Martinborough Wastewater Treatment Plant

Land Application Option Assessment

Prepared for

South Wairarapa District Council

Prepared by

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TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 5

2 INTRODUCTION 8
2.1 Purpose 8
2.2 Background 8
2.3 Scope 8

3 MARTINBOROUGH WASTEWATER TREATMENT UPGRADE 10

4 DESIGN PARAMETERS FOR MWWTP DISCHARGES 12
4.1 General 12
4.2 Resource Assessment 12
4.3 Land Application Area for Assessment Purposes 12

5 LAND APPLICATION ASSESSMENT METHODOLOGY 14
5.1 Process Overview 14
5.2 Parameters 14
5.3 Development of Zones 15
5.4 Aggregation of Rating Results 16

6 ASSESSMENT PARAMETERS 17
6.1 General 17
6.2 Reticulation Requirements 17
6.3 Land Area 17
6.4 Land Use Attributes 18
6.4.1 Nutrient Uptake 18
6.4.2 Acceptability 18
6.4.3 Special Use Locations 18
6.5 Soil Attributes 19
6.5.1 Soil Drainage and Permeability 19
6.5.2 Depth to Restrictive Layer 19
6.6 Hydrological and Hydrogeological Attributes 19
6.6.1 Depth to Seasonal High Groundwater Table 20
6.6.2 Mounding Risk 20
6.6.3 Flood Return Interval 20
6.7 Summary 21

7 OPTION ASSESSMENT 22
7.1 Assessment by Parameter 22
7.1.1 Reticulation Zones 22
7.1.2 Land Area 22

7.1.3 Nutrient Uptake Potential 22
7.1.4 Acceptability of Wastewater Application 22
7.1.5 Special Use Locations 23
7.1.6 Soil Drainage and Permeability 23
7.1.7 Soil Depth to Restrictive Layer 23
7.1.8 Depth to Seasonal High Groundwater 23
7.1.9 Mounding Risk 24
7.1.10 Flood Return Interval 24
7.2 Combining Rating Results 24
7.2.1 Rating Summary 24

8 CASE STUDY: PAIN FARM 26
8.1 Background 26
8.2 Combining Rating Results 26

9 CONCLUSIONS AND RECOMMENDATIONS 28
9.1 Assessment Conclusions 28
9.2 Pain Farm 28
9.3 Recommendations 29

10 REFERENCES 30

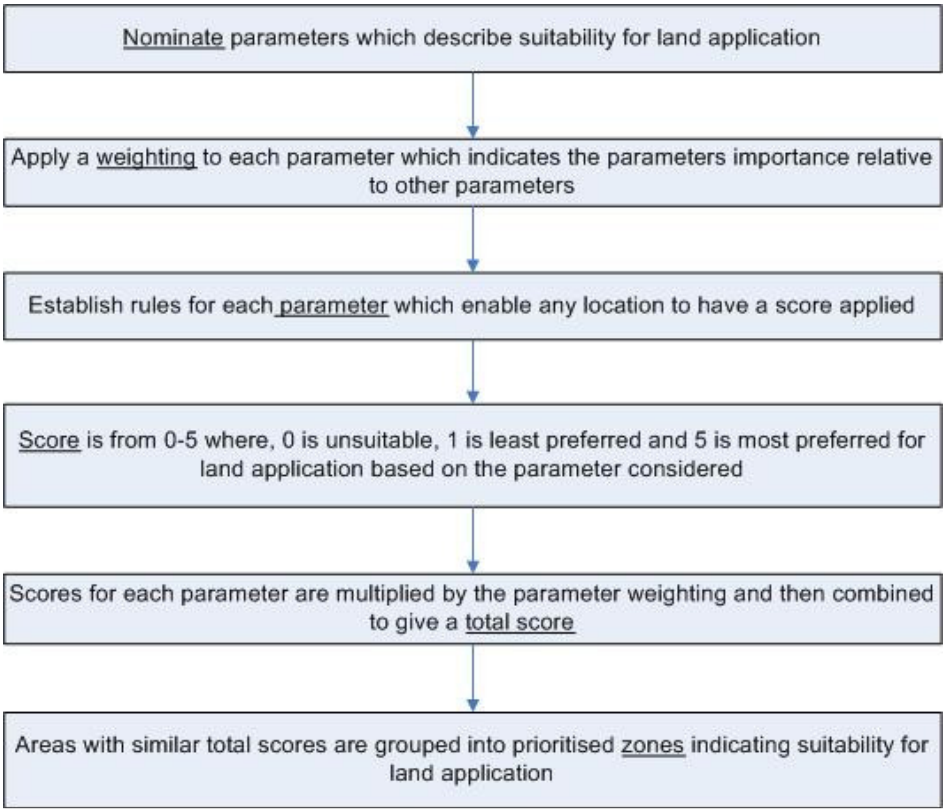
11 APPENDICES 31
Appendix A: Figures 32

1 EXECUTIVE SUMMARY

South Wairarapa District Council (SWDC) is responsible for the provision, operation and maintenance of a reticulated wastewater treatment system for Martinborough. The Martinborough wastewater treatment plant (MWWTP) includes an oxidation pond followed by four maturation cells and UV disinfection (recently installed). At present, following pond treatment the wastewater is discharged to the Ruamahanga River around 2.6 km downstream from Waihenga Bridge.

SWDC have been examining potential options for the improvement of its wastewater discharge including the establishment of a land application scheme. Lowe Environmental Impact (LEI) has been engaged by SWDC to investigate the suitability of sites in the area surrounding Martinborough for the land application of MWWTP wastewater.

The process undertaken to determine the ability of areas near to MWWTP to receive wastewater is summarised as follows:



Parameters considered for the investigation area were (relative weighting in brackets):

- Reticulation requirements (distance and elevation) (10 %);
- Land area available (10 %);
- Land use;
    - Nutrient uptake (10 %);
    - Acceptability (10 %);
    - Special use locations (archaeological, historic, water take, etc.) (10 %).
- Soil attributes;
    - Soil drainage and permeability (10 %);
    - Depth to restrictive layer (10 %).

- Hydrological and hydrogeological attributes.
    - Depth to seasonal high water table (10 %);
    - Mounding risk (10 %);
    - Flood return interval (10 %).

This desktop assessment method is intended to be used as a first step in the design process for a wastewater application to land scheme. Additional stages are required to supply detail about preferred land areas and project engineering considerations such as reticulation routes. This additional information contains a level of detail which is not considered feasible or appropriate for this desktop assessment of regional suitability for land application of wastewater. Recommendations are given below for the progression of additional work to determine an appropriate location and application regime.

Areas corresponding to Zone B represent the most suitable land for application of wastewater. These areas occur:

- Directly surrounding Martinborough between the confluence of the Huangarua River with the Ruamahanga River and the area known as the Martinborough Terraces;
- A wedge of land extending from Lake Ferry Road at approximately Kellys Stream, south for around 1.7 km; and
- Land in the vicinity of Dyerville following the terraces associated with Dry River.

SWDC has access to a site known as Pain Farm. LEI has applied the desktop assessment method described to the site which enabled the assessment of Pain farm against:

- Other land in the Martinborough area; and
- An idealised land treatment site that has optimum conditions for wastewater application.

The results of the Pain Farm investigation indicated that:

- The Pain Farm site has a total score of 32/50 placing it within "Zone C" which is described as: *Zone C (25-33) – Some limitations are experienced within areas of this rating zone. Zone C is suitable for land treatment when appropriately managed*.
- Land treatment of wastewater on Pain Farm is likely to be feasible with careful management to:
    - Avoid soil damage due to excessive irrigation or cultivation and traffic on wet soils;
    - Ensure drainage to groundwater in excess of the unirrigated rate is minimised so that groundwater elevation and direction of movement is not impacted.
- As a result of the site's constraints the number of days per year on which wastewater application can occur is likely to be less than for sites in Zone B.
- There are higher scoring areas than Pain Farm in the Martinborough surrounds. The availability of land in preferred zones should be investigated before further work is done on Pain Farm.

It is recommended that the following actions are undertaken:

- Weightings for each of the assessed criteria should be reviewed based on stakeholder concerns and SWDC considerations. Following the review the Pain Farm ranking should be reassessed.
- Availability and access to land within the areas demarked as Zone B should be investigated with the top 12 sites identified.

- A preliminary investigation should be considered for up to four sites.
- A detailed evaluation of the preferred site(s) should be undertaken.

2 INTRODUCTION

2.1 Purpose

The purpose of this land application option assessment report is to:

- identify the areas surrounding the Martinborough wastewater treatment plant (MWWTP) which are theoretically suitable for land application;
- to determine limitations to land application in the area; and
- to identify preferred locations for land application of MWWTP wastewater.

2.2 Background

South Wairarapa District Council (SWDC) is responsible for the provision, operation and maintenance of a reticulated wastewater treatment system for Martinborough. The Martinborough wastewater treatment plant (MWWTP) includes an oxidation pond followed by four maturation cells and UV disinfection (recently installed). At present, following pond treatment the wastewater is discharged to the Ruamahanga River around 2.6 km downstream from Waihenga Bridge.

SWDC have been examining potential options for the improvement of its wastewater discharge including the establishment of a land application scheme. Lowe Environmental Impact (LEI) has been engaged by SWDC to investigate the suitability of sites in the area surrounding Martinborough for the land application of MWWTP wastewater.

2.3 Scope

This report corresponds to Stage 6 of LEIs proposal dated 28 November 2011 and presents the results of a desktop investigation of available information to determine the location of land potentially suitable for the land application of wastewater. The report details:

- Section 3 outlines the project objectives;
- Section 4 summarises the land treatment system design parameters;
- Section 5 describes the methodology for evaluating the suitability of areas;
- Section 6 details the assessment parameters;
- Section 7 details the results of the investigation and identifies suitable areas for land treatment;
- Section 8 presents the results of the investigation method for a site known as Pain Farm; and
- Section 9 gives conclusions and recommendations for the direction of further investigations.

This report provides a preliminary desktop investigation and collation of information available regarding the area examined. The information provided is intended to define locations that are potentially suitable for wastewater application based on mapped characteristics of the physical environment.

No consideration has been given to land availability, and no field investigations to verify the accuracy of the mapped information have been undertaken.

This investigation's purpose has been to firstly identify if land is potentially suitable for land application, prior to further investigation. It is anticipated that prior to final selection any suitable sites potentially identified here should be subject to a further site investigation to verify the relevant characteristics pertaining to that site and required of a land application system.

3 MARTINBOROUGH WASTEWATER TREATMENT UPGRADE

As part of a resource consenting process SWDC is evaluating potential options for the improvement of the MWWTP wastewater discharge. There are a number of options available to improve the discharge quality including:

- Long term full time discharge to river with a WWTP upgrade;
- Land disposal (high rate discharge to result in land passage but little attenuation of wastewater components);
- Full time land treatment (at a rate maximizing nutrient and pathogen assimilation in the soil);
- Combined discharges to land and water; and
- Wastewater reuse.

The present discharge to water is unlikely to be acceptable for a long term consent. In order to obtain a long term consent for a full time surface water discharge from the treatment plant there would be a requirement to demonstrate that the discharge results in no significant adverse impact on the river system. Based on the approach used elsewhere in the Wairarapa the river water quality outside of the zone of reasonable mixing would need to be returned to background concentrations of measured analytes under MALF conditions. Further, the mixing zone would need to be small enough to avoid restrictions to fish migration. In addition to the parameters traditionally considered in water quality monitoring, the stakeholder group has indicated that they want some assurance regarding potential issues with emerging contaminants (personal care products, pharmaceuticals, etc.).

The technologies available to consistently and reliably achieve the required wastewater discharge quality for surface water discharge are typically very expensive and have a high requirement for operational skill and high maintenance costs. Depending on the methodology the treatment process may produce a new contaminant in the form of a chemical derived sludge (e.g. additional aluminum in treatment plant sludge from Alum dosing for P removal). Further, social and cultural issues remain even if environmental issues are resolved.

Other options for wastewater discharge including reuse options, groundwater recharge and land application may be considered. For these options the required treatment quality prior to discharge will be variable depending on its use and the potential to impact on the receiving environment. For discharges to groundwater, including direct injection and land disposal, treatment requirements are likely to be as high as for full time surface water discharge. In the case of wastewater reuse (e.g. reticulation for firefighting or reticulation for non-potable uses) there is also a requirement for additional infrastructure such as dual reticulation and a greater level of disinfection.

Land application providing a high degree of nutrient attenuation i.e. land treatment (as opposed to land disposal) is considered to be the most feasible alternative to full time surface water discharge for the Martinborough community. The exact requirement of a land application system (i.e. land treatment versus land disposal) should be evaluated further given the outcomes of the sections later in this report.

Irrespective, a land application system may not need to employ the same technologies needed to meet very high treatment standard required for surface water discharge. Land application can use well understood technology and is able, often with minor treatment plant

upgrades, to use the existing wastewater. Despite the possible minor need for upgrades, additional requirements of a land application system to consider may include:

- The extent of filtration which can be dependent on the irrigation type used;
- Capex of irrigation infrastructure system – which varies according to the type of irrigation;
- Operation and maintenance requirements of land application systems vary depending on the system;
- Provision of storage may be needed if deferred application is used; and
- Reticulation from WWTP to site.

What is clear is that changes are required to the current WWTP discharge. If surface water is to continue to be used considerable treatment plant upgrades will be required. If land application options are considered a lesser upgrade may be required, but this lesser requirement needs to be considered in light of additional non-treatment items e.g. storage and additional piping infrastructure.

The following sections of this report evaluate land resources in the vicinity of the MWWTP so that land application options can be more accurately described.

4 DESIGN PARAMETERS FOR MWWTP DISCHARGES

4.1 General

SWDC routinely monitors the characteristics of the MWWTP discharge. In 2007, following construction of 4 maturation cells, wastewater properties are likely to have changed and so the characterisation of MWWTP wastewater utilises data from 2007 onwards only. Further changes to the wastewater treatment system have occurred, including the commissioning of a UV treatment plant, which may not yet be reflected in the monitoring data available.

In addition, it is likely that the MWWTP will undergo an upgrade within the next few years, further influencing the characteristics of the treated wastewater to be discharged. At the time of writing, details regarding the future wastewater characteristics were not available and so parameters adopted for this report are from the existing monitoring record.

The use of land application for wastewater discharge is typically as an alternative to WWTP upgrades such that the land is used as a form of treatment reducing the extent of treatment plant upgrade required. It is therefore considered appropriate to base the land treatment assessment on current wastewater characteristics. Characteristics considered in the design include:

- Flow parameters;
- Population growth and flow projections; and
- Wastewater quality.

The characteristics are described in detail elsewhere (NZET, 2010).

4.2 Resource Assessment

Typically a broad scale assessment of the investigation including discussion of the underlying geology, climate, topographical assessment and hydrology, amongst others would be undertaken to give information about the setting for a land treatment scheme. Due to the scale of the investigation area this step has been excluded. It is recommended that a resource assessment is included as part of subsequent investigation stages following the narrowing of the search area.

4.3 Land Application Area for Assessment Purposes

The wastewater characterisation as described above has been used to determine a conceptual daily volume and nutrient mass loading from the WWTP. A required land area has then determined based on the volume or mass loading to be discharged. While site specific design is required to determine the limiting factor and rate of application for any site, for the purpose of this assessment a conservative land treatment regime has been adopted to enable comparison between sites. As a result land disposal is not considered further in this report since availability of land characteristics for land disposal are rare in this area. Land application is therefore taken to mean land treatment whereby wastewater is applied at a rate that allows the soil and plant system to utilise most of the applied water and nutrients, and pathogen attenuation occurs in the soil.

The required land area is determined as follows:

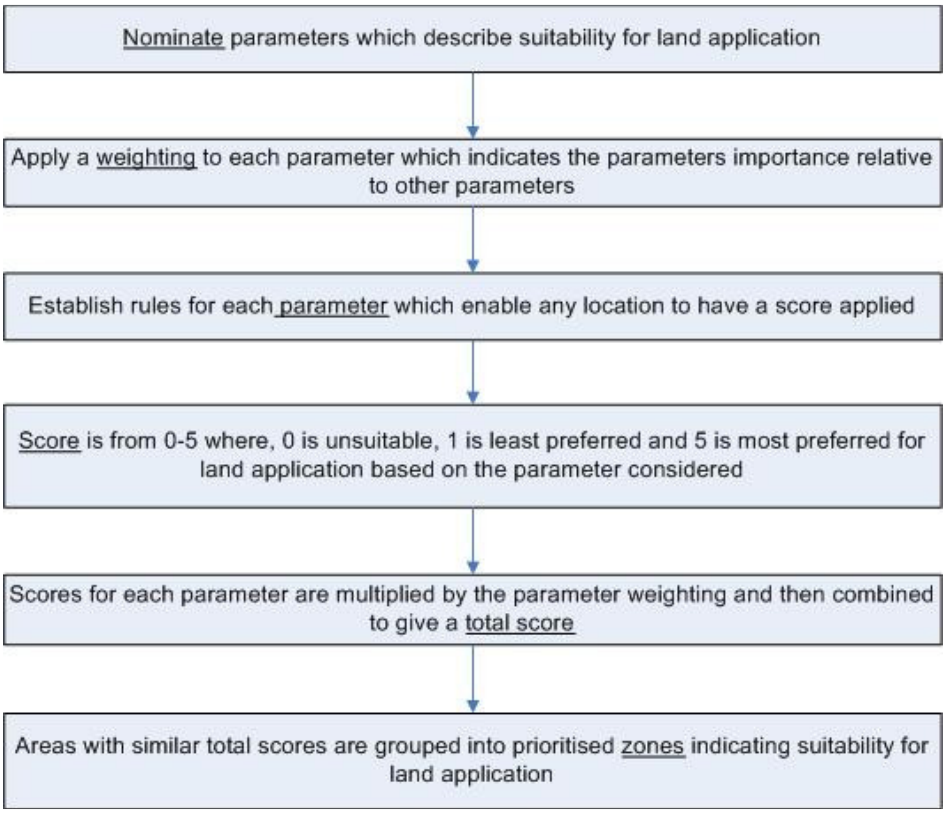
- Annual average daily flow = 536 m^3/day;
- Annual flow = 195,640 m^3/year;
- Assuming sufficient storage is available to enable discharge to occur on 180 days per year at 5 mm/day;
- Then, required land area is 22 ha;
- Allowing for 3 ha buffer;
- **Land area required is 25 ha**.

It should be noted that the land area given is for assessment purposes only. There may be other parameters, such as nutrients (i.e. nitrogen) which may influence this land area requirement, but this depends on the system design and management.

5 LAND APPLICATION ASSESSMENT METHODOLOGY

5.1 Process Overview

The process undertaken to determine the ability of areas near to MWWTP to receive wastewater is outlined as follows:



Details of the process are given below.

5.2 Parameters

There is a wide range of parameters which contribute to describing the ability of a land application site to receive treated wastewater. The selection and interpretation of assessment parameters may vary due to location specific challenges or advantages.

The relative importance of the various parameters is variable and in many cases subjective. However, there is a need to consider the collective suitability of a particular site based on the merits of each parameter, and this is achieved using a weighted scoring system whereby each parameter is given a percentage (the weighting), which indicates it's importance relative to other parameters. Each location within the investigation area is given a score for each parameter from 1 to 5 based on suitability, with 1 being least preferred for land application and 5 being most preferred. This then enables sites to be compared.

Martinborough, and its surrounds, are dominated by the floodplain and terrace lands associated with the Ruamahanga River. This has the advantage that ample land is located

near to the MWWTP which is flat to gently undulating and therefore well suited to wastewater application infrastructure. It is also unlikely to be subject to slope instability issues. Disadvantages of the location are the high ground and surface water levels that occur and the young, poorly structured and therefore slowly draining nature of some of the soils.

An additional consideration for Martinborough is the amount of vineyards located on the more free draining soil of the area. There may be limitations to land application where crops such as grapes are grown because of perceptions of public health risk. The inclusion of existing land use is an important parameter for assessing options around Martinborough.

The parameters selected for assessment of land application sites in the Martinborough area are given below. Included is their proposed weighting.

- Reticulation requirements (distance and elevation) (10 %);
- Land area available (10 %);
- Land use;
    - Nutrient uptake (10 %);
    - Acceptability (10 %);
    - Special use locations (archaeological, historic, water take, etc.) (10 %).
- Soil attributes;
    - Soil drainage and permeability (10 %);
    - Depth to restrictive layer (10 %).
- Hydrological and hydrogeological attributes.
    - Depth to seasonal high water table (10 %);
    - Mounding risk (10 %);
    - Flood return interval (10 %).

The parameters are described in more detail in Section 6.

For each of the parameters a score from 0 (least favourable) to 5 (most favourable) has been assigned to reflect the relevance of that parameter/layer to its suitability as a land application area. The total of the parameter scores can then be aggregated and in this case the maximum is 50.

The weighting proposed may be altered based on feedback from SWDC and stakeholders to better reflect the aspirations of the community. It is recommended that consultation regarding the weightings be undertaken with the stakeholder group. This will help to identify the highest and lowest rated issues for stakeholders and may assist to stimulate discussion regarding the most feasible outcomes.

5.3 Development of Zones

When the weighted scores from individual parameters are grouped they provide a total that can be compared with totals of parameters from different locations. To help rank the suitability of the parameter totals at individual locations they can be grouped, and in this case the groupings are called Zones. Five Zone groupings have been used and are:

- Zone A (score of 42-50) – No significant limitations are experienced within areas of this rating zone. Zone A represents the preferred zone for siting of a land treatment system;

- Zone B (score of 34-41) – Minor limitations are experienced within areas of this rating zone. Zone B is likely to be well suited for land treatment;
- Zone C (score of 25-33) – Some limitations are experienced within areas of this rating zone. Zone C is suitable for land treatment when appropriately managed;
- Zone D (score of 13-24) – Significant limitations are experienced within areas of this rating zone. Land treatment is likely to be possible within zone D however costs and management requirements are expected to be greater than other zones; and
- Zone E (score of 0-12) – Severe limitations to land treatment are experienced within areas of this rating zone. It is likely that cost and management requirements would be prohibitive to the establishment of land treatment in zone E.

A GIS based approach has been used to develop zones locations (spatially), effectively resulting from an aggregation of the parameter scores. In GIS terms this is known as combining layers. This allows a continuous assessment of individual points on a map to be compared; which may not necessary reflect a transition between any one individual parameter score (layer).

5.4 Aggregation of Rating Results

As mentioned above, a score has been applied to each parameter (as represented by GIS layers). This allows a graduated map to be produced which shows how the individual parameter score varies over an area. Such maps for each parameter are presented in Appendix A, Figures 1 to 12.

The individual parameter maps can be aggregated to produce a map which shows the summation of the combined parameters. Rather than a continuation of totals over a map, the totals are grouped into Zones, as discussed above. The combined Zone map, indicating greatest to least preference for land application, is shown in Appendix A, Figure 12.

The limits assigned for each zone are based on a judgemental estimate of suitability for land application.

6 ASSESSMENT PARAMETERS

6.1 General

The parameters listed in Section 5 are described below and the method for rating the areas surrounding MWWTP are given.

6.2 Reticulation Requirements

The reticulation of MWWTP wastewater is likely to require the installation of pipe work and pumping stations. The feasibility of the land treatment location is influenced by the availability of land for pipe installation, which considers the presence of existing easements, or ease of obtaining easements. Piping distance is a consideration due to the cost of infrastructure and maintenance, and the energy required to transmit the wastewater over the length of the route. The requirement for pumping is a consideration and is affected by pipe diameter, distance of piping (both due to internal friction) and the elevation of the route where pumping is employed to overcome gravity. Scored from 1-5 for the reticulation parameters are determined based on:

a) Proximity to WWTP and preferred pipe routes (existing easements and road reserves); and
b) Pumping capacity required to transmit the wastewater.

6.3 Land Area

Martinborough is a rural servicing township. There are a range of property types within the investigation area including:

- Residential;
- Lifestyle;
- Horticultural (in particular vineyards and olive orchards);
- Intensive pastoralism (e.g. dairy); and
- Extensive pastoralism (e.g. drystock).

There is great variance in property sizes and distance to dwellings on adjacent sites. Large sites capable of receiving the entire daily wastewater flows from the MWWTP are preferred. Where sites are smaller multiple properties would be needed to meet the land requirement for discharge of daily flows generated at the MWWTP.

Individual properties have been scored based on an effective area. The effective area has been determined as:

- Total property area less a 25 m buffer to boundaries for all properties except:
- Total area less a 5 m buffer to boundaries for reserves.

Scores for the sites are as follows:

- 5 – >50 ha;
- 4 – 35.000 to 49.999 ha;
- 3 – 20.000 to 34.999 ha;
- 2 – 10.000 to 19.999 ha; and
- 1 – <10 ha.

6.4 Land Use Attributes

The land use of any site indicates both:

a) The potential for nutrient removal from the site; and
b) Limitations for the establishment of a land treatment system due to the acceptability of certain crops and land management practices receiving wastewater from a municipal source.

The existing land use of sites within the investigation area was determined from the LINZ land use database. The data was current at June 2010. It is acknowledged that some change in land use is likely to have occurred in the ensuing time but the data used is considered to provide sufficient certainty for this desktop assessment. Land use parameters considered are as follows.

6.4.1 Nutrient Uptake

The land cover type and land management practices adopted on any site are an indicator of the sites ability to remove nutrients applied as wastewater. Sites in the investigation area are scored as given in Table 1.

6.4.2 Acceptability

Food safety issues and public health perceptions create limitations to land treatment of wastewater. Further discussion with land holders is recommended following identification of preferred locations for wastewater application with regard to the acceptability of wastewater application to crops. A qualitative and comparative score can be given to each land use based on similar experience in other areas. Scores are given in Table 1 below.

Table 1: Land use parameter scores

Land Use Class	Nutrient uptake score	Acceptability score
71 – Natural forest	2	3
72 – Pre-1990 planted forest	2	5
73 – Post 1989 forest	2	5
74 – Grassland with woody biomass	3	5
75 – Grassland, high producing	5	3
76 – Grassland, low producing	3	4
77 – Cropland, perennial	4	2
78 – Cropland, annual	4	2
79 – Wetland, open water	0	0
81 - Settlements	1, 4 (reserves)	1, 3 (reserves)

6.4.3 Special Use Locations

Special use areas refer to sites with an identified community or cultural value. Typically, these areas are denoted on the Wairarapa Combined District Plan. Areas that are included, but not limited are:

- Water supply and catchment above water supply;
- Archaeological sites and sites identified by the Historic Places Trust;
- Other district plan designations.

There are varying concerns for different special use locations and the potential for impact from land application of wastewater is variable i.e. surface water take may create limitation

for the entire catchment above the take, while it may be acceptable to discharge wastewater up to a determined buffer distance form a small archaeological site. Each identified special use site is to be treated individually and scored from 0-5 as for other parameters. It is recommended that in detailed investigation of any site which has a special use on-site further consultation with concerned parties should be undertaken.

6.5 Soil Attributes

The soil is the primary receiving environment for applied wastewater and is the final treatment process for renovating the wastewater. The capability of the soil to:

a) Avoid transmittance of wastewater derived contaminants to the wider environment; and
b) Effectively recover the nutrient resource within the wastewater for plant and biota use.

is key to the successful development of a land treatment scheme. For the purpose of rating the land in the investigation area soil parameters assessed are given below.

6.5.1 Soil Drainage and Permeability

Soils ability to drain is a function of soil texture and soil structure. Data for the investigation area comes from the Fundamental Soil Layer (FSL, LRIS portal) and has a scale of 1:50,000. Areas are scored as follows:

- 5 – Well drained;
- 4 – Moderately well drained;
- 3 – Imperfectly drained or excessively drained;
- 2 – Poorly drained
- 1 – Very poorly drained.

6.5.2 Depth to Restrictive Layer

Restriction to water passage may be due to soil pans, rocks or groundwater. Data is from the FSL and has a scale of 1:50,000. Areas are scored as follows:

- 5 – >1.50 m;
- 4 – 1.20 – 1.49 m;
- 3 – 0.90 – 1.19 m
- 2 – 0.60 – 0.89 m;
- 1 – 0.45 – 0.59 m;
- 0 – <0.44 m

6.6 Hydrological and Hydrogeological Attributes

The prevention of wastewater derived contaminants entering water (surface or ground) is a key environmental objective of land treatment system design. It is of lesser concern in a land disposal system. The main mechanisms for transport to water are drainage to groundwater and direct surface water discharge i.e. by overland flow or flooding. The system should be designed to avoid overland flow and ideally excessive drainage volumes if land disposal is to be avoided. The likelihood of insufficiently treated wastewater entering water is reduced by:

a) Avoidance of sites with a high groundwater table; and

b) Avoidance of sites with a high risk of flooding.

In addition, the hydraulic properties of the shallow groundwater can influence the impact that the increased drainage volume can have and so must be considered. Land areas have been assessed as follows.

6.6.1 Depth to Seasonal High Groundwater Table

The ability to treat and disperse applied wastewater is limited by the available unsaturated soil volume i.e. depth to groundwater. The investigation area has been scored based on piezometric surface data form Greater Wellington Regional Council (GWRC). Ratings are as follows:

- 5 – >6 m
- 4 – 3-6 m
- 3 – 2-3 m
- 2 – 1-2 m
- 1 – 0.5-1 m
- 0 – <0.5 m

6.6.2 Mounding Risk

The rate at which groundwater moves, both horizontally and vertically influences the mixing and transport of drainage from soil. If the rate of movement is slow there is a potential for mounding of the piezometric surface to occur. This may cause a localised elevation of the groundwater table and may influence the flow of groundwater beyond the application site. The investigation area has been scored for mounding risk as follows:

- 5 – Horizontal hydraulic conductivity of groundwater >200 m/day;
- 4 – Horizontal hydraulic conductivity of groundwater 100-200 m/day;
- 3 – Horizontal hydraulic conductivity of groundwater 20-100 m/day;
- 2 – Horizontal hydraulic conductivity of groundwater 5-20 m/day;
- 1 – Horizontal hydraulic conductivity of groundwater 1-4 m/day;
- 0 – Horizontal hydraulic conductivity of groundwater <1 m/day.

6.6.3 Flood Return Interval

Flooding of a land treatment site causes:

- Loss of soluble applied nutrients;
- Potential loss of nutrient laden sediment;
- Damage to crops and soil quality;
- Damage to irrigation infrastructure; and
- Reduction in number of irrigable days.

The areas are scored based on the FSL Flood Return Interval as follows:

- 5 – Nil risk;
- 4 – Slight risk = <1 in 60 y;
- 3 – Moderate risk = 1 in 20 y to 1 in 60 y;
- 2 – Moderately severe risk = 1 in 10 y to 1 in 20 y;
- 1 – Severe risk = 1 in 5 y 1 in 10 y;
- 0 – Very severe risk = >1 in 5 y.

6.7 Summary

The described parameters when combined are considered to give a qualitative assessment of areas suitable for land application of wastewater at any point within the investigation area.

7 OPTION ASSESSMENT

7.1 Assessment by Parameter

Assessment of each parameter has been undertaken as described in Section 6. Maps for each parameter and for the aggregated maps are provided in Appendix A and the results and trends shown are detailed below. A legend which applies to the parameter maps is given as Figure 1, Appendix A.

7.1.1 Reticulation Zones

Figure 2, Appendix A gives a map of the area investigated. It was intended that the evaluation of the investigation area would incorporate limits based on pumping and piping requirements. Due to the limited availability of information and the scope of the assessment it was decided that this parameter should be addressed in more detail following the narrowing of the search area.

The 60 m contour has been identified on Figure 2. The MWWTP is located at approximately 20 m above mean sea level. It is considered that the requirements (pumping and piping) to reticulate the treated wastewater beyond 60 m above mean sea level would be prohibitive to the project. A number of the locations discussed in the following sections are highlighted on Figure 2.

7.1.2 Land Area

Figure 3, Appendix A gives a map of cadastral land parcels within the investigation area. In the process of developing a series of rules to score the land areas it was noted that property boundaries (titles) were often not represented by the cadastral parcels as often a property may be made up of a number of land parcels. Because of the level of detail required to resolve this layer, and specifically developing an understanding of the ownership structures, it was determined that property size should be addressed in a further investigation after other resource characteristics have narrowed down the likely area that could be used.

7.1.3 Nutrient Uptake Potential

Figure 4, Appendix A gives a map of nutrient uptake potential based on current land use. Extensive areas surrounding Martinborough are well suited to wastewater application for the purpose of nutrient removal. It is unlikely that a land application scheme will be limited by nutrient loading if a high removal cropping regime is managed on the site. Areas scored as 4 (yellow areas) tend to correspond to areas with an established horticultural crop such as vineyards and olive groves, which have a slower rate of biomass accumulation and removal, and correspondingly lower nutrient requirements.

7.1.4 Acceptability of Wastewater Application

Figure 5, Appendix A gives a map of acceptability of wastewater application based on the current land use. In general the acceptability is deemed to be low within the investigation area. This reflects the extent of horticulture and high producing (i.e. suitable for dairy) pasture in the area. These industries have traditionally taken a conservative view to wastewater application based largely on perception for their consumer. The issue of acceptability will vary widely amongst the community and should be examined more closely as preferred land areas are identified.

7.1.5 Special Use Locations

Figure 6, Appendix A shows the locations of historic, archaeological or designations identified by the Combined Wairarapa District Plan within the investigation area. In the case of the Martinborough water take on the Huangarua River the catchment above the water take is considered to have a greater sensitivity to wastewater application to land and so has been included in the area associated with the water take.

The presence of a special use at any location may not exclude the application of wastewater however, ease of consenting is expected to be less and the inclusion of buffer zones would reduce the available area for application of wastewater.

7.1.6 Soil Drainage and Permeability

Figure 7, Appendix A gives a map of soil drainage for the investigation area. Areas identified as well to moderately drained are typically located within the active floodplain of the Ruamahanga River. In general the Martinborough surrounds is dominated by imperfectly to poorly drained soils. These soils are considered to be limiting to wastewater application. Careful management and low application rates are likely to need to be employed for a MWWTP land application scheme.

Land in the area of Dry River/Dyerville is likely to be well suited to wastewater application on the basis of soil drainage.

7.1.7 Soil Depth to Restrictive Layer

Figure 8, Appendix A gives a map of soil depth to a restrictive layer. In general the areas adjacent to the Ruamahanga River and Huangarua River, corresponding to the active floodplain are not constrained by a restrictive layer. The landform associated with Martinborough township, forming a wedge between the Ruamahanga River and Huangarua River, is similarly not constrained by a restrictive layer. Land around Dry River/Dyerville are not constrained by a restrictive layer. These areas are considered to be well suited to application of wastewater on this basis.

Areas associated with the Martinborough terraces, an uplifted alluvial surface southwest of the township, have limitations due to shallow restrictive layers (soil pan and high groundwater) and are less suited to wastewater application. The area around Ponatahi Road is similarly limited.

Areas over the right bank of the Ruamahanga River below Te Maire Ridge have severe limitations due to a shallow restrictive layer.

7.1.8 Depth to Seasonal High Groundwater

Figure 9, Appendix A gives a map of the piezometric surface across the investigation area. The map indicates that seasonal high groundwater level is unlikely to be a limiting factor over most of the investigation area. Field experience within the general area suggests that seasonal saturation at comparatively shallow depths occurs in the parts of the investigation area but is not reflected in the piezometric surface mapped. As a result the information available for review is considered to be of a scale which is insufficient for this assessment. Scores for the depth to seasonal high groundwater parameter have not been included in the aggregated mapping.

Depth to restrictive layer (Section 7.1.7) is considered to adequately describe the depth to a saturated layer since it includes saturation due to a perched water table where that occurs.

7.1.9 Mounding Risk

Figure 10, Appendix A gives a map of the horizontal hydraulic conductivity of the unconfined groundwater within the investigation area. It can be seen that the area to the west of Martinborough, on the left of the Ruamahanga River and known as the Martinborough Terraces, is the most limited for wastewater application due to the slow movement of groundwater under the site. Wastewater if applied at an inappropriate rate has the potential to raise the groundwater in the region of the application and alter the flow direction of the groundwater. Low rate application would be necessary in this area.

Areas associated with the Ruamahanga river channel and active floodplain are unlikely to have issues with groundwater mounding due to the rapid movement of groundwater in these zones.

The remaining areas, in particular in the area of Dry River, have a moderate risk of groundwater mounding. The design of a wastewater application regime in these areas would require consideration of the mounding risk in the region of the site.

7.1.10 Flood Return Interval

Figure 11, Appendix A gives a map of the flooding risk in the investigation area as indicated by the flood return interval. In general the areas with the lowest flooding risk are upfaulted areas to the east of the Ruamahanga River and around Te Maire Ridge. The areas subject to most frequent flooding are adjacent to the Huangarua and Dry River, and are located along the Lower Ruamahanga River Floodways floodplain and low lying areas adjacent to Lake Wairarapa.

7.2 Combining Rating Results

Ratings for the individual parameters were combined as described in Section 5. As outlined in Section 7.1, some parameters were excluded from the combined ratings and so the final rating was based on a total score of 30. Zones as described have been assigned as follows:

- Zone A (score of 25-30) – No significant limitations are experienced within areas of this rating zone. Zone A represents the preferred zone for siting of a land treatment system;
- Zone B (score of 20-24) – Minor limitations are experienced within areas of this rating zone. Zone B is likely to be well suited for land treatment;
- Zone C (score of 15-19) – Some limitations are experienced within areas of this rating zone. Zone C is suitable for land treatment when appropriately managed;
- Zone D (score of 8-14) – Significant limitations are experienced within areas of this rating zone. Land treatment is likely to be possible within zone D however costs and management requirements are expected to be greater than other zones; and
- Zone E (score of 0-7) – Severe limitations to land treatment are experienced within areas of this rating zone. It is likely that cost and management requirements would be prohibitive to the establishment of land treatment in zone E.

Land located below 60 m above mean sea level has been considered.

7.2.1 Rating Summary

Areas corresponding to Zone A and Zone E do not occur in the investigation area. This suggests that no land considered ideal for wastewater application is present is the area, and also no area is present which has severe limitations to land application of wastewater.

The area directly surrounding Martinborough between the confluence of the Huangarua River with the Ruamahanga River and the area known as the Martinborough Terraces is Zoned B and is considered to be suitable for the sustainable operation of a wastewater land application scheme. Other areas nearby which are Zone B are a wedge of land extending from Lake Ferry Road at approximately Kellys Stream, south for around 1.7 km, and land in the vicinity of Dyerville following the terraces associated with Dry River.

In the event that no land within Zone B is available for wastewater application the areas zoned C and located on the Martinborough Terraces and north east of the township can be considered for the development of a land application scheme. Zone C land it is likely to require the employment of more technical solutions, higher management inputs and greater wastewater storage requirements.

8 CASE STUDY: PAIN FARM

8.1 Background

SWDC presently owns a section of land on Lake Ferry Road known as Pain Farm. Property details are given in Table 2.

Table 2: Pain Farm Details

Address	588 Lake Ferry Road
Legal description	Pt. Section 5/Wharekaka DIST
Area	84.9839 ha
Owner	South Wairarapa District Council
Distance from WWTP	~2 km by pipe route

Pain Farm has been identified as a potential location for the establishment of a land treatment system for Martinborough's WWTP wastewater. Some initial investigation has been undertaken into, in particular, the costs associated with establishment of land treatment on the site. These investigations include assessment of the potential agronomic benefit and preliminary irrigation design (Baker and Associates, 2011); and, evaluation of pipe routes (NZET, 2011).

LEI has applied the above desktop evaluation of the site to determine:

- Suitability and limitations to land treatment on the site; and
- Whether Pain Farm corresponds to a 'preferred' location for land treatment and therefore whether further detailed investigation of the site is warranted.

8.2 Combining Rating Results

Pain Farm has been identified on Figures 2-12 representing each of the assessment parameters. Ratings for the individual parameters were combined as described in Section 5. The score for each parameter is given in Table 3. Because the location is known parameters which were excluded in the determination of Zones given in Section 7 can be applied to the Pain Farm location as follows.

Table 3: Pain Farm Rating Summary

Parameter	Score
Reticulation	4
Land area	5
Land use – nutrient	5
Land use – acceptability	3
Land use – special use	2
Soil – drainage	2
Soil – depth to restriction	3
Hydro – seasonal high groundwater	2
Hydro – mounding risk	1
Hydro – flood return interval	5
Total	**32**

The total score of 32/50 corresponds to Zone C which is described as follows:

- *Zone C (25-33) – Some limitations are experienced within areas of this rating zone. Zone C is suitable for land treatment when appropriately managed;*

The results given in Table 3 indicate that limitations at the Pain Farm site are due to the soil drainage, and groundwater level and slow rate of movement under the site. These conditions occur due to the location of the Pain Farm site on the Martinborough terraces which is an up-faulted block with surficial geology dominated by fine grained alluvium (river sediment). The soil is young and poorly structured as a result water movement in both the unsaturated and saturated (groundwater) zone is restricted. This indicates that the rate at which water (as wastewater) can be added to the surface of the soil should be designed to match the rate of plant uptake and evapotranspiration at the site as closely as possible (i.e. minimise drainage following irrigation). The careful management of application, soil cultivation and harvest regimes is necessary to:

- Avoid soil damage due to excessive irrigation or cultivation and traffic on wet soils; and
- Ensure drainage to groundwater in excess of the unirrigated rate is minimised so that groundwater elevation and direction of movement is not impacted.

As a result of the site's constraints the number of days per year on which wastewater application can occur is likely to be less than for sites in Zone B.

In addition, as indicated by the Special Use Zone score, the proximity of the site to a closed landfill is considered to be a limitation. Details of the management and monitoring of the adjacent closed landfill was not reviewed for this case study. In the event that additional investigation is undertaken with regard to Pain Farm, it would be advisable to conduct a detailed review of monitoring information relating to the adjacent closed landfill. Particular care would be needed in the design of wastewater application regime to ensure that the properties of the groundwater near the landfill were not altered, potentially impacting on the interaction of groundwater with the landfill.

The available land area which is capable of receiving the entire daily wastewater flow from MWWTP on days when application is possible is an advantage of the Pain Farm site. The potential land use score reflects the site's capability to sustain a high production regime for well managed crops.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Assessment Conclusions

This desktop assessment method is intended to be used as a first step in the design process for a wastewater application to land scheme. Additional stages are required to supply detail about preferred land areas and project engineering considerations such as reticulation routes. The additional information contains a level of detail which is not considered feasible or appropriate for a desktop assessment of regional suitability for land application of wastewater. Recommendations are given below for the progression of additional work to determine an appropriate location and application regime.

Areas corresponding to Zone B represent the most suitable land for application of wastewater. These areas occur:

- Directly surrounding Martinborough between the confluence of the Huangarua River with the Ruamahanga River and the area known as the Martinborough Terraces;
- A wedge of land extending from Lake Ferry Road at approximately Kellys Stream, south for around 1.7 km; and
- Land in the vicinity of Dyerville following the terraces associated with Dry River.

9.2 Pain Farm

- Initial investigation has been undertaken into, in particular, the costs associated with establishment of land treatment on the Pain Farm site. Including:
    - Potential agronomic benefit and preliminary irrigation design (Baker and Associates, 2011); and
    - Evaluation of pipe routes (NZET, 2011).
- LEI has applied a desktop assessment method to the site using weighted criteria which enabled the assessment of Pain farm against:
    - Other land in the Martinborough area; and
    - An idealised land treatment site that has optimum conditions for wastewater application.

The results of the Pain Farm investigation indicated that:

- The Pain Farm site has a total score of 32/50 placing it within "Zone C" which is described as: *Zone C (25-33) – Some limitations are experienced within areas of this rating zone. Zone C is suitable for land treatment when appropriately managed*.
- Land treatment of wastewater on Pain Farm is likely to be feasible with careful management to:
    - Avoid soil damage due to excessive irrigation or cultivation and traffic on wet soils;
    - Ensure drainage to groundwater in excess of the unirrigated rate is minimised so that groundwater elevation and direction of movement is not impacted.
- As a result of the sites constraints the number of days per year on which wastewater application can occur is likely to be less than for sites in Zone B.

- There are higher scoring areas than Pain Farm in the Martinborough surrounds. The availability of land in preferred zones should be investigated before further work is done on Pain Farm.

9.3 Recommendations

It is recommended that the following actions are undertaken:

- Weightings for each of the assessed criteria should be reviewed based on stakeholder concerns and SWDC considerations. Following the review the Pain Farm ranking should be reassessed.
- Availability and access to land within the areas demarked as Zone B should be investigated with the top 12 sites identified and a resource assessment for the areas considered should undertaken.
- A preliminary investigation should be considered for up to four sites.
- A detailed evaluation of the preferred site(s) should be undertaken.

10 REFERENCES

NZ Environmental Technologies (NZET). 2010. Martinborough Wastewater Treatment Short-Term Upgrade - Consent Variation - Assessment of Environmental Effects.

11 APPENDICES

Appendix A: Figures

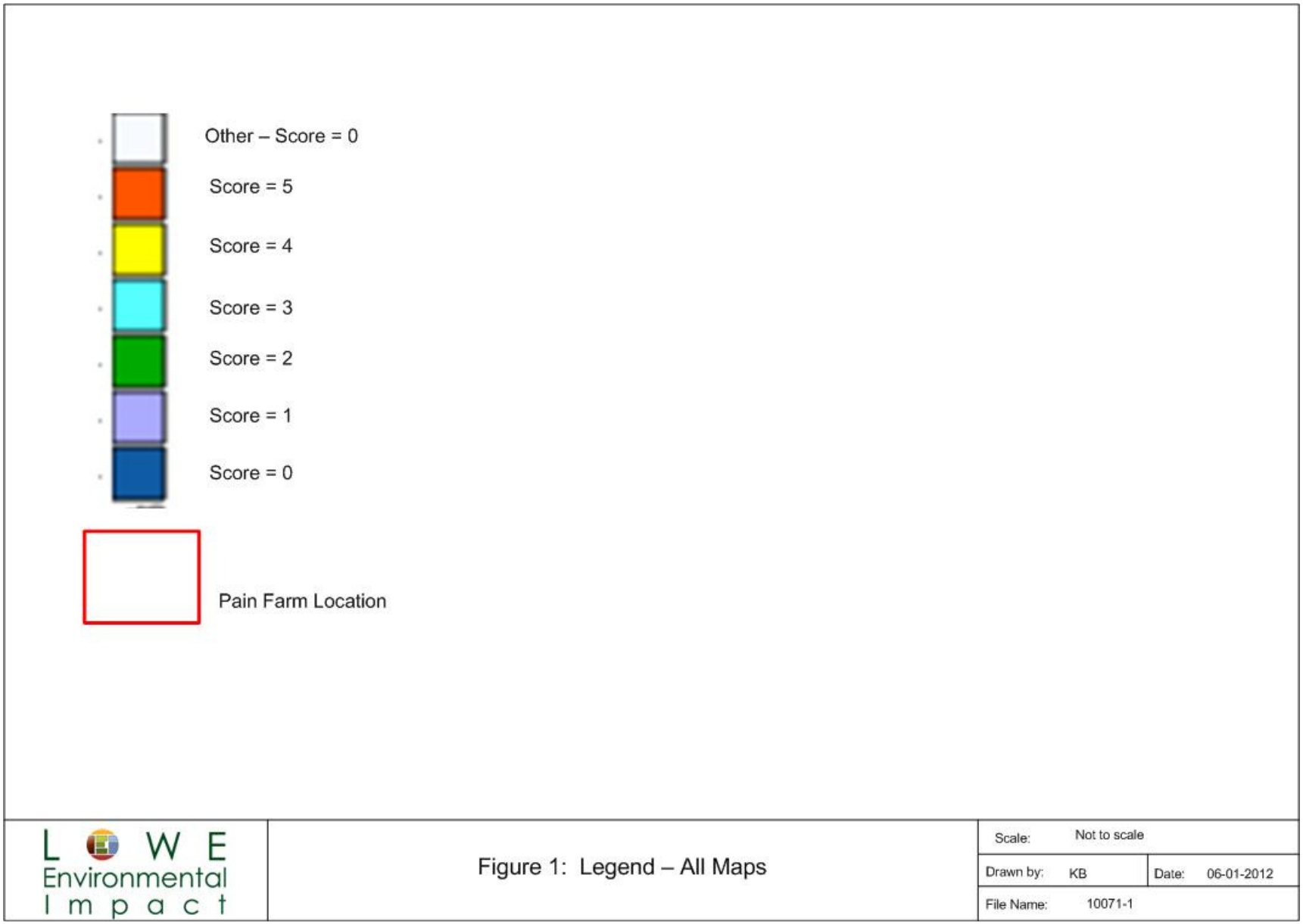


Figure 1: Legend – All Maps

Figure 2: Evaluation Area and Reticulation Zones

Figure 3: Property Land Areas

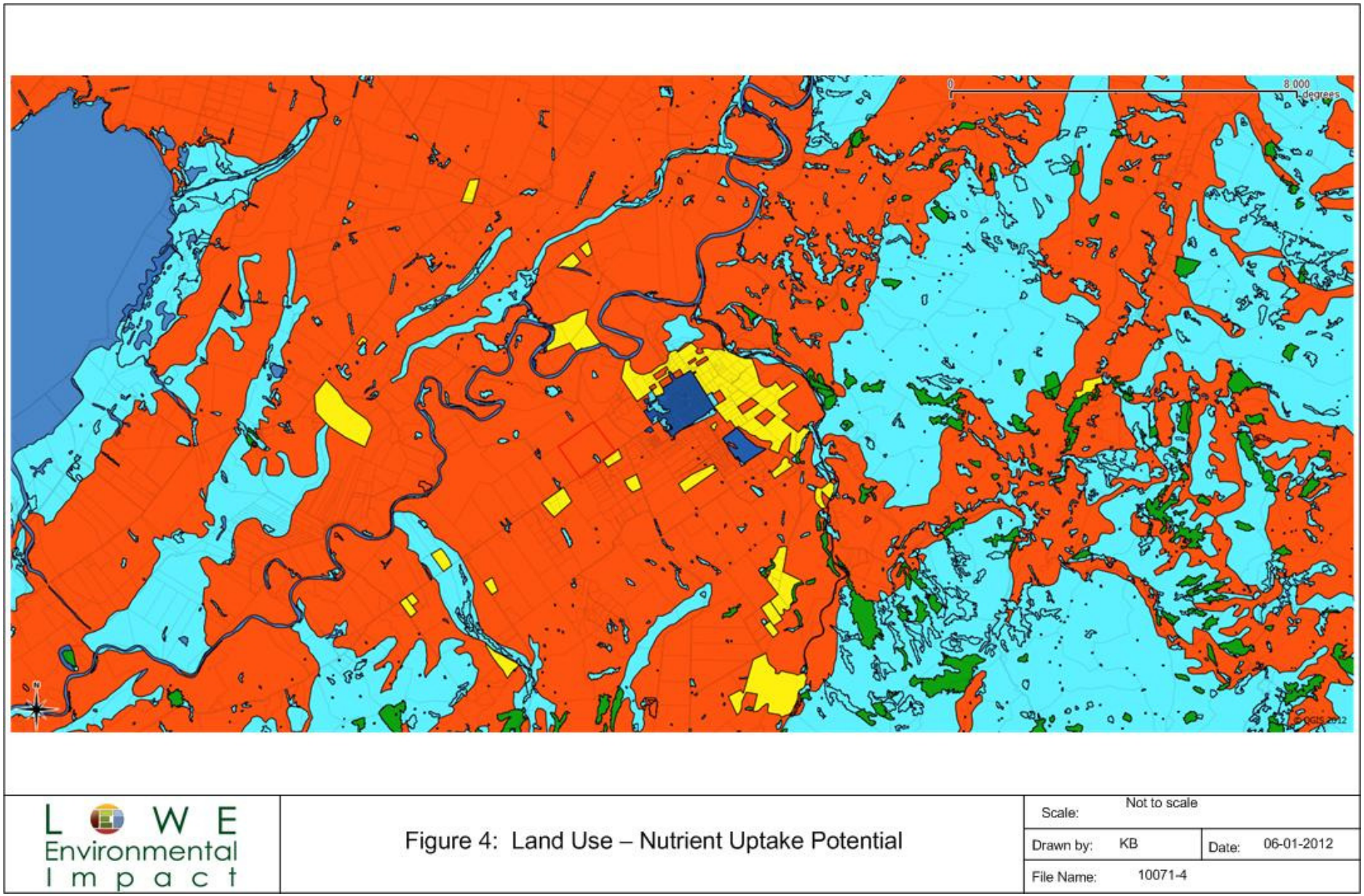


Figure 4: Land Use – Nutrient Uptake Potential

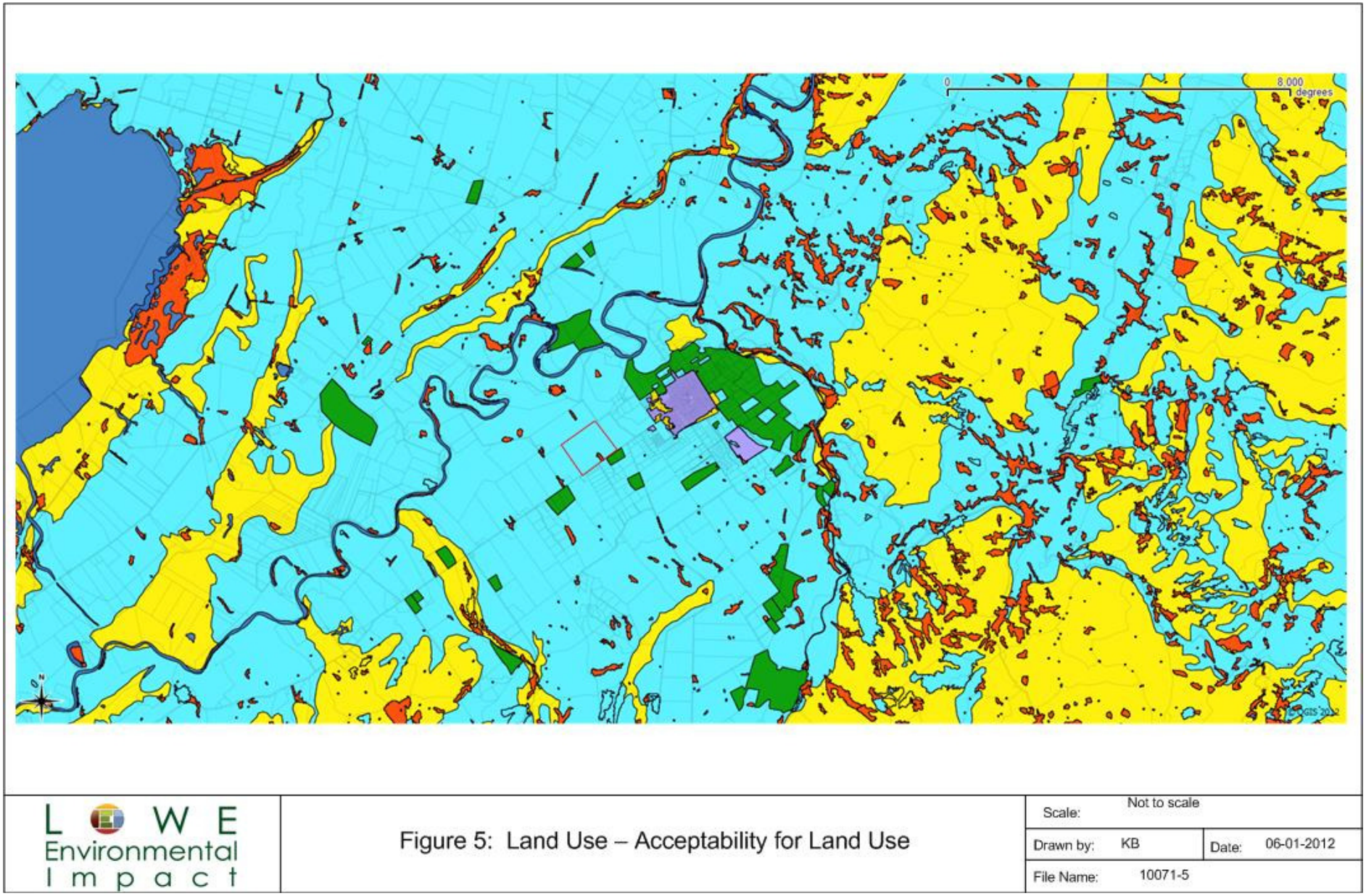


Figure 5: Land Use – Acceptability for Land Use

Figure 6: Land Use – Special Use Areas

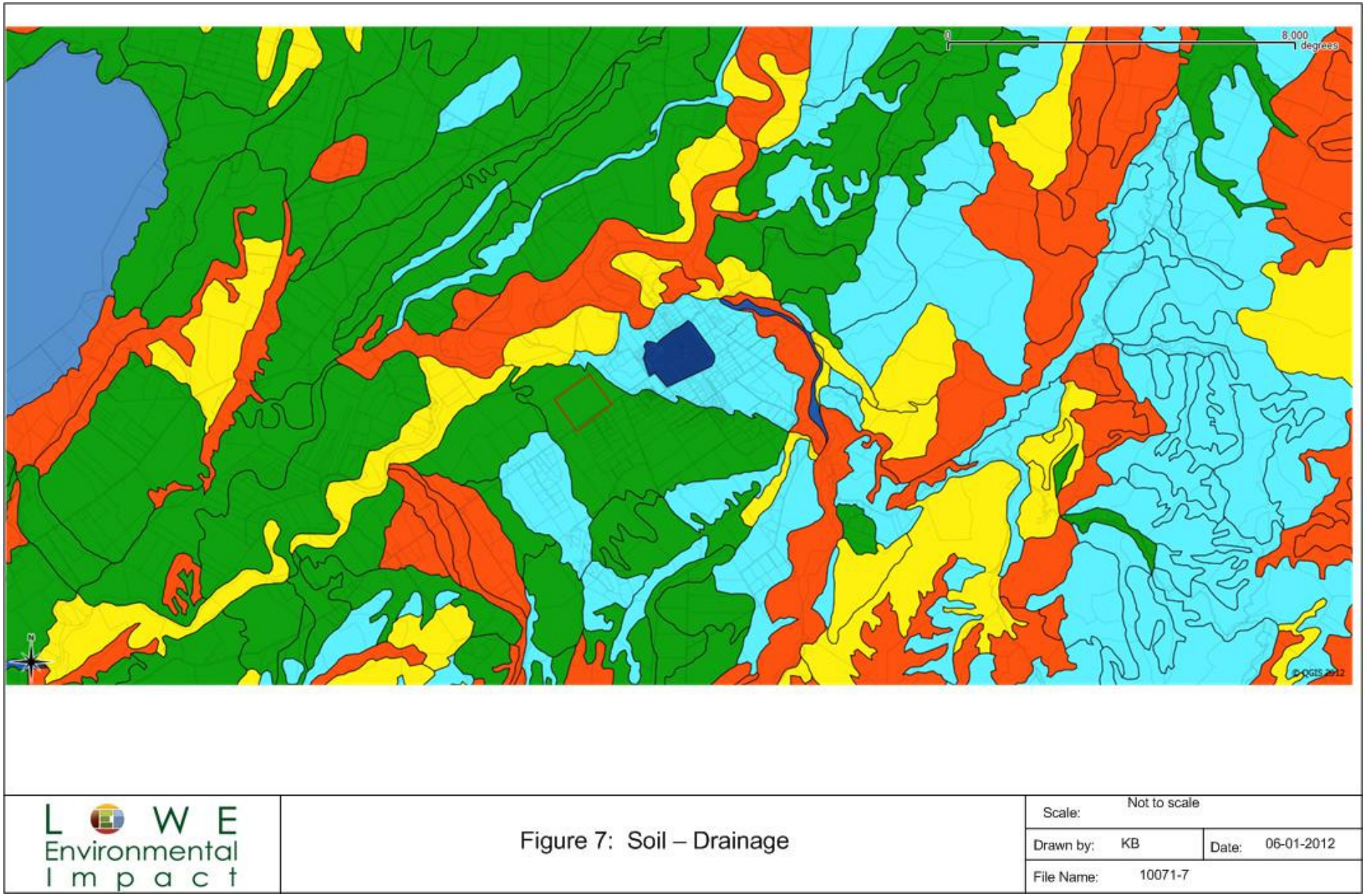


Figure 7: Soil – Drainage

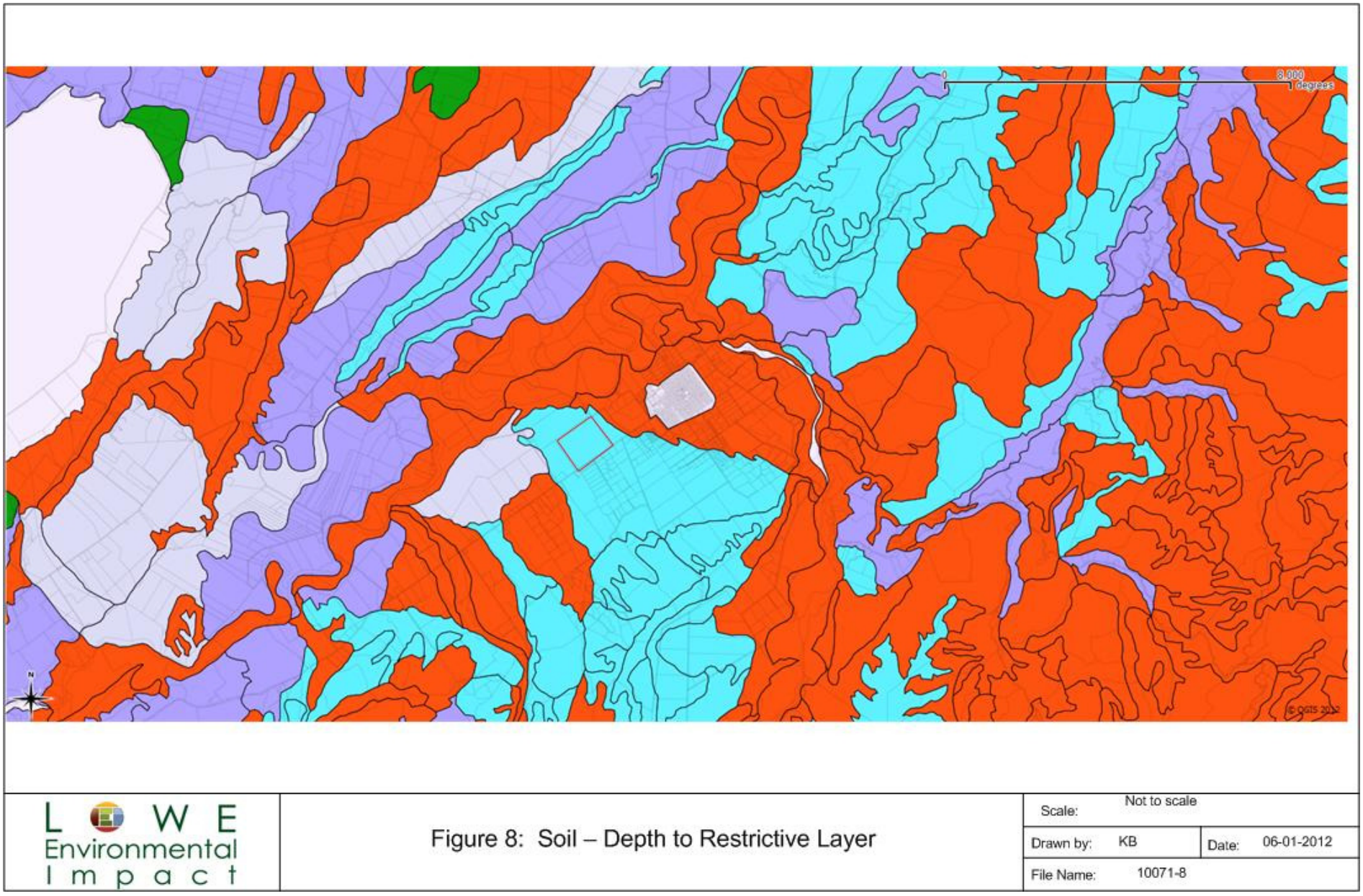


Figure 8: Soil – Depth to Restrictive Layer

Figure 9: Hydrogeological – Seasonal High Groundwater Level

Figure 10: Hydrogeological – Groundwater Mounding Risk

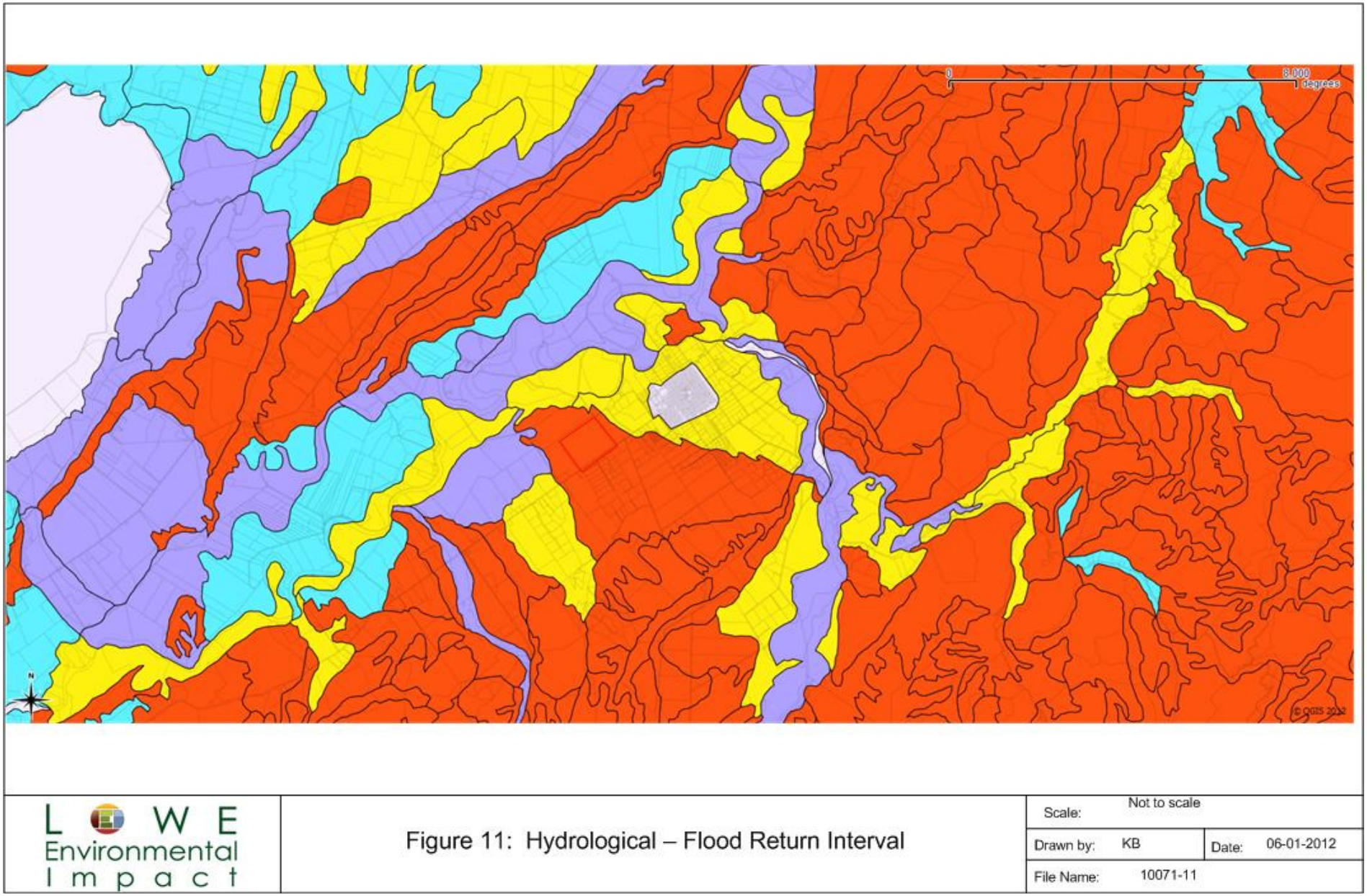


Figure 11: Hydrological – Flood Return Interval

Figure 12: Land Treatment Suitability Zones

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