far too generalised and inaccurate for use in Level 3 Land and Environment Planning.

The inventory includes an Extended Legend that describes characteristics of the mapped resources.

Why? Without an underlying description the Land Resource Map would be little more than a pretty picture. The resource description is used as a basis for the Strengths, Weaknesses, Threats and Opportunities analysis.

The inventory is prepared according to standards or guidelines set out in one or more of the following publications (full details in the LEP Resource Guide booklet):

- **The Land Use Capability Handbook**
- **Soil Survey Method (soil survey ield guide) and the Soil Description Handbook**
- **Introductory Guide to Farm Soil Mapping**

Why? These publications provide mapping and description proceedures for achieving a standard of survey suitable for Level 3 Land and Environment Planning.

The Land Resource Map is prepared according to the same standards as the Property Map (but without the need to map in the same features).

Soil or LUC based mapping?

Soil mapping is generally more informative for latter land, while LUC is more suitable for hill country farms. However, both strongly overlap, and either method can be used irrespective of land type when applied correctly. A brief outline of each system is provided on the opposite page, and an example LUC map is presented on page 11.

How to obtain a Level 3 resource inventory

At least four options are available:

1. A small number of farms will already have a paddock-scale soil map.
2. Many erosion affected farms have had paddock-scale LUC mapping undertaken by the old Catchment Boards, and more recently by some regional councils. Contact your local regional council if you suspect LUC mapping has been done for your farm.
3. Have a professional undertake new mapping. Qualified soil surveyors can be difficult to find, but there are LUC surveyors available. Likewise, some regional councils may be prepared to undertake a LUC survey on your behalf if its within their environmental programmes.
4. Do it yourself. Soil and LUC mapping are simply an advance on the steps outlined in the Level 2 LEP Guidelines (landform mapping). Likewise, the published mapping standards and guidelines are mostly designed to be practical and straight forward (LUC Handbook and Soil Survey Method), and one of the publications is designed especially for farming (Introductory Guide to Farm Soil Mapping).

The soil survey approach

1) What is it?

Soil survey is the process of identifying different soils and mapping their distribution. It is based on the idea that a 'soil' is formed by the interaction of five soil-forming factors (climate, rock type, topography, time and biological activity).

2) What does it involve?

Conventional soil survey requires an understanding of how soils form. This understanding is used to build a conceptual model of soil distribution based on observed landscape features. This basic model is then developed by inspecting soil profiles at strategic locations (i.e. where the surveyor predicts a different soil). Profile inspections are taken from existing exposures (e.g. track cuttings), or by digging or augering.

After soil units have been mapped, the surveyor will pick one 'representative site' for each soil and undertake a full 'soil description'. This details the immediate soil forming environment, and the physical characteristics of each soil horizon or layer (e.g. drainage, friability, soil strength). Soils can then be classified but this is not usually required for farm soil mapping purposes.

3) When to use the soil survey approach

Soil survey is most useful for smaller farms, or parts of farms where landscape variation is difficult to see. This can include flat terraces or plains that have differences in wetness, stoniness, productive capability, or any similar land quality. Soil survey is particularly useful when considering drainage, irrigation, land use change (or intensification), or when there is a persistent soil-related problem that needs solving.

The Land Use Capability (LUC) system

1) What is it?

The LUC system ranks land according to its capability to sustain a productive land use over time. It was originally developed especially for early types of Land and Environment Planning.

2) What does it involve?

A two-part system involving Land Resource Inventory (LRI) mapping followed by LUC classification. LRI is mapped by recording rock type; soil unit, slope, erosion type and severity, and vegetation cover as a code (example on page 10). A new LRI unit is mapped when there is a change in any one factor. Generally the 'soil unit' is only quickly considered.

LRI is classified into LUC using eight LUC Classes, four LUC Sub-Classes, and a LUC Unit. Classes rank land from the highest to lowest capability; Sub-Classes are used to indicate the most limiting factor to production (climate, soil, wetness, erodibility); while the Unit provides a more detailed ranking that can also link into regional classifications for more information.

3) When to use the LUC system

LUC was designed to be relatively quick to apply across extensive areas. It is therefore most useful on larger farms, and where the five LRI factors are easy to recognise (i.e. hill country). However, identifying or measuring some of the LRI factors correctly, plus knowing how to apply the classification consistently, requires a degree of self-calibration.

Example LAND USE CAPABILITY map and EXTENDED LEGEND

Interpreting map codes

Both Land Resource Inventory (LRI) and Land Use Capability (LUC) are recorded using codes to maximise information content. LRI code is recorded using a standard five-factor format of:

$$\frac{\text{Rock type - Soil unit - Slope class}}{\text{Erosion type \& severity - Vegetation}}$$

Standard symbols are used for LRI codes. Symbols used in the map include:

Rock Type

LO= Loess
SM= Sandstone
Gr= Gravel
Us= Unconsolidated sand and silt
AL= River alluvium

Soil Unit

1= Takapau silt loam
2= Takapau sandy loam
3= Matapiro silt loam deep
4= Matapiro silt loam shallow
5= Waituna sandy loam
6= Puketapu steepland soils
BR= bare rock

Slope classes

A= 0-3 degrees
B= 4-7 degrees
C= 8-15 degrees
D=16- 20 degrees
E= 21-25 degrees
F= 26-35 degrees
G= >35 degrees

Erosion type

W= Wind erosion
Sh= Sheet erosion
Ss= Soil slip
G= Gully erosion
Ef= Earthflow

Erosion severity

0= Neglible
1= Slight
2= Moderate
3= Severe
4= Very severe
5= Extreme

Vegetation

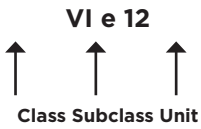
gl= Improved pasture
gS= Semi- improved pasture
hR= Rushes and sedges
fF= Exotic conifer forestry
fO= Bush
sM= Manuka/ kanuka

For example, the code below would be read as loess over sandstone, with Waituna sandy loam soil, slopes ranging from 21-35 degrees (moderately steep to steep), moderate soil slip erosion, & a mix of improved & semi-improved pasture, together with rushes & some bush.

$$\frac{\text{Lo/Sm- 5- E+F}}{\text{2Ss- glgShRfO}}$$

VIe12

The LUC code is represented by three parts. The Class indicates the general capability of land for productive use under common land uses. Eight Roman numeral classes are used, with Class I representing the best land with elite soils, through to Class VIII land which is generally unsuitable for production (e.g. gorges, bluffs, river beds).

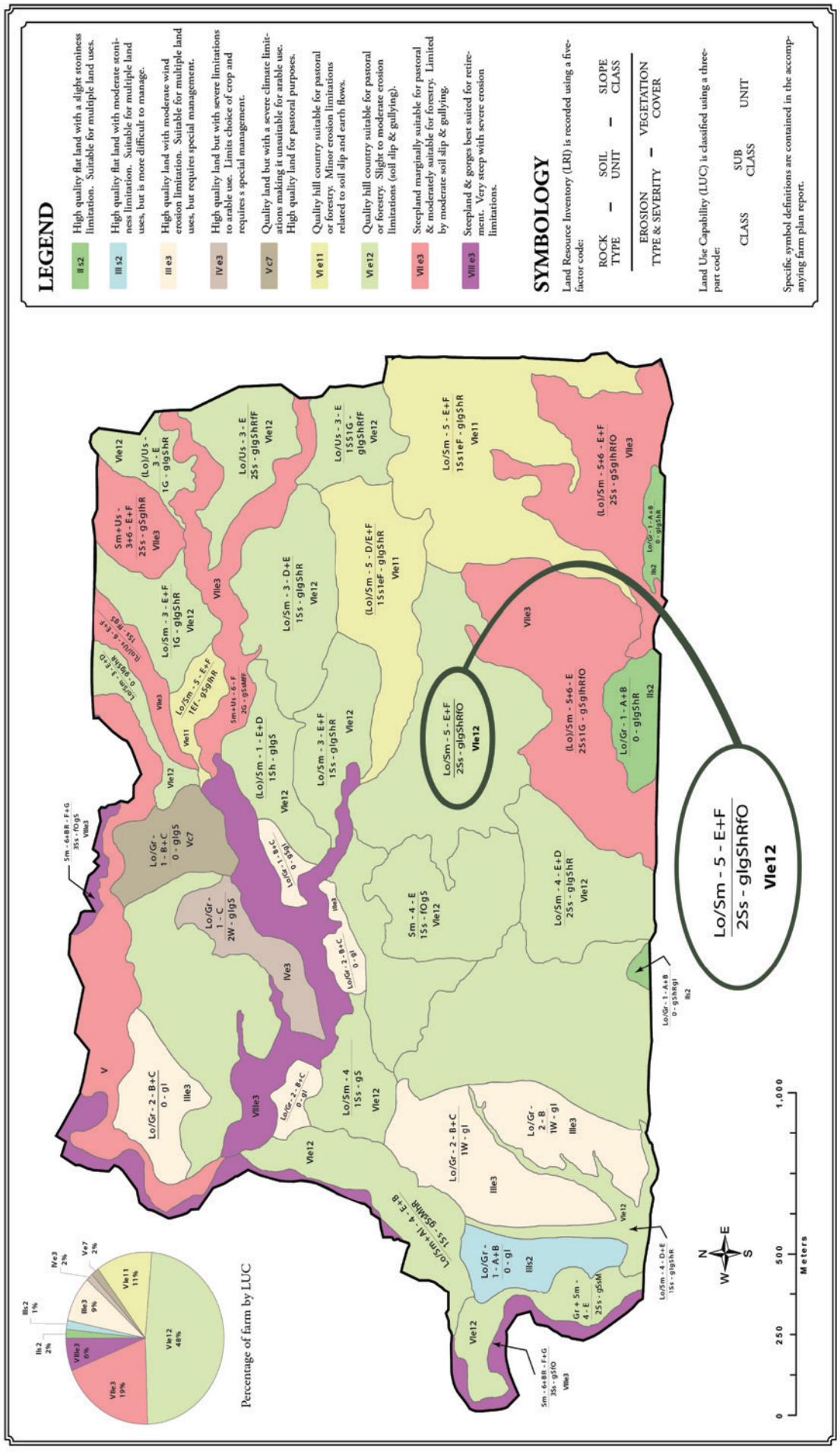


The **Subclass** indicates the major limitation that constrains land use in some manner. Limitations include Wetness (e.g. poor drainage), Soil rooting zone limitations (e.g. stoniness), Climate, and Erosion.

The **Unit** groups classifications according to similarities for management. For example, LUC VIe11 in the map is slightly different than LUC VIe12 because it requires different soil conservation management. These Units can be created especially for an individual farm (e.g. VIe 1, 2, 3...) or taken from a regional classification (like the map).

Extended Legend

Users to not need an expert understanding of LRI and LUC codes, because each LUC classification is summarized in an Extended Legend (example to right).


LEGEND
II s2
High quality flat land with a slight stoniness limitation. Suitable for multiple land uses.
III s2
High quality flat land with moderate stoniness limitation. Suitable for multiple land uses, but is more difficult to manage.
III e3
High quality land with moderate wind erosion limitation. Suitable for multiple land uses, but requires special management.
IV e3
High quality land but with severe limitations to arable use. Limits choice of crop and requires s special management.
V c7
Quality land but with a severe climate limitations making it unsuitable for arable use. High quality land for pastoral purposes.
VI e11
Quality hill country suitable for pastoral or forestry. Minor erosion limitations related to soil slip and earth flows.
VI e12
Quality hill country suitable for pastoral or forestry. Slight to moderate erosion limitations (soil slip & gullying).
VII e3
Steepland marginally suitable for pastoral & moderately suitable for forestry. Limited by moderate soil slip & gullying.
VIII e3
Steepland & gorges best suited for retirement. Very steep with severe erosion limitations.
SYMBOLOGY
Land Resource Inventory (LRI) is recorded using a five-factor code:
ROCK TYPE – SOIL UNIT – SLOPE CLASS
EROSION TYPE & SEVERITY – VEGETATION COVER
Land Use Capability (LUC) is classified using a three-part code:
CLASS SUB CLASS UNIT
Specific symbol definitions are contained in the accompanying farm plan report.
Lo/Sm - 5 - E+F
2Ss - glgShRfO
VIe12
Percentage of farm by LUC
VIIe3 19%
VIe12 48%
VIe3 6%
IIs2 2%
IIIe3 9%
VIe11 11%
Ve7 2%
IVe3 2%
IIs2 1%
N
W
E
S
0
250
500
1,000
Meters

EXTENDED LEGEND (Land use capacity), Glenilliad Farm, Puketapu						
LUC	Ha	Description	Rock type	Soil	Slope	Vegetation
IIs2	9.0	Flat terraces with minor undulations	Deep wind-blown loess over gravels	Takapau silt loam	Flat (0-3°) & some undulating (4-7°)	Pasture with some rushes
IIs2	7.7	Flat terrace with minor undulations	Loess over gravels	Takapau silt loam	Flat (0-3°) & some undulating (4-7°)	Well developed pasture
IIIe3	44.5	Uneven terraces	Loess over gravels	Takapau sandy loam	Undulating (4-7°) & rolling (8-15°)	Well developed pasture
IVe3	7.8	High terrace from flat to rolling	Loess over gravels	Takapau silt loam	Rolling (8-150)	Pasture
Vc7	9.2	High terrace exposed to prevailing wind	Loess over gravels	Takapau silt loam	Rolling (8-15°) to strongly rolling (16- 20)	Mostly old browntop pasture
VIe11	58.4	Most productive hill country	Loess over sandstone	Waituna sandy loam	Strongly rolling (16- 20°) & moderately steep (21-25°)	Developed pastures with rushes
VIe12	248.2	Hill country and steepland	Loess over sandstone or unconsolidated sands/silts	Matapiro silt loam, deep & shallow phases	Strongly rolling (16- 20°) & moderately steep (21-25°)	Pasture & forestry with scattered bush, scrub & rushes.
VIIe3	100.6	Hard steepland and easier gorges	Various combinations of loess over sandstone or unconsolidated sands/silt	Waituna sandy loam & Puketapu steepland soils	Moderately steep (21-25°) & steep (26- 35°)	Pasture with scattered bush, scrub & rushes.
VIIIe3	31.6	Steep gorges and river scarps	Sandstone & unconsolidated sand/silt	Puketapu steep-land soils & bare rock	Steep (26-35°) & very steep (>35°)	Pasture with scattered bush, scrub & some forestry.

Erosion	Land use suitability	Considerations
Nil	• Intensive cropping • Intensive pastoral • Viticulture & horticulture	• Shelter recommended • Care with cultivation to avoid wind erosion
Nil	• Intensive cropping • Intensive pastoral • Viticulture & horticulture	• Shelter needed • Vary careful cultivating to avoid wind erosion
Minor wind in places	• Cropping (with care) • Finishing	• Shelter needed • Vary careful cultivation to avoid wind erosion
Moderate wind	• Fodder cropping (with care) • Pastoral	• Only cultivate after shelter planted & then with extreme care
Nil	• Pastoral • Forestry in places	• Requires more shelter • No cultivation • Could develop with water retention
Slight soil slip & earth flow	• Pastoral (with conservation practices) • Forestry in places	• Strategic pole planting • Avoid heavy winter stock
Slight gully & soil slip erosion (moderate in places)	• Pastoral (with conservation practices) • Forestry in places	• The large bush are could be covenanted • Strategic pole planting
Moderate and slight gully & soil slip erosion	• Forestry • Pastoral (with conservation practices)	• Gorges particularly suitable for Blackwoods • Strategic pole planting
Severe soil slip	• Carbon farming • Retirement • Some forestry in places	• Possums & weed control • Fences require upgrading in places

4) Land Management Units and SWOT analysis

Land Management Units

Land Management Units (LMUs) are areas of land that can be farmed or managed in a similar way because of underlying physical similarities.

- The aim is to produce the best configuration of land use and management for your farm through:
  - Realising land potential through alternative management mixes or policies, or even different land uses.
  - Identifying areas that need special management to remain sustainable.
  - Targeting highest potential land for development.
  - Isolating lowest performance land for reduced input or even retirement.
- Creating LMUs requires several factors to be considered together:
  1. How is this part of the farm currently used?
  2. What underlying strengths, weaknesses, opportunities and threats does it have for improved sustainable farming?
  3. How can this part of the farm be managed in a more productive and sustainable way?

Developing Land Management Units

- Look to aggregate resource units (soils, LUC) into Land Management Units using existing fence line boundaries. A poor match between resource units and fences may suggest an opportunity for improved subdivision.
- Consider factors that may affect current and potential use. For example (this is a very short list):
  - Is it a stock risk area (gorge, liver fluke, tutu, tomos)?
  - Does access limit current and potential use?
  - Is flooding, frost or wind a limiting factor?
  - Is it big enough to be managed differently?
  - Do returns from the area justify current fertiliser input, fencing and weed control?
  - Summer dry or winter wet?
- Do a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis at the same time for each proposed LMU.

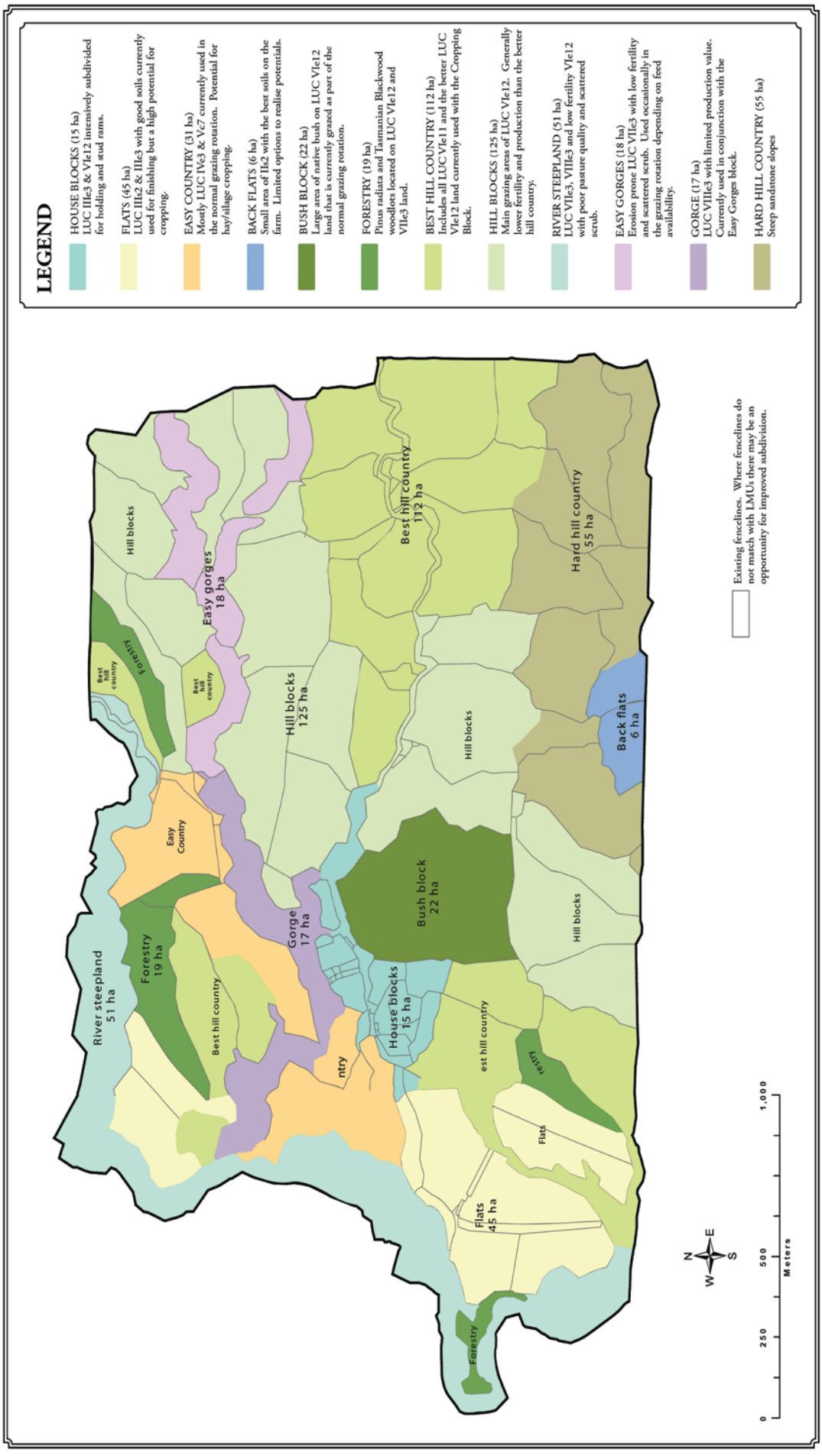
Ask yourself; “What are the strengths, weaknesses, opportunities and threats for sustainable production?”

STRENGTHS are favorable land qualities for production, or qualities that protect against land use impacts.

WEAKNESSES are factors that limit or constrain production, or factors that increase the risk of environmental impact.

OPPORTUNITIES are potential responses to capitalise on strengths, overcome limitations, or manage weaknesses.

THREATS are situations that compromise future productivity, and/or amplify impacts.


LEGEND
HOUSE BLOCKS (15 ha)
LUC IIIe3 & VIe12 intensively subdivided for holding and stud rams.
FLATS (45 ha)
LUC IIIe2 & IIIe3 with good soils currently used for finishing but a high potential for cropping.
EASY COUNTRY (31 ha)
Mostly LUC IVe3 & Vc7 currently used in the normal grazing rotation. Potential for hay/silage cropping.
BACK FLATS (6 ha)
Small area of IIe2 with the best soils on the farm. Limited options to realise potentials.
BUSH BLOCK (22 ha)
Large area of native bush on LUC VIe12 land that is currently grazed as part of the normal grazing rotation.
FORESTRY (19 ha)
Pinus radiata and Tasmanian Blackwood woodlots located on LUC VIe12 and VIIe3 land.
BEST HILL COUNTRY (112 ha)
Includes all LUC VIe11 and the better LUC VIe12 land currently used with the Cropping Block.
HILL BLOCKS (125 ha)
Main grazing areas of LUC VIe12. Generally lower fertility and production than the better hill country.
RIVER STEEPLAND (51 ha)
LUC VIIe3, VIIIe3 and low fertility VIe12 with poor pasture quality and scattered scrub.
EASY GORGES (18 ha)
Erosion prone LUC VIIe3 with low fertility and scattered scrub. Used occasionally in the grazing rotation depending on feed availability.
GORGE (17 ha)
LUC VIIIe3 with limited production value. Currently used in conjunction with the Easy Gorges block.
HARD HILL COUNTRY (55 ha)
Steep sandstone slopes
River steepland 51 ha
Forestry 19 ha
Best hill country
Easy Country
Gorge 17 ha
House blocks 15 ha
Bush block 22 ha
Hill blocks 125 ha
Easy gorges 18 ha
Best hill country 112 ha
Hard hill country 55 ha
Back flats 6 ha
Flats 45 ha
Existing fencelines. Where fencelines do not match with LMUs there may be an opportunity for improved subdivision.
N
W
E
S
0
250
500
1,000
Meters

Examples are given in the table below.

LAND MANAGEMENT UNITS

LMU	Area (ha)	Description	LUC	Strengths
House Block	15ha	Intensely subdivided block around the house and yards	IIIe3 & Vie12	• Farm hub • Well developed
Flats	45ha	Flat to undulating terrace land with good soils	IIIs2 & IIIe3	• High fertility • Excellent soil physical properties • Good machinery access • Pugging resilience
Easy country	31ha	High terraces and some easy rolling country, some of which is exposed	IVe3 & Vc7	• Easy contour • High fertility • Accessible • Large area
Back Flats	6ha	Small area at back of farm, but with the best soils	IIs2	• Deep, friable & well drained soils with much potential
Bush Block	22ha	Large area of native bush and grazed pasture	VIe12	• Sheltered • Close proximity to yards • Never been milled (+1000 yrs some trees)
Forestry	19ha	Several woodlots of radiate & Tasmanian Blackwoods	VIe12& VIIIe3	• Well established part of the farm • Emergency income (+/- 10yrs) • Adds shelter to some paddocks
Best hill country	1.12ha	Better parts of the class VII hill county	VLe11 & VIe12	• Free draining • Holds on in summer • Good fertility levels

Weaknesses	Opportunities	Threats
• Established (difficult to change)	• Limited • Improved access from southern end of farm	• Erosion taking out farm access, buildings and fences
• Wind erosion	• Wind erosion • Stoniness • High P retention	• Soil loss • Grass grub • Cartage costs
• Exposure to climate extremes • Wind erosion risk is high when cultivated	• Shelter • Hay & Silage • Italian rye	• Higher risk of crop failure
• Difficult access • Small area • Underdeveloped • Low fertility	• Pasture improvement • Subdivision • Life fertility • Winter crop to support back country?	• Erosion cutting of machinery access
• Possum refuge • Stock mustering hassles • Stock losses • Fence maintenance	• Emergency shelter for shorn ewes • QEII Trust covenant • Possum control	• Fire
• Fragmented (harvesting costs) • Irregular pruning	• Carbon credits?	• Fire • Snow storms • Wind damage
• Big paddocks • Erosion	• Subdivision • Reticulated water	• Erosion (particularly around access road)

5) Nutrient budgeting

The standard

An OVERSEER® nutrient budget prepared by a qualified operator.

The nutrient budget is prepared using OVERSEER Nutrient Budgeting Software.

Why? OVERSEER® is a nutrient management tool developed for New Zealand farming. It is backed by years of research and testing and represents the most up to date understanding of nutrient cycling and processes

The nutrient budget is prepared by a certified operator who has completed an intermediate or advanced course in Sustainable Nutrient Management (Massey University).

Why? Effective use of OVERSEER® requires a sound understanding of underlying nutrient principles and characteristics of the model. Sustainable Nutrient Management accreditation is an industry standard designed to ensure that OVERSEER® operators provide the best advice.

Finding a qualified operator

standard by the Fertiliser Association of New Zealand (FANZ), and is therefore considered an industry standard. Major fertiliser companies now expect their field officers to achieve this standard, and a large number independent advisors have completed the course(s). Finding a qualified operator only requires an enquiry to your local fertiliser representative or farm advisor.

Information required for effective nutrient budgeting

A checklist of the information required to set up an OVERSEER® model is provided with the LEP Resource Guide. A brief outline is provided below:

- The farm needs to be broken up into nutrient management blocks. In most cases these are the same as Land Management Units. The model requires block area, land cover (pasture, crop, trees), and an option is available for assigning pasture yield differences between blocks.
- Stock types and numbers are required. This can be on an annual average based on stock units, or an advanced calculator is available for seasonal stock reconciliation.
- Supplements harvested, brought in, and fed (hay, silage, etc.).
- Physical characteristics of each block, including rainfall, soils, and basic topography class (lat, rolling, etc.).
- Soil test results. Ideally for each block, but estimates can be made if necessary.
- Fertiliser use, including type, amount, and when it is applied (nitrogen and superphosphate fertilisers).

Interpreting nutrient budgets

The main output is a nutrient budget table, either for the whole farm, or for individual blocks. The table is broken into two main parts - nutrient inputs, and nutrient outputs. The bottom row can be considered as a nutrient balance, with a positive value suggesting nutrients are accumulating, while a negative value would suggest that nutrients are being mined.

Nutrient Budget

Block: EASY COUNTRY

INPUTS into the farm nutrient cycle. Includes indirect sources such as N & S from rainfall, P & K from rock weathering, and nutrients added in supplementary feed.

OUTPUTS including losses by fertility transfer (stock camps), gaseous losses, leaching & runoff, and nutrients that get locked up in the mineral and organic matter fractions

Nutrient balance. Positive values suggest nutrient levels are building up, while negative values suggest

	N	P	K	S	Ca	Mg	Na	H+
	Kg/ha/yr							
Inputs								
Fertiliser	22	35	0	12	0	0	0	-0.5
Effluent added	0	0	0	0	0	0	0	0
N Irrigation	0	0	0	0	0	0	0	0
Slow release	0	3	30	0	4	6	6	0
Supplements	0	0	0	0	0	0	0	0
Outputs								
Product	7	1	0	1	2	0	0	-0.2
Transfer	1	0	1	0	0	0	0	0
Supplements sold	99	15	95	10	18	10	5	0.5
Atmospheric	11	0	0	0	0	0	0	0
Leaching/runoff	9	1	15	24	19	9	37	-0.3
Immobilisation/ absorption	12	16	0	-19	0	0	0	-0.1
Change in organic soil pool	0	5	-79	0	-32	-7	-11	-0.4

Example: Phosphorus is accumulating because of excessive fertilizer use, and soil test P levels will increase by 1 unit. This block already has optimal P levels so P-fertiliser can be decreased, thereby saving money without compromising production, along with

Example: Potassium is being depleted because of hay making and soil test levels will drop by 1.6 units. Additional K-fertiliser is required to maintain optimum nutrient levels for pasture production.

Environmental indicators

OVERSEER® also produces reports for three important environmental indicators and their reference ranges. These include nitrate leaching, phosphorus runoff risk, and greenhouse gases. OVERSEER® will indicate:

1. Current indicator levels for the farm.
2. Whether or not current +levels are above or below accepted reference values, to help decide if special management is required.
3. Provide measurable target levels to aim for.
4. Successive OVERSEER® modelling will tell you if or when targets are being achieved (monitoring).

If any of the OVERSEER® environmental indicators are outside the reference values with your nutrient budget, then targets should be set and responses developed as part of your Land and Environment Plan. Your qualified OVERSEER® operator is expected to help in the development of any nutrient-loss mitigation strategies.

6) Yield gap

Pasture yield gaps

Purpose is to speculate the difference between current and potential pasture production.

1. Calculate stocking rate

Calculate total stock units using the conversion table below. Use your own conversion factors if necessary.

Stock class	Enter Stock numbers		Conversion factor		Stock Units
Beef cows		×	5.5	=	
Beef dry		×	4.75	=	
Beef replacements		×	4	=	
Dairy cows		×	7	=	
Dairy replacements		×	4.25	=	
Other cattle		×	5.5	=	
Breeding ewes		×	1	=	
Sheep dry		×	0.8	=	
Sheep replacements		×	0.7	=	
Other sheep		×	0.8	=	
Hinds		×	1.9	=	
Deer for meat		×	1.8	=	
Stags for velvet		×	2.1	=	
Other Deer		×	1.8	=	
			Stock units for the whole farm =		

2. Convert stock units to dry matter demand

Estimate the pasture utilisation factor. Sheep and beef farms generally have around 70-75% utilisation. Hard hill may be as low as 60-65%, while intensive cell grazing may achieve upwards of 80-85%. Divide the % by 100 to get the factor (e.g. at 80% utilisation = 80/100 = utilisation factor of 0.8). Calculate pasture yield using the equation below:

Calculate whole farm pasture production (/ha)

Stock units			Utilisation factor		Whole farm yield		Effective area (ha)		Yield per ha
	× 550	÷		=		÷		=	
			*Utilisation % divided by 100		kg DM/yr				kg DM/ha/yr

3. Convert stock units to dry matter demand

- **Multiply the pasture yield estimate (kg DM/ha/ye) by farm effective area to get whole farm pasture yield.**
- **Distribute whole-farm yield between either LUC units or LMU blocks. The example above is for LUC units. Options include:**
  1. Repeat the stock unit calculations using stock numbers for each unit. Most should be able to approximate where different stock are grazed across the farm. This option takes some time, but provides the best estimate.
  2. Use pasture cuts if available. It may be possible to transfer local pasture monitoring results according to similar land types.
  3. Use experience to estimate relative productivity as a percent (%). For example, 70% of the farm's productivity may be coming from the flats, while remaining 30% comes from the hill country
- **Build a table that lists each unit and the estimate for current pasture yield. Add another column with the heading 'Potential yield'.**

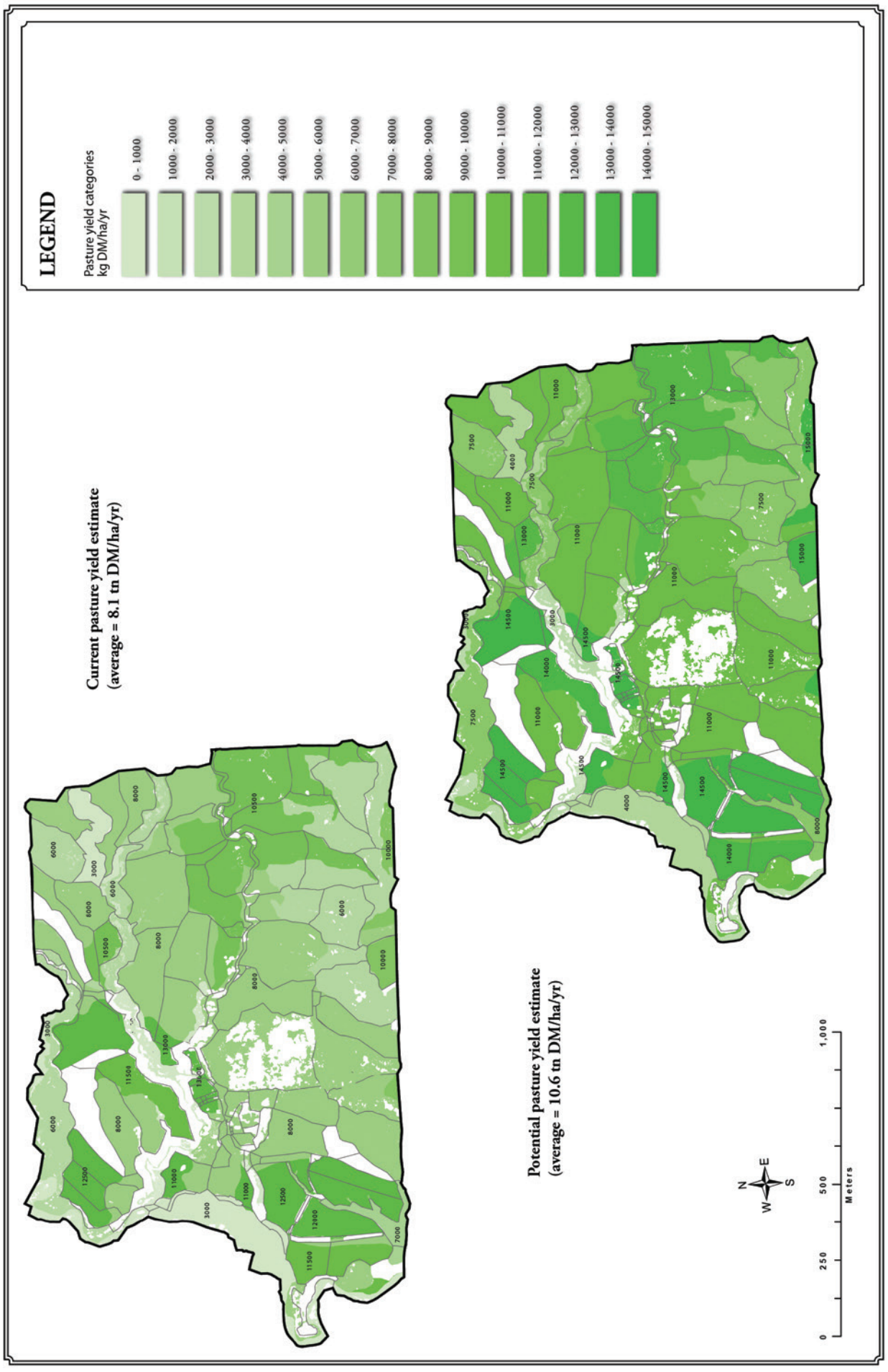
4. Speculate potential pasture yield

What could each unit produce if all physical limitations were overcome? Speculate how pasture yields could increase. Examples are provided below.

Achieve optimal pH

- Establish shelter
- Irrigation
- Ripping
- Fully effective pugging management
- New pasture species
- Artificial drainage
- Flipping
- Aeration
- Achieve optimal nutrient status
- Fully effective weed and pest control
- Optimal subdivision
- Stone picking
- Stopbanks
- Full stock access to water, shelter & shade
- Fully effective erosion control

List each new estimate of potential production in the table, and sum to see what it may mean for whole farm production. If there is a realistic opportunity to improve production build them into the response plan (next section).


LEGEND
Pasture yield categories kg DM/ha/yr
0 - 1000
1000 - 2000
2000 - 3000
3000 - 4000
4000 - 5000
5000 - 6000
6000 - 7000
7000 - 8000
8000 - 9000
9000 - 10000
10000 - 11000
11000 - 12000
12000 - 13000
13000 - 14000
14000 - 15000
Current pasture yield estimate
(average = 8.1 tn DM/ha/yr)
Potential pasture yield estimate
(average = 10.6 tn DM/ha/yr)
N
E
S
W
0
250
500
1,000
Meters

7) Land and Environment Works Programme

The standard

A Land and Environment Works Programme validated by a resource management specialist.

The Works Programme is checked by a resource management specialist to ensure key issues have been identified, and that appropriate actions are planned to address those issues.

What is the Works Programme?

- The Works programme is the most important part of a Level 3 LEP. It summaries the what, when, how and how much of Land and Environment Planning for your farm.
- Three components are involved:
  1. A Response Plan that shows how and when both issues and opportunities will be acted on.
  2. A Works Programme Map showing where activities will be directed
  3. An annual budget

Developing a Response Plan

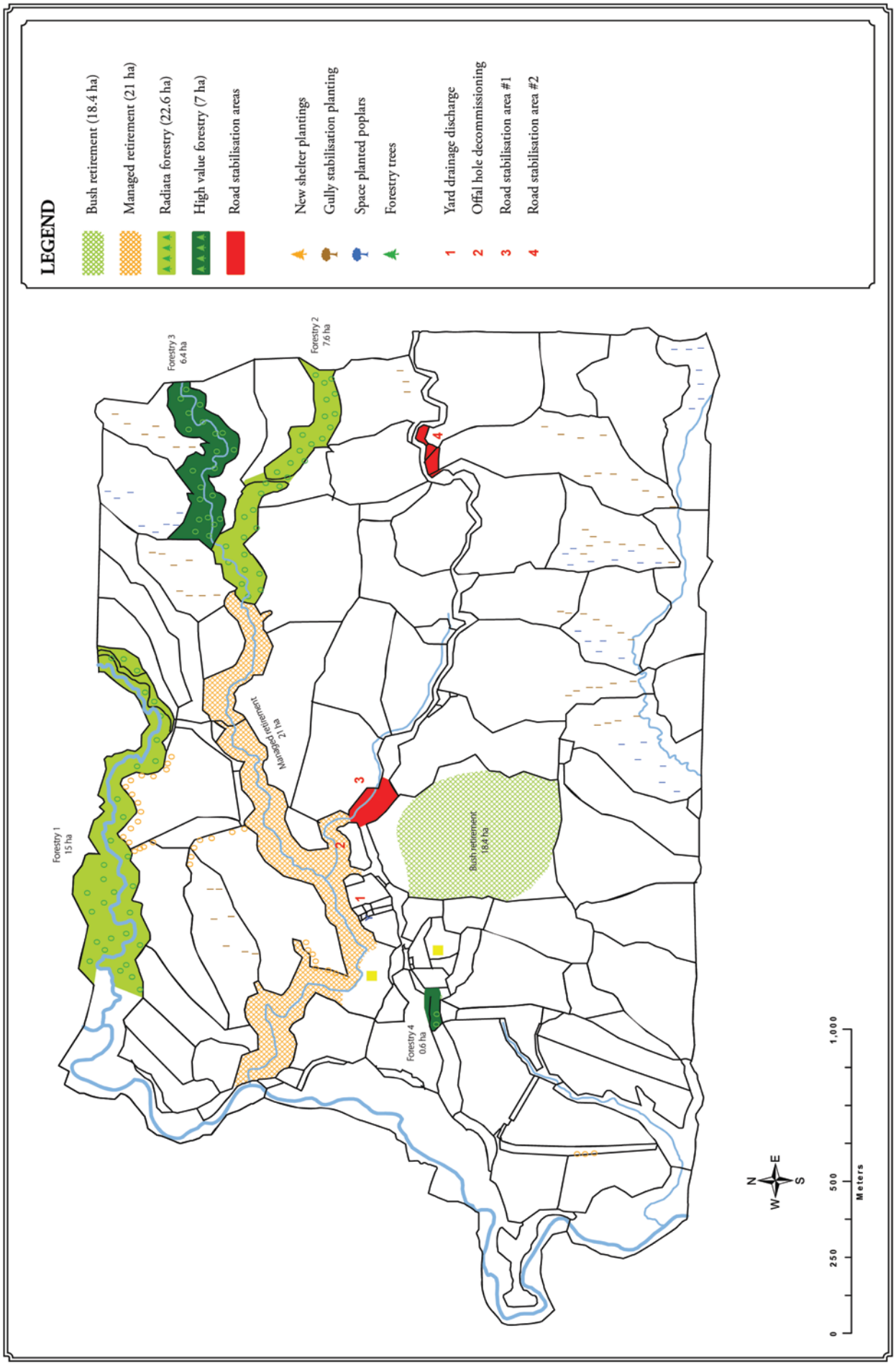
- Draw up a Response Table using the opposite examples as a template.
- Review the issues and opportunities that you have identified for your farm (Part 2: Locate priorities, Part 4: LMUs & SWOT analysis)
- List each opportunity or issue in your Response Table, and then describe how it will be managed, addressed, or capitailsed on. Spread your responses across several years if necessary (3-10 years).
- Elaborate your responses so that they are SMART (Specific, Measurable, Achievable, Relevant and Timebound).

Developing a Works Programme Map

- Mark on a map where and what activities are going to take place.

Developing a budget for the first year

- Realistic costing's require a budget to be prepared on an annual basis.
- Cost estimates for most items can be provided by the resource management specialist you engage to validate your Works Programme.


LEGEND
Bush retirement (18.4 ha)
Managed retirement (21 ha)
Radiata forestry (22.6 ha)
High value forestry (7 ha)
Road stabilisation areas
New shelter plantings
Gully stabilisation planting
Space planted poplars
Forestry trees
1 Yard drainage discharge
2 Offal hole decommissioning
3 Road stabilisation area #1
4 Road stabilisation area #2
Forestry 1 15 ha
Forestry 2 7.6 ha
Forestry 3 6.4 ha
Forestry 4 0.6 ha
Managed retirement 21 ha
Bush retirement 18.4 ha
N
E
S
W
0
250
500
1,000
Meters

RESPONSE PLAN, Glenilliad Farm, Puketapu

Issue or opportunity	**Priority** Rank each in order of priority	**Responses** Year 2013	Year 2014	Year 2017
Ongoing soil slip erosion in Back Country and Sams	1	15 Kawa poles with sleeves starting in Sams. Minimum 10 metre spacings Approx $200 cost Focus around the wet parts of the track	Another 30 poles + sleeves. Start planting across the slope heading towards Back Country Approx $230 cost	Another 30 poles + sleeves destined for the worse parts of Back Country Approx $230 cost
Wind erosion in front paddocks (James's , Corden and No.2) when cultivated	4	No cultivation this year. Avoid hard grazing if soils go droughty, and especially keep the bulls out.	October barkant turnips. Avoid over cultivating, espc the headlands, and sow early when soils still damp No tillage no-good here. Sow back into pasture before NWesters start	Same as 2013
Old man willows along stream have raised the bed and....	2	1. Find out if the council is supposed to be dealing with the willows	Aim to spray all willows with a helicopter in late summer. Find out cost and if a....	Aim to get digger in summer 2015 to...

8) Monitoring programme

The standard

A programme that records achievements, and monitors the change in freshwater quality, soil condition, and natural biodiversity (if relevant) every three years.

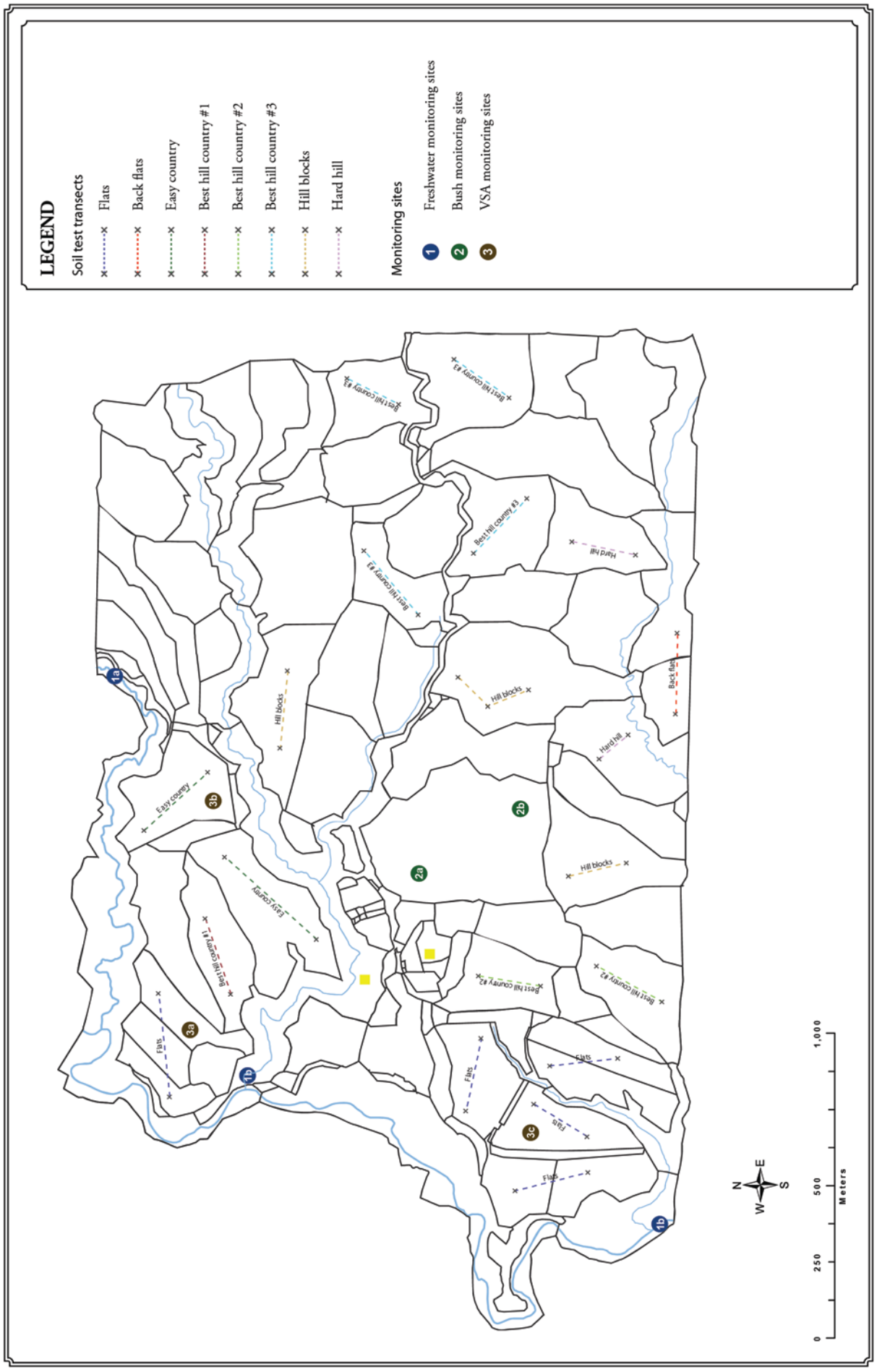
- Recording achievements demonstrates that responsible actions are being taken.
- Monitoring water, soil and bush condition can demonstrate actual improvements in environmental quality, or signal that new actions are required.

Designing a monitoring programme

- Decide on which indicators should be monitored. Some indicators cannot be measured regularly or cost effectively in a farming situation. However, there are now several practical tools available that are fully adequate from monitoring change in important environmental indicators.
- Use the table below to select indicators relevant to your farm, and the appropriate monitoring technique or guide. An internet search will show a range of suppliers for each tool.
- Establish monitoring sites and transects on a map (example opposite). This will ensure the exact same comparisons each year.
- Undertake baseline monitoring before you start implementing your LEP. This involves addressing the current status of the indicators to provide a baseline reference and comparison when you re-monitor in three years time.
- Record your results in a monitoring report. While each monitoring kit has its own templates, it can be useful to summarise all results in one table. An example is provided.

Available monitoring techniques & guides

Issue	Indicators	Technique or tool
Soil health	Nutrient status (P, K, S, Mg, Ca) and pH	Standard soil test Overseer Nutrient Budgets
	Trace elements, contaminants (e.g. Cd, DDT), nitrogen, chemical properties (CEC, AEC)	Additional soil testing
	Erosion degree, soil structure & consistence, porosity, earthworms, bare ground, pasture characteristics, (and more...)	Visual Soil Assessments (VSA)
Water quality	Nitrogen leaching, P-runoff risk	Overseer Nutrient Budgets
	Stream habitat (pH, temperature, conductivity, clarity, riparian, vegetation, more...)	SHMAK kit
	Biological indicators (assessing stream life and activity)	SHMAK kit
	Faecal coliform counts	Specialist laboratory test
	Nutrient contents	Specialist laboratory test
Natural biodiversity	Stream habitat and biological indicators (stream life and activity)	SHMAK kit
	Wetland condition	Handbook for monitoring wetland condition
	Bush condition	FORMAK, Bush Vitality Assessment Kit


LEGEND
Soil test transects
Flats
Back flats
Easy country
Best hill country #1
Best hill country #2
Best hill country #3
Hill blocks
Hard hill
Monitoring sites
Freshwater monitoring sites
Bush monitoring sites
VSA monitoring sites
1a
1b
2a
2b
3a
3b
3c
Flats
Back flats
Easy country
Best Hill country #1
Best Hill country #2
Best Hill country #3
Hill blocks
Hard hill
N
E
S
W
0
250
500
1,000
Meters

MONITORING REPORT, Glenilliad Farm, Puketapu

	Indicator	Location	Year 2011 (baseline)					Year 2004						Comments
Soil health	Soil quality (VS score)	Site 3a	VS= 22 (moderate)					VS= 32 (excellent						Improvement attributed to new cultivation methods
		Site 3b	VS= 32 (excellent)					VS-= 31 (excellent)						
		Site 3c	VS 25 (good)					VS= 28 (good)						Significantly increased earthworm counts
	Soil fertility		**P**	**K**	**S**	**Ca**	**Mg**	**pH**	**P**	**K**	**S**	**Ca**	**Mg**	**pH**	
		Flats	33	20	18	-	20	6.0	34	20	15	-	18	6.0	Maintenance fertiliser levels working well
		Back flats	8	20	22	-	18	6.2	10	20	20	-	17	6.1	Responding as expected to increased fertiliser
		Easy country	25	8	21	-	22	6.0	24	6	16	-	22	5.9	Need an increase for maintenance
		Best hill	18	5	9	-	8	5.8	18	6	10	-	7	5.8	Expected a much higher increase with use of 30% K super
		Best hill 2	20	6	10	-	3	5.8	22	12	11	-	5	5.7	As expected
		Best hill 3	20	6	10	-	5	5.8	44	17	20	-	8	6.4	Probably dung contaminated sample (see Olsen P result)
		Hill blocks	17	5	8	-	5	5.7	17	5	8	-	5	5.6	
		Hard hill	5	3	6	-	3	5.3	5	3	6	-	3	5.3	Poor but expected
Water quality	SHMAK HABITAT SCORE (L3)	Site 3a						L3 score= 61 (poor)			L3 score= 58 (poor)			No appreciable difference where river enters and exits the farm
		Site 1b						L3 score= 65 (poor)			L3 score= 84 (good to very good)			Major improvement perhaps because gorge has been partially retired
		Site 1c						L3 score= 63 (poor)			L3 score= 60 (poor)			Results from site 3 a & b suggest quality might be decreasing but the difference is small so more monitoring required
	SHMAK bug score (L3)	Site 3a						L3 score= 3.9 (poor)			L3 score= 3.8 (poor)			Results reflect trends for habitat scores, suggesting they are reliable
		Site 1b						L3 score= 4.2 (poor)			L3 score= 5.8 (good)			
		Site 1c						L3 score= 4.0 (poor)			L3 score= 4.3 (poor)			

Where to from here?

- Implement each response as indicated
- Monitor every three years and record all your achievements
- Remember to review and reassess each year
- Register your completed plan at LEP@beeflambnz.com. This way you can be sure to receive the latest news on LEPs and be notified of the latest modules on specific topics relevant to on-farm environmental issues.

Congratulations on designing a Land and Environment Plan specifically for your farm.

For full integration with farm business planning you may wish to refer to this LEP when making decisions about farm development and financial planning.

Beyond Land and Environment Plans - ISO 14001

ISO 14001 is a voluntary international standard used to set up an Environment Management System (EMS).

Designing an EMS needs to include an environmental policy, a commitment to meeting all regulatory requirements, an accounting of significant environmental aspects (and a systematic way to identify them), a way to discover failure to meet regulatory requirements, and what to do if such a failure occurs. It also requires periodic review, usually including formal audits.

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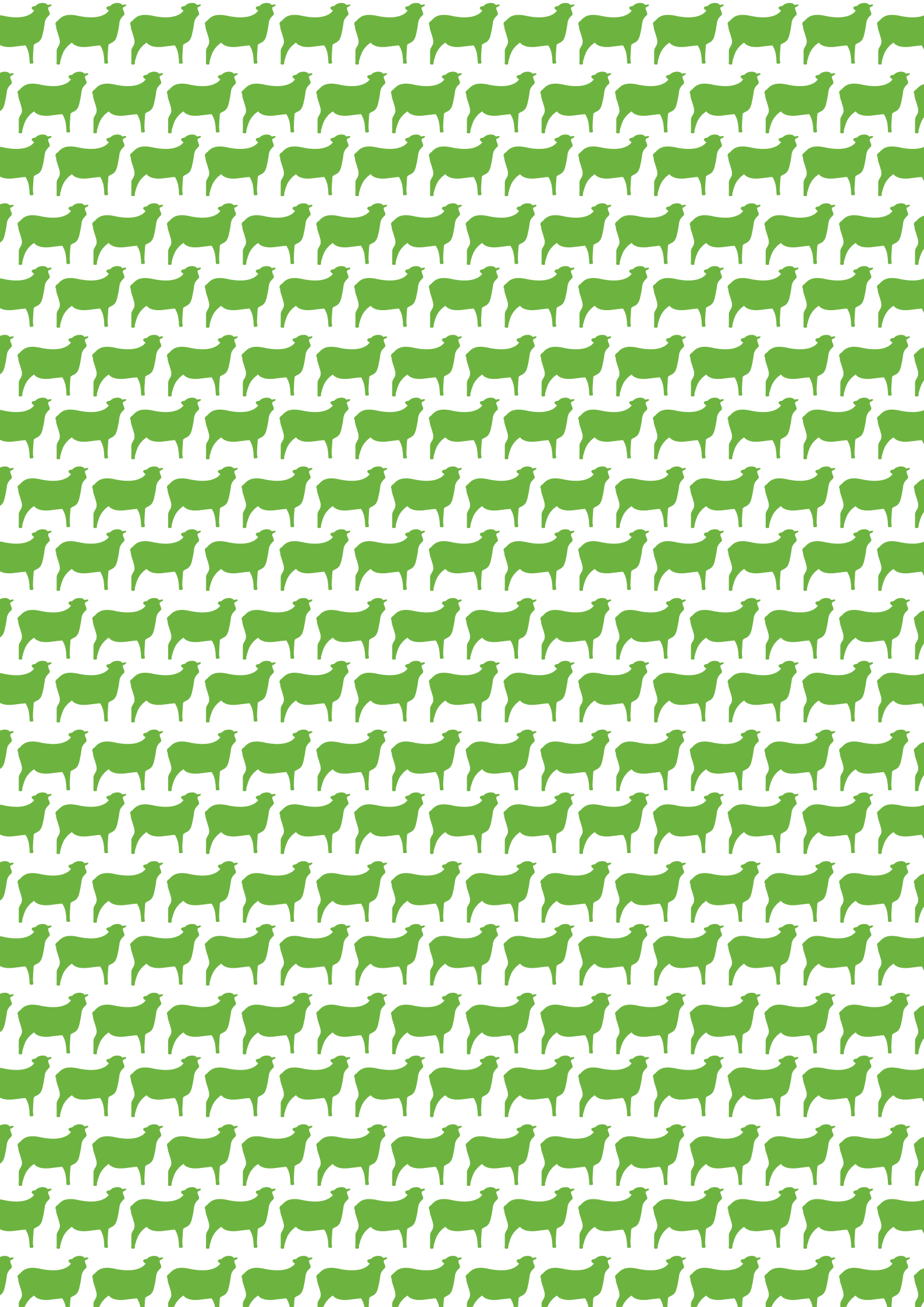

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