ATTACHMENT C

RPI Assessment Report

TECSOL

Tenement & Environment Compliance Solutions

ACACIA COAL LIMITED

Comet Ridge Project

Regional Planning Interests (RPI) Assessment Report

Version 1.0 29 October 2014

ACACIA COAL LIMITED

Comet Ridge Project

Regional Planning Interests (RPI) Assessment Report

DOCUMENT CONTROL

ITEM	DESCRIPTION
Project Name	Comet Ridge Project
Project Ref	Regional Interests Development Approval
File Location	X:\CLIENTS\Acacia Coal\3. ENVIRONMENTAL\Approvals\RIDA
Author	Emma Montgomery
Status	Final
Version	1.0
Date	29 October 2014

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Acacia Coal Limited is the Proponent for the Comet Ridge Project (CRP); a proposed open-cut coal mine located approximately 30 kilometres south of the township of Comet, Queensland. Following attainment of the necessary statutory approvals, the mine will involve the extraction of a maximum of 1.95 Million tonnes per annum (Mtpa) of Run-of-Mine (ROM) coal. The coal will be progressively mined from four pits over a nine year term.

This document is referred to as the Regional Planning Interests (RPI) Assessment Report (RPI Assessment Report). The report is provided to describe the proposed Project activities, the impacts of the activities on the area of regional interest, the current land use, the existing and proposed approvals for the Project, and the validity of the Project lands classification as Priority Agricultural Area (PAA) and Strategic Cropping Area (SCA).

Sections 19(1) and 19(2) of the *RPI Act* state that a *"person must not wilfully* (or otherwise) *carry out, or allow the carrying out of, a resource activity or regulated activity in an area of regional interest unless the person holds, or is acting under, a regional interests development approval for the activity*".

Our studies have concluded that the CRP land is not currently used for Priority Agricultural Land Use (PALU), nor has the land been used for PALU within the last ten (10) years. Further, the CRP land is not located within land mapped as Strategic Cropping Area (SCA).

This report is therefore provided to seek confirmation from the Chief Executive of the Department of State Development, Infrastructure and Planning (DSDIP) that the proposed CRP does not require a Regional Interests Development Approval (RIDA) under Part 3, Division 2 of the *RPI Act*.

1.0 INTRODUCTION

1.1 Document Purpose

The *Regional Planning Interests Act 2014 (RPI Act)* identifies and protects areas of Queensland that are of regional interest. In doing this, the *RPI Act* seeks to manage the impact and support coexistence of resource activities and other regulated activities in areas of regional interest (Department of State Development, Infrastructure and Planning, 2014).

A Regional Interests Development Approval (RIDA) may be required when a resource activity is proposed to be located in an area of regional interest.

The *RPI Act* identifies and protects:

- Priority Agricultural Areas (PAAs);
- Priority Living Areas (PLAs);
- Strategic Environmental Areas (SEAs); and
- Strategic Cropping Areas (SCAs, formerly Strategic Cropping Land).

This document addresses the requirement for a RIDA for the CRP, with particular reference to section 29(b) of the *RPI Act.*

1.2 Project Proponent

Acacia Coal Limited (Acacia Coal) (ACN 009 092 068; ABN 13 009 092 068) (ASX:AJC) is the Proponent for the proposed Comet Ridge Project (the 'Project'); a small open-cut coal mine (i.e. a resource activity) located near Comet in Central Queensland.

Acacia Coal is a publicly listed company on the Australian Securities Exchange (ASX) and is actively involved in coal exploration and mine development (Acacia Coal, 2014). The company identifies, acquires and exploits opportunities in coal resources that could be brought into production to provide coking coal suitable for the export market (ASX, 2014).

1.3 Project Location

The Project is located approximately 30 kilometres (km) south of the township of Comet and 250 km west of Rockhampton in the Bowen Basin of Central Queensland (**Figure 1**).

The CRP site is located in the Central Highlands Regional Council Local Government Area. The CRP is located approximately 33 km southwest of Blackwater. The closest regional centres are Comet and Springsure which are respectively located 25 km to the north and 65 km to the southwest of the Project.

There are no registered easements within the MLA.

620000 650000 680000

7390000

7360000

Retreat Creek
Theresa Creek
Nogoa River
Mackenzie River
Sandhurst Creek
Comet River
Minerva Creek
Springsure Creek
Blackwater Creek

Capricorn Hwy
Emerald
Selma Rd
Gregory Hwy
Fairbairn Dam Rd
Fairbairn State Forest
Comet
Blackwater
Mace Dr
Blackwater-Rolleston Rd
Stewarton
Comet River Rd
Amaroo State Forest
Gindie
Kilkivan Hwy

A4 A7

•Townsville
•Hughenden
•Mackay
•Longreach
Barcaldine
•Emerald
•Rockhampton
•Gladstone

NOTES
Tenements: Dept. of Mines & Energy, October 2014
BaseMap: ESRI

LEGEND

Proposed Comet Ridge Mining Lease Application

0 1.5 3 4.5 6
Kilometres
Coordinate System:
GDA 1994 MGA Zone 55

DISCLAIMER
In preparing this map, RLMS have endeavoured to ensure
that the data and information are as accurate and reliable as possible.
However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study.
RLMS expressly disclaims any loss or damage that may
arise therefrom.

CLIENT	ACACIA COAL LIMITED
PROJECT	COMET RIDGE PROJECT
FIGURE 1	LOCATION OF THE COMET RIDGE PROJECT
DATE	OCTOBER 2014

REF: CRP-RLMS023 Rev3

RLMS
Acacia Coal

Layout: A3 Landscape

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\RegionalLocation_023.mxd
Created on 17/10/2014 by KR

1.4 Project Approvals

The CRP comprises one Mining Lease Application (MLA) which requires assessment and approval by the Department of Natural Resources & Mines (DNRM) under the *Mineral Resources Act 1989 (MR Act)*. The ML covers an area of 1186 hectares (ha) and is wholly contained within Acacia Coal's existing Exploration Permit for Coal (EPC) 1230. **Figure 2** illustrates the proposed MLA and EPC 1230.

The MLA will be accompanied by a Site-specific Environmental Authority (EA) application which will required assessment and approval by the Department of Environment & Heritage Protection (DEHP) under the *Environmental Protection Act 1994 (EP Act)*. The EA will be sought to allow the conduct of numerous Environmentally Relevant Activities (ERAs) including but not limited to ERA 13 – Mining Black Coal and ERA 31 – Mineral Processing. The EA Application will cover all of the land that is the subject of the RIDA.

The Proponent intends on lodging the MLA & EA Application to the regulatory authorities for assessment in early 2015.

1.5 Property Description

The Project MLA traverses two grazing properties, known as The Lagoons and Monash Pastoral. The majority of the MLA is located on the Monash Pastoral property. The MLA occurs on one freehold and one pastoral leasehold land tenures, as described in **Table 1**. However, the Monash property is currently in the process of conversion to Freehold.

Table 1: Properties underlying Project MLA

LOT NUMBER	REGISTERED PLAN NUMBER	LAND TENURE	LAND USE	PROPERTY NAME
2	HT56	Freehold	Grazing	The Lagoons
3	SP185510	Leasehold	Grazing	Monash

Appendix A provides the title searches for the aforementioned properties.

The contact details for the land owners are provided in **Table 2**.

Table 2: Land Owner Details

LAND PARCEL ID	LAND OWNER	POSTAL ADDRESS	TELEPHONE NUMBER	EMAIL ADDRESS
Lot 2 HT56	Stuart Thomas Dixon & William Richard Dixon	2672 Comet River Road TOGARA QLD 4702	(07) 4986 1920	wrstdixon@bigpond.com
Lot 3 SP185510	Stephen Charles Bottomley & Vicki Delia Bottomley	Barlow Road COMET QLD 4702	(07) 4986 1872	monashpastoral@activ8.net.au

1.6 Current Land Use

The aforementioned CRP land parcels are currently used for cattle grazing and have been partially cleared to accommodate this activity.

Figure 3 provides an illustration of the existing land uses and activities of the MLA area plus an additional 1km radius beyond the MLA boundary.

650000

680000

7390000

7360000

Townsville
Hughenden
Mackay
Longreach
Barcaldine
Emerald
Rockhampton
Gladstone

Capricorn Hwy
A4
Comet
Comet River Rd
Mace Dr
Blackwater
Blackwater Creek
Stewarton
Amaroo State Forest
Comet River
Minerva Creek
Blackwater Rolleston Rd
Comet Rolleston Rd

EPC1230

NOTES
Tenements: Dept. of Mines & Energy, October 2014
BaseMap: ESRI

LEGEND
- Proposed Comet Ridge Mining Lease Application
- Acacia Coal Exploration Permit (EPC1230)

0 1.5 3 4.5 6
Kilometres
Coordinate System:
GDA 1994 MGA Zone 55

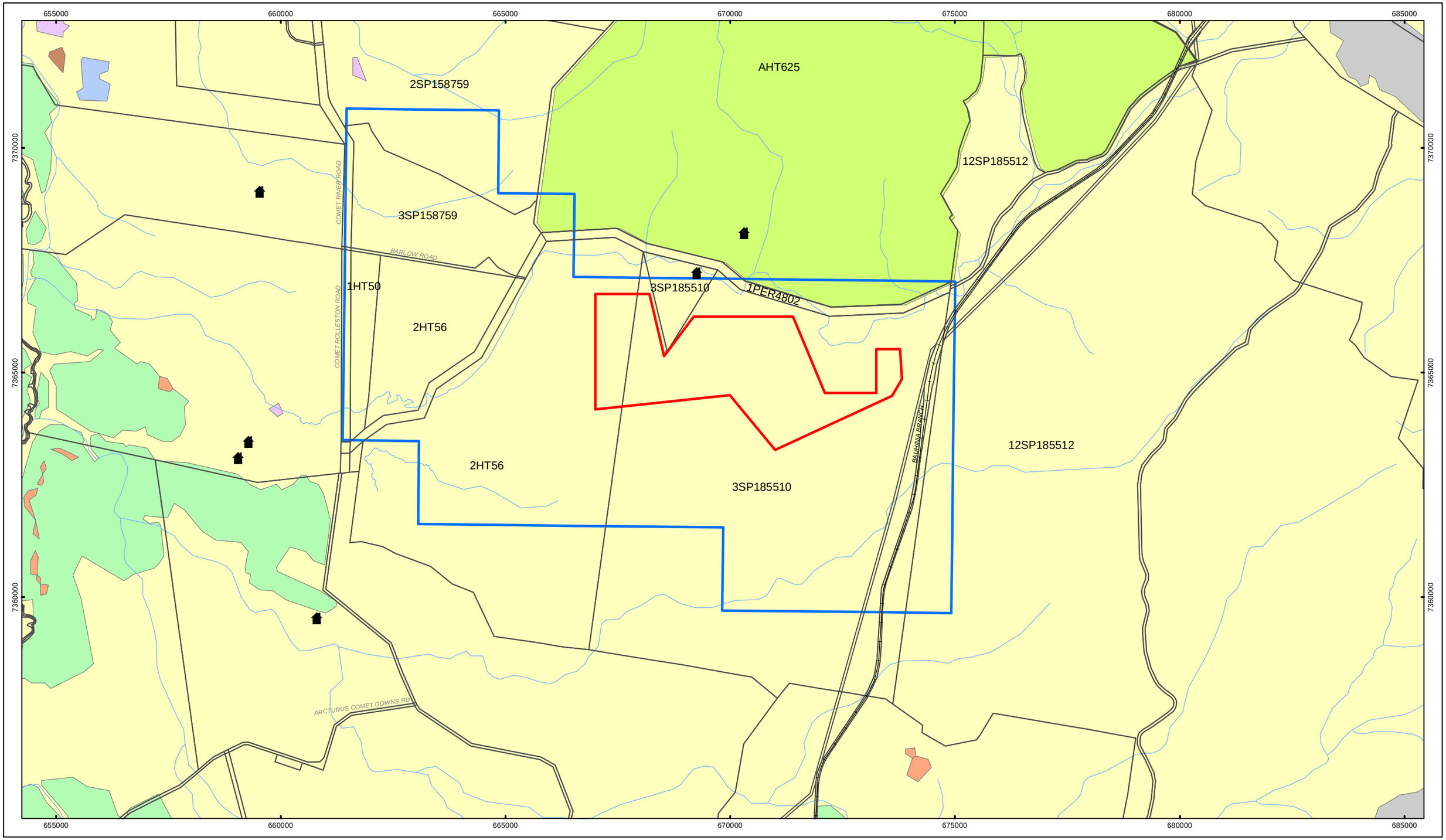
DISCLAIMER
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\RegionalLocation_023.mxd
Created on 17/10/2014 by KR

CLIENT **ACACIA COAL LIMITED**
PROJECT **COMET RIDGE PROJECT**
FIGURE 2 **EPC 1230 & PROPOSED MINING LEASE APPLICATION**
DATE **OCTOBER 2014**
REF: CRP-RLMS023 Rev3

RLMS
Acacia Coal

Layout: A3 Landscape



NOTES
Cadastral Boundary: DERM, March 2014
Priority Agricultural Area: Dept of State Development, Infarstructure & Planning, September 2014
Mining Lease: Acacia Coal, 10/09/2014

LEGEND

- Proposed Comet Ridge Mining Lease Application
- Acacia Coal Coal Exploration Permit (EPC 1230)
- Cadastral Boundary
- Existing Railway
- Minor Watercourse
- Homestead

Land Use

- Cropping
- Grazing natural vegetation
- Intensive animal production
- Mining
- Other minimal use
- Production forestry
- Reservoir/dam
- Waste treatment and disposal

0 1 2 3 4
Kilometres
Coordinate System:
GDA 1994 MGA Zone 55

DISCLAIMER
In preparing this map, RLMS have endeavoured to ensure
that the data and information are as accurate and reliable as possible.
However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study.
RLMS expressly disclaims any loss or damage that may
arise therefrom.

CLIENT **ACACIA COAL LIMITED**
PROJECT **COMET RIDGE PROJECT**
FIGURE 3 **EXISTING LAND USES**
DATE **OCTOBER 2014**
REF: CRP-RLMS058 Rev1

RLMS
Acacia Coal
Layout: A3 Landscape

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\LandUse_058.mxd
Created on 19/10/2014 by KR

2.0 DESCRIPTION OF RESOURCE ACTIVITIES

2.1 Overview

The Comet Ridge Project (CRP) is a proposed small open-cut coal mine wholly located within one Mining Lease Application (MLA) area. The CRP will involve the average extraction of approximately 1.6 Million tonnes per annum (Mtpa) of Run-of-Mine (ROM) coal from two seams. In favourable conditions, the ROM extraction rate will increase to a maximum of 1.95 Mtpa. Typical truck and shovel mining methods will be utilised to progressively develop four consecutive open-cut pits over nine years.

The key infrastructure components of the CRP include:

- Four open cut pits namely, George Pit, Triumph Pit, Boundary North Pit & Boundary South Pit and associated waste rock dumps;
- Coal Processing Plant (CPP);
- Product Coal Stockpile and Truck Load Out (CP-TLO) facility;
- ROM pad;
- Make-up water dam, dirty water dam & sediment dams;
- Co-disposal handling and storage facilities (CDF);
- Haul roads; and
- Workshop & site offices.

ROM coal will be processed on site in a modular Coal Processing Plant (CPP) yielding up to 200 kilo tonnes per annum (Ktpa) of saleable semi-hard coking coal for offshore export via the Port of Gladstone. Product coal will be stockpiled at the Coal Processing Plant and loaded into trucks for transport off lease via MLA 70502 to the multi user Triumph Creek Train Load Out Facilities located on MLA 70501 (**Figure 4**).

MLAs 70501 & 70502 are currently held by Springsure Creek Coal Pty Ltd (SCC) which is a wholly owned subsidiary of Bandanna Energy. On 22 September 2014, the Bandanna Energy Group was placed into Voluntary Administration. Receivers were appointed to Springsure Creek Coal Pty Ltd on 22 October 2014. It is believed that the Administrators for the Bandanna Energy Group are currently pursuing new owners for their Springsure Creek Coal Project, which includes MLAs 70501 & 70502.

The CRP will employ approximately 40 contractors for the construction phase and a peak work force of up to 50 full time and part time personnel for the operational phase. All site personnel will source their own accommodation in the surrounding area including the townships of Comet and Blackwater.

Access to the CRP site will be via the Comet Downs Road and private road by way of the adjacent transport corridor contained within MLA 70502 (**Figure 4**).

667000 668000 669000 670000 671000 672000 673000 674000 675000

7367000 7366000 7365000 7364000 7363000

Triumph Creek

Boundary North Pit

Boundary South Pit

Triumph Pit

George Pit

Make-up Water Dam

Dirty Water Dam

ROM Pad

CPP

Workshop & Offices

CP-TLO

MLa 70501

MLa 70502

Mine Access Road

Point	Easting	Northing
1	667000.0	7366750.0
2	668200.0	7366750.0
3	668527.0	7365366.0
4	669182.0	7366250.0
5	671400.0	7366250.0
6	672100.0	7364551.0
7	673250.0	7364551.0
8	673250.0	7365521.0
9	673781.0	7365521.0
10	673821.0	7364857.0
11	673597.0	7364485.0
12	670998.9	7363281.3
13	670000.0	7364500.0
14	667000.0	7364180.0

NOTES
Tenements: Dept. of Mines & Energy, 2014
Imagery: NearMap, April 2011
Proposed Mining Lease Boundary: Acacia Coal: 10/09/2014
Potential Pits: Acacia Coal, 28/08/2014
Springsure Corridor: Bandanna Energy, 24/02/2014

DISCLAIMER
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

LEGEND

Comet Ridge Project
- EPC 1230
- Proposed Mining Lease Area
- Open Cut Pits
- Dams
- Dump
- Co-disposal Facility
- Other Infrastructure
- Co-disposal Pipeline
- Sediment Dams & Diversions
- Conveyor
- Road
- Existing Railway
- Minor Watercourse

Springsure Creek Coal Project
- Proposed Triumph Creek Rail Loop
- Springsure Creek Coal Mining Lease Area

0 0.25 0.5 0.75 1
Kilometres
Coordinate System:
GDA 1994 MGA Zone 55

CLIENT **ACACIA COAL LIMITED**
PROJECT **COMET RIDGE**
FIGURE 4 **PROPOSED MINING LEASE APPLICATION LAYOUT PLAN**
DATE **OCTOBER 2014** REF: CRP-RLMS018 Rev18

RLMS Acacia Coal

Layout: A3 Landscape

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\Operations_Layout_018.mxd
Created on 17/10/2014 by KR

2.2 Mining Activities

The coal sequences the CRP include two (2) multi-banded seams (namely the Fair Hill Seam and Triumph Seam) of varying thickness of coal, mudstone, sandstone and shale. These seams will be targeted across four small open-cut pits. The mining process will involve the removal of overburden material to access the coal seams followed by the direct mining of the banded sequences in a series of stages. The staged mining approach will provide the appropriate proportions of raw coal feed blend to the CPP and thereby ensuring consistent product coal quality.

Overburden will be removed with a combination of wheeled scrapers for the topsoil and free dig material in the upper sections and conventional excavator and truck equipment. Initially, as a new pit is commenced, the overburden will be placed in selected areas out of the pit and adjacent to the open pit, forming above ground dumps that will be subsequently shaped, topsoiled and revegetated to produce a stable landform. Any interburden and partings that may be selectively mined will also be directed to the relevant active waste dump at that time. As mining progresses and the pit void volume increases to provide space, all waste will be dumped within the pit in order to backfill the void.

The ROM coal sequence will be mined at rates of up to 600 tph and sized to reduce all of the coal to <50 mm lump sizes and the oversized >50 mm rejects will remain in the pit as waste. Some in pit screening will also remove the +35mm lump size from the Fair Hill seam ROM coal, which will also be treated as in pit rejects. As the proportion of rejected material in the pit will be substantial, and for operational efficiency, this primary sizing and separation process will be performed “in-pit” and at the coal face as an integral part of the coal mining operations.

2.3 Processing Activities

The extracted ROM coal will be sized and screened in-pit by a mobile breaker and screening plant. Coarse rejects (waste) from this process will be disposed of in the pit, whilst the sized ROM coal will be trucked to the ROM pad located adjacent to the CPP. As the initial stage of coal processing will comprise dry sizing and crushing within the pit, the CPP activities will be limited to conventional wet coal washing, with all rejects and tailings pumped to an out of pit co-disposal facility (CDF).

The CDF will be used for tailings and rejects disposal for the first four years of mining, after which in-pit tailings and rejects disposal into pit voids will be employed. Backfilling pits in this manner will assist in the reshaping and remediation process enabling a minimal final void footprint.

Water reclaimed from the rejects and tailings disposal areas (CDF and in-pit) will be reused in the CPP and for dust suppression across the CRP area.

Using the access road provided by MLA 70502, the product coal will be transported by truck from the CPP to the Triumph Creek Train Load Out (CP-TLO) on MLA 70501. Here the product coal will be temporarily stockpiled prior to loading onto the coal trains for delivery to the Port of Gladstone.

3.0 DESKTOP FINDINGS

Areas of regional interest maps are available in a searchable spatial format via the DSDIP website. Map searches of the CRP area have revealed one category of regional interest, that being, Priority Agricultural Areas (PAA).

3.1 Priority Agricultural Areas

As illustrated in **Figure 5**, the CRP land is mapped by DSDIP as a PAA.

Clause 8 of the *RPI Act* prescribes a PAA as an area that:

(a) includes 1 or more areas used for a Priority Agricultural Land Use (PALU), whether it also includes other areas or features, including, for example, a regionally significant water source; and

(b) is either—

i. shown on a map in a regional plan as a priority agricultural area; or

ii. prescribed under a regulation.

A regionally significant water source is a water source prescribed under a regulation. The Condamine Alluvium is the only regionally significant water source prescribed under the *RPI Reg* and is not associated with the CRP area.

Section 4.0 of this report discusses the assessment of the validity of PAA in the CRP area with reference to RPI Act Guideline 02/14 *"Carrying out resource activities in a priority agricultural area"* (Guideline 02/14).

3.2 Priority Living Areas

The CRP land is not mapped as a Priority Living Area (PLA) under the *RPI Act*. Accordingly, RPI Act Guideline 04/14 "*Carrying out activities in a Priority Living Area*" is not addressed in this report.

3.3 Strategic Environmental Areas

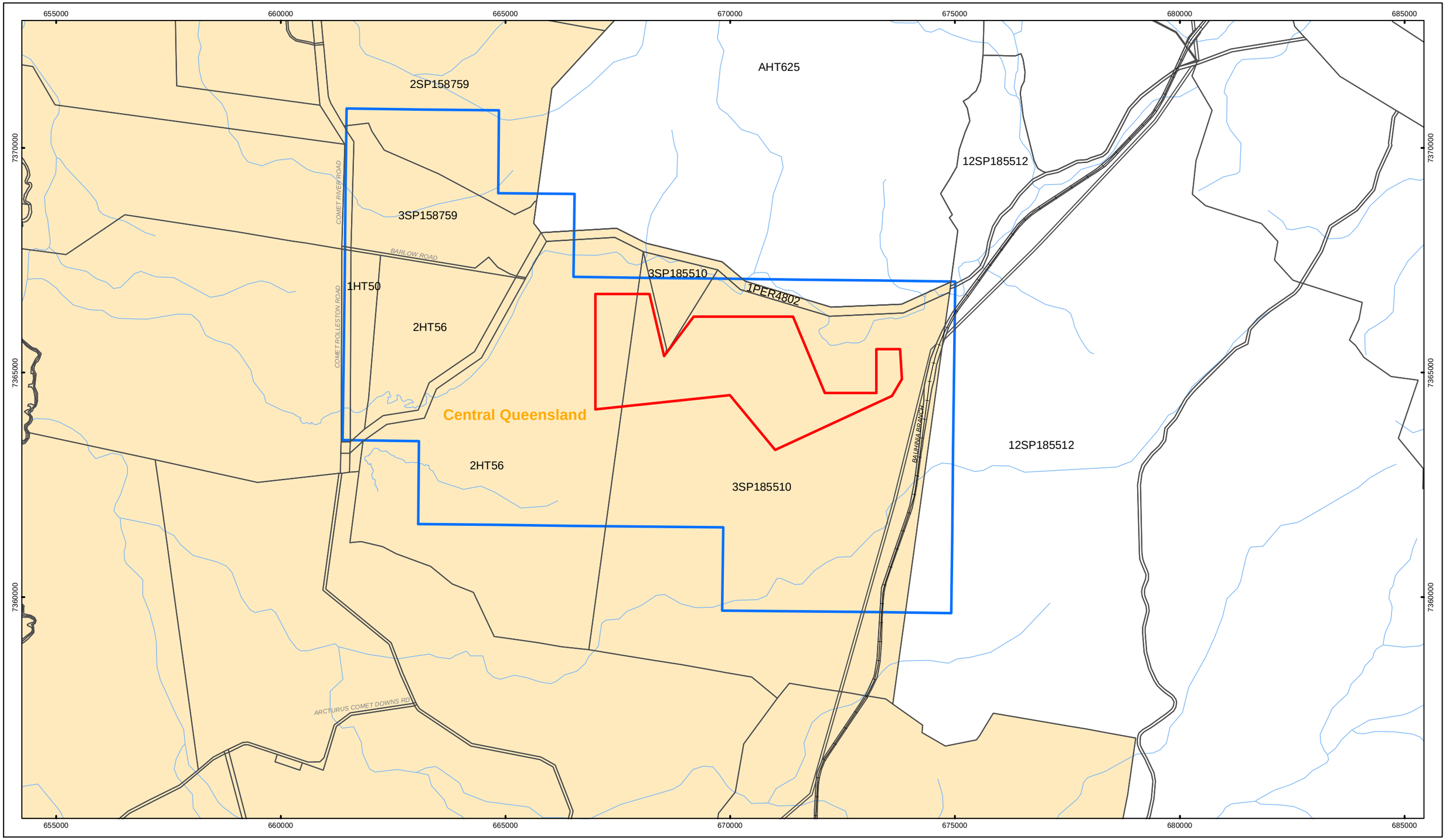
The CRP land is not mapped as a Strategic Environmental Area (SEA) under the *RPI Act*. Accordingly, RPI Act Guideline 05/14 *"Carrying out resource activities in a strategic environmental area"* is not address in this report.

3.4 Strategic Cropping Areas

The Strategic Cropping Area (SCA) is an area of regional interest under the *RPI Act* and consists of areas shown on a trigger map for Strategic Cropping Land (SCL). The land, to be considered for SCA assessment against the SCL criteria (DSDIP 2014), needs to be located within an SCA.

As illustrated in **Figure 6**, the CRP area is not located on land that is mapped as SCL however, SCL does occur on Lot 2 HT56 and Lot 3 SP185510 but this is beyond the boundaries of the CRP.

Accordingly, RPI Act Guideline 08/14 *"How to demonstrate that land in the strategic cropping area does not meet the criteria for strategic cropping land"* and RPI Act Guideline 03/14 *"Carrying out resource activities in the strategic cropping area"* are not addressed in this report.



NOTES
Cadastral Boundary: DERM, March 2014
Priority Agricultural Area: Dept of State Development, Infarstructure & Planning, September 2014
Mining Lease: Acacia Coal, 10/09/2014

DISCLAIMER
In preparing this map, RLMS have endeavoured to ensure
that the data and information are as accurate and reliable as possible.
However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study.
RLMS expressly disclaims any loss or damage that may
arise therefrom.

LEGEND

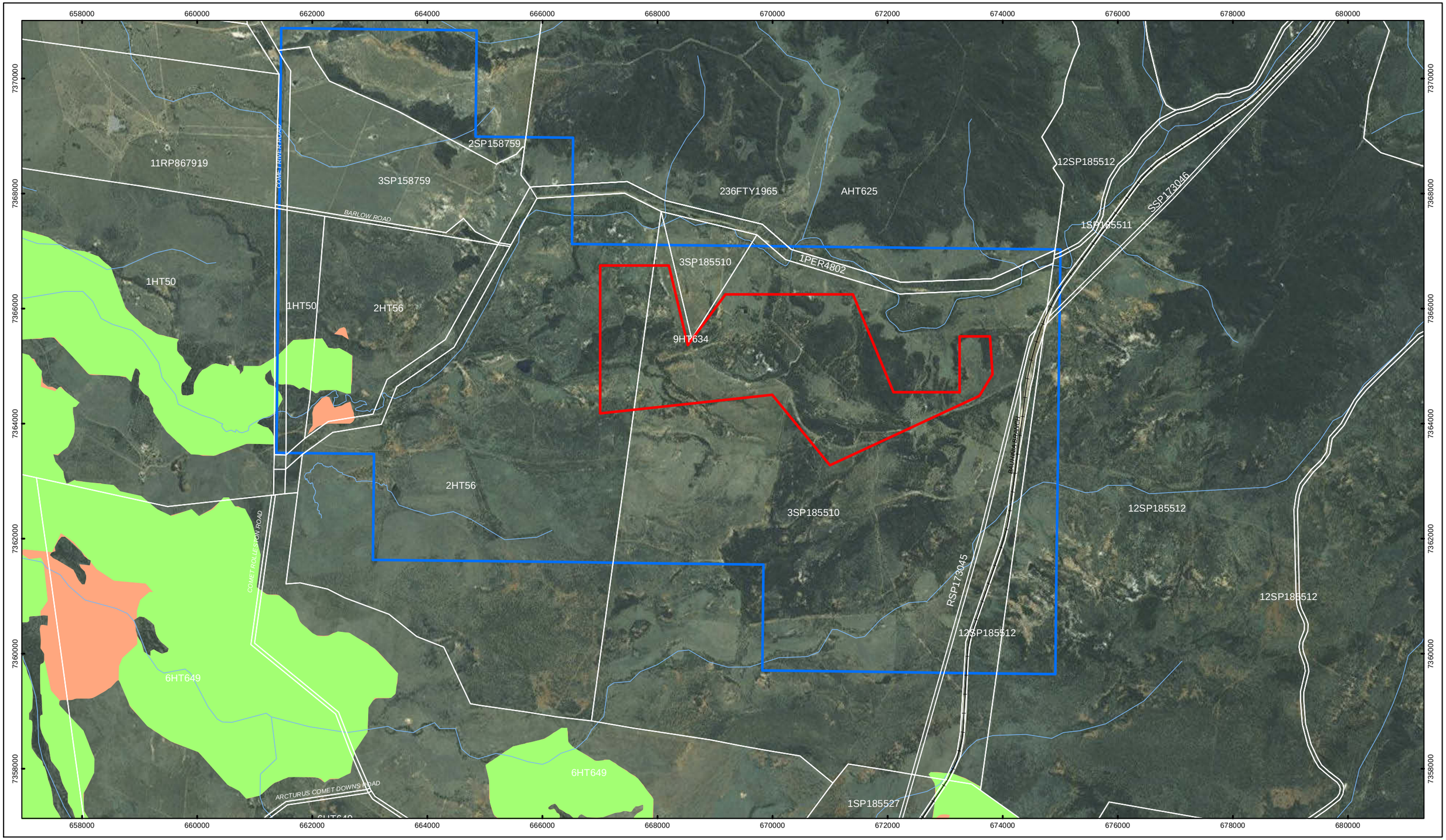
- Proposed Comet Ridge Mining Lease Application
- Acacia Coal Coal Exploration Permit (EPC 1230)
- Priority Agricultural Area
- Cadastral Boundary
- Existing Railway
- Minor Watercourse

0 1 2 3 4
Kilometres
Coordinate System:
GDA 1994 MGA Zone 55

CLIENT	**ACACIA COAL LIMITED**
PROJECT	**COMET RIDGE PROJECT**
FIGURE 5	**PRIORITY AGRICULTURAL AREAS**
DATE	**OCTOBER 2014** REF: CRP-RLMS057 Rev1

RLMS
Acacia Coal
Layout: A3 Landscape

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\PAA_057.mxd
Created on 17/10/2014 by KR



NOTES
Cadastral Boundary: DERM, March 2014
Strategic Cropping Areas: Dept of Natural Resources & Mines v6.13 09/09/2014
Mining Lease: Acacia Coal, 10/09/2014
Imagery: ESRI

DISCLAIMER
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

LEGEND

- Proposed Comet Ridge Mining Lease Application
- Acacia Coal Coal Exploration Permit (EPC 1230)
- Strategic Cropping Area
- Proposed Strategic Cropping Area
- Cadastral Boundary
- Existing Railway
- Minor Watercourse

0 1 2 3 4
Kilometres
Coordinate System:
GDA 1994 MGA Zone 55

CLIENT **ACACIA COAL LIMITED**
PROJECT **COMET RIDGE PROJECT**
FIGURE 6 **STRATEGIC CROPPING AREAS**
DATE **OCTOBER 2014** REF: CRP-RLMS055 Rev1

RLMS Acacia Coal
Layout: A3 Landscape

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\SCL_055.mxd
Created on 17/10/2014 by KR

4.0 PAA VALIDITY ASSESSMENT

4.1 PAA Definition

The validity of an area being classed as PAA is subject to the following:

- The land must be currently used for a Priority Agricultural Land Use (PALU), which consist of the following Australian Land Use and Management (ALUM) classes:
    - Class 3.3 – Cropping;
    - Class 3.4 – Perennial horticulture;
    - Class 3.5 – Seasonal horticulture;
    - Class 4 – Irrigated agriculture and plantations; and/or
    - Class 5.1 – Intensive horticulture
- The land has been, for a total of three years during the 10 years immediately before an assessment application in relation to the land is made, used for a PALU.

RPI Act Guideline 07/14 *How to identify a priority agricultural land use (PALU)*, is used to assess the validity of PAA in the CRP area. As required by RPI Act Guideline 02/14, the PAA Assessment Criteria will also apply and will need to be addressed if a Proponent proposes to locate an activity in a PAA. This section discusses the assessment of the validity of PAA in the CRP area with reference to these two Guidelines.

4.2 Assessment Methodology

The assessment of the current land use and cropping history of the CRP area for the past 10 years has included reviewing and analysing the following data sources:

- the Queensland Land Use Mapping Program (QLUMP) data to verify Australian Land Use and Management (ALUM) classifications for the CRP area;
- recent soil survey fieldwork undertaken by qualified specialists, GTE Environmental;
- Department of Science, Information Technology, Innovation and the Arts (DSITIA) Forage Crop Frequency data for the affected land parcels;
- available aerial photography from the Department of Natural Resources and Mines (DNRM) and available online mapping resources and tools such as Google Maps, Landsat TM, Spot6, GeoEye-1 and Bing; and
- verbal and written evidence of current and past land uses from the affected landowners.

The assessment of the aforementioned data sources was undertaken with the intent to confirm and/or improve the existing PAA mapping data, as required by Step 2 of RPI Guideline 07/14.

4.3 Assessment Findings

4.3.1 Queensland Land Use Mapping Program (QLUMP)

A review of the QLUMP dataset was undertaken to confirm the ALUM classifications for the CRP land parcels, with the results provided in **Table 3** and **Figures 7**.

Table 3: Australian Land Use Management Mapping Review

LAND PARCEL	TYPE OF LAND USE
2/HT56	Grazing native vegetation
3/SP185510	Grazing native vegetation

For land to be considered as used for a Priority Agricultural Land Use (PALU), the land must be classed as one of the following ALUM classes:

- Class 3.3 – Cropping;
- Class 3.4 – Perennial horticulture;
- Class 3.5 – Seasonal horticulture;
- Class 4 – Irrigated agriculture and plantations; and/or
- Class 5.1 – Intensive horticulture

As shown within **Table 3**, the land use for the two affected land parcels is grazing native vegetation. Therefore, the CRP area and the two land parcels as a whole are not considered to be classed as PALU.

4.3.2 Soil Survey

During the period of 26th to 29th May 2014, GTE Environmental Pty Ltd (GTE Environmental) undertook a soil survey of the CRP area. The soil survey fieldworks involved identifying and classifying Soil Mapping Units (SMUs) across the project site by ground truthing at multiple locations. These locations were selected based on topography, vegetation and ease of access.

A total of 43 sites were assessed, as illustrated in **Figure 8**. Of these sites, none were observed as being currently or previously used for cultivation practices.

Five SMUs were identified for the CRP area, of which four were considered suitable for limited beef cattle grazing (Class C3) and one was considered unsuitable for agricultural use (Class D). The results suggested that the CRP area would be unsuitable for rainfed cropping.

A copy of GTE Environmental's soils report is provided in **Appendix B**.

4.3.3 Historical Imagery & Forage Cropping Frequency Reports

Historical imagery was reviewed by GTE Environmental and a summary of the findings with respect to cropping frequency is presented in **Table 4** below. **Figures 1 – 20** of **Appendix C** provides the referenced figures.

655000 660000 665000 670000 675000 680000 685000

7370000 7365000 7360000

2SP158759
AHT625
12SP185512
3SP158759
COMET RIVER ROAD
BARLOW ROAD
1HT50
COMET ROLLESTON ROAD
3SP185510
1PER4802
2HT56
BALUNIA BOARDER
12SP185512
2HT56
3SP185510
ARCTURUS COMET DOWNS RD

NOTES

Cadastral Boundary: DERM, March 2014
QLUMP: Dept of Science, Information Technology, Innovation & the Arts.
Mining Lease: Acacia Coal, 10/09/2014

DISCLAIMER

In preparing this map, RLMS have endeavoured to ensure
that the data and information are as accurate and reliable as possible.
However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study.
RLMS expressly disclaims any loss or damage that may
arise therefrom.

LEGEND

- Proposed Comet Ridge Mining Lease Application
- Acacia Coal Coal Exploration Permit (EPC 1230)
- Cadastral Boundary
- Existing Railway
- Minor Watercourse

ALUM v7 Secondary Level

- Nature conservation
- Other minimal use
- Grazing native vegetation
- Production forestry
- Cropping
- Irrigated cropping
- Intensive animal husbandry
- Mining
- Waste treatment and disposal
- Reservoir/dam

0 1 2 3 4
Kilometres

Coordinate System:
GDA 1994 MGA Zone 55

CLIENT **ACACIA COAL LIMITED**
PROJECT **COMET RIDGE PROJECT**
FIGURE7 **QUEENSLAND LAND USE MAPPING PROGRAM**
DATE **OCTOBER 2014**
REF: CRP-RLMS056 Rev1

RLMS
Acacia Coal

Layout: A3 Landscape

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\QLUMP_056.mxd
Created on 17/10/2014 by KR

667000 668000 669000 670000 671000 672000 673000 674000 675000

7367000 7366000 7365000 7364000 7363000

Triumph Creek

BAUHINIA BRANCH

Horse Plain Creek

13 1 2 3 4 5 6 7 8 9 10 11 12

Ob1 Ob2 Ob3 Ob4 Ob5 Ob6 Ob7 Ob8 Ob9 Ob10 Ob11 Ob12 Ob13 Ob14 Ob15 Ob16 Ob17 Ob18 Ob19 Ob21 Ob22 Ob23 Ob24 Ob25 Ob26 Ob27 Ob28 Ob29 Ob30 Ob31 Ob32 Ob33

NOTES
Tenements: Dept. of Mines & Energy, 2014
Proposed Mining Lease Boundary: Acacia Coal: 10/09/2014
Distrubance Area: Acacia Coal, September 2014
Springsure Corridor: Bandanna Energy, 24/02/2014
Soil Mapping Units& Sites: GT Environmental 17/10/2014

DISCLAIMER
In preparing this map, RLMS have endeavoured to ensure
that the data and information are as accurate and reliable as possible.
However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study.
RLMS expressly disclaims any loss or damage that may
arise therefrom.

LEGEND

- EPC 1230
- Proposed Mining Lease Area
- Disturbance Area
- Observation Sites
- Detailed Sites
- Sunrise (Sr) - Shallow and often rocky, gravelly sandy loam over laterised bedrock
- Wyoming Red Variant (Wy-Rv) - Variant of Wyoming with red colour
- Wyoming Grey Silty Variant (Wy-GSv) Variant of Wyoming with grey silty loam
- Wyoming Drainage Pathway (Wy-Dp) Brownish black to dark black sandy clay, silty loams, drainage paths
- Wyoming (Wy) - Hard setting brown to reddish brown sandy loam to clay loam or gradational soil overlying hard ferricrete between 0.5 and 0.8m depth

0 0.25 0.5 0.75 1
Kilometres
Coordinate System:
GDA 1994 MGA Zone 55

CLIENT **ACACIA COAL LIMITED**
PROJECT **COMET RIDGE**
FIGURE 8 **SOIL SURVEY SAMPLING SITES**
DATE **OCTOBER 2014** REF: CRP-RLMS059 Rev1

RLMS Acacia Coal

Layout: A3 Landscape

WKSP Z:\Clients\Acacia_Coal\12-0028_Mapping_Request\Mapping\Workspaces\SoilsMappingUnits_Sites_059.mxd
Created on 20/10/2014 by KR

Table 4: Historical Copping Imagery Review Findings

TITLE	APPENDIX C FIGURES	IMAGERY TYPE	CAPTURE DATE	SECTION OF FIGURE	IMAGERY REVIEW	PAA
Queensland Department of Natural Resources and Mines (DNRM), Comet 2003	1	Aerial image	17/05/2004	-	The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity. The site overall contains areas of dense natural vegetation and has been visibly cleared in parts.	Not present
Digital Globe (Google Earth)	2	Satellite image	12/09/2004	-	The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	3	Satellite image	25/03/2005	-	Very low resolution image, however, it shows similar areas of dense natural vegetation and cleared areas across the project area as per the 2004 images. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	4	Satellite image	24/09/2005	-	As per USGS-Landsat satellite image 25/03/2005, this image has poor resolution, however, it shows similar areas of dense natural vegetation and cleared areas across the project area as per the 2004 images. No additional areas of clearing appear to be visible. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	5	Satellite image	24/02/2006	-	Very low resolution image with a portion of the western area unavailable. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS-Landsat 2005 images. No additional areas of clearing appear to be visible. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present

TITLE	APPENDIX C FIGURES	IMAGERY TYPE	CAPTURE DATE	SECTION OF FIGURE	IMAGERY REVIEW	PAA
Digital Globe (Google Earth),	6	Satellite image	06/10/2006	-	The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	7	Satellite image	15/03/2007	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	8	Satellite image	14/09/2007	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	9	Satellite image	21/02/2008	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present

TITLE	APPENDIX C FIGURES	IMAGERY TYPE	CAPTURE DATE	SECTION OF FIGURE	IMAGERY REVIEW	PAA
USGS-Landsat	10	Satellite image	03/11/2008	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	11	Satellite image	06/01/2009	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	12	Satellite image	11/08/2009	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present

TITLE	APPENDIX C FIGURES	IMAGERY TYPE	CAPTURE DATE	SECTION OF FIGURE	IMAGERY REVIEW	PAA
USGS-Landsat	13	Satellite image	15/04/2010	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
Digital Globe (Queensland Globe),	14	Satellite image	20/07/2010	H1, H2, I1 and I2	Faint contour banks are visible within the south western portion of the project area. Cultivation or vegetation patterns do not appear visible within these contour lines. Sporadic vegetation growth appears to be present.	Possible contour banks observed
				Other sections	The remaining project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	15	Satellite image	04/05/2011	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous 2010 USGS- Landsat images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
Bing Maps. Microsoft	16	Satellite image	10/2011	-	The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity. Contour lines are no longer visible within sections H1, H2, I1 and I2.	Not present

TITLE	APPENDIX C FIGURES	IMAGERY TYPE	CAPTURE DATE	SECTION OF FIGURE	IMAGERY REVIEW	PAA
Spot6	17	Satellite image	14/03/2013	G3 and G4	Faint contour banks are visible again within the south western portion of the project area. Cultivation or vegetation patterns do not appear visible within these contour lines. Sporadic vegetation growth appears to be present. These contour lines appear to be part of the area to the south west of the project area where contour lines are more distinguishable.	Possible contour banks observed
				Other sections	The remaining project areas do not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
GeoEye-1	18	Satellite image	13/10/2013	G2, G3, H2 and H3.	Faint contour banks are visible within the south western portion of the project area. Darkened areas within the contour banks to the south of H2 and H3 are similar to the area to the south outside the project area suggesting cultivation may be present.	Possible contour banks observed
				Other sections	The remaining project areas do not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	19	Satellite image	05/01/2014	-	Very low resolution image. It shows similar areas of dense natural vegetation and cleared areas across the project area as per previous 2013 GeoEye-1 images. Slight sporadic changes in colour suggest either some natural regrowth of native bushland. The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present
USGS-Landsat	20	Field work pictures	27/05/2014 & 28/05/2014	-	The project area does not show any visible signs of cultivation, contour banks or vegetation patterns that suggest cropping activity.	Not present

In addition to the historical imagery discussed in section 4.3.3 above, forage crop frequency reports were also assessed to compensate for the historical imagery that could be considered inaccurate due to actively growing pasture areas, areas of high water content and cloud and cloud shadow. The review findings are tabulated below and a copy of the Forage Reports are provided in **Appendix D**.

Table 5: Visual Assessment Findings of Forage Crop Frequency Reports for CRP Area

YEAR	REVIEW OF FORAGE CROP FREQUENCY AREAS USING OTHER AVAILABLE IMAGERY	
	SUMMER (FEBRUARY)	WINTER (SEPTEMBER)
2003	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Queensland DNRM, Comet 2003.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Queensland DNRM, Comet 2003.
2004	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Digital Globe (Google Earth), 12/09/2004.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Digital Globe (Google Earth), 12/09/2004.
2005	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 25/03/2005.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 24/09/2005.
2006	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 24/02/2006.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Digital Globe (Google Earth), 06/10/2006..
2007	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 24/02/2006.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 14/09/2007.
2008	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 21/02/ 2008.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 03/11/ 2008.
2009	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 06/01/ 2009.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 11/08/ 2009.

YEAR	REVIEW OF FORAGE CROP FREQUENCY AREAS USING OTHER AVAILABLE IMAGERY	
	SUMMER (FEBRUARY)	WINTER (SEPTEMBER)
2010	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 15/04/ 2010.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Digital Globe (Queensland Globe), 20/07/ 2010.
2011	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 04/05/ 2011.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Bing Maps. Microsoft, 10/2011.
2012	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 04/05/ 2011.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Bing Maps. Microsoft, 10/2011.
2013	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, Spot6, 14/03/2013.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, GeoEye-1, 13/10/2013.
2014	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 05/01/2014.	No visible cropping of contour banks. The areas nominated within the forage crop frequency report are not illustrated as cropping area within the available imagery, USGS-Landsat, 2014.

The review of the historical imagery for the CRP area from 2004 to 2014 contained one occurrence where cropping or cultivation activities may have been undertaken, this being on 13 October 2013. Historical imagery for 20 July 2010 and 14 March 2013 contained contour banks within the same area however based upon other visual evidence such as vegetation patterns, vegetation colour and sporadic vegetation growth, no evidence of cropping or cultivation had occurred at these times.

The remaining project area did not exhibit any sign of cropping during the preceding 10 years.

4.3.4 Landowner Liaison

The Proponent has established a mutually beneficial and productive relationship with the landholders of the CRP. Discussions with both landowners have confirmed that the properties are not rainfed or irrigated for cash cropping now or within the last ten years.

With respect to the possible contour banks on Lot 2 HT56 that were identified in the 2010 and 2013 imagery (Table 4), the landowners, William & Stuart Dixon have confirmed that no cropping has occurred in this area. A copy of written evidence to this effect is provided in **Appendix E**.

5.0 EXEMPTIONS

5.1 RIDA

Sections 19(1) and 19(2) of the *RPI Act* state that a *"person must not wilfully* (or otherwise) *carry out, or allow the carrying out of, a resource activity or regulated activity in an area of regional interest unless the person holds, or is acting under, a regional interests development approval for the activity*". Section 19(4) of the *RPI Act* further states that sections 19(1) and 19(2) do not apply to a resource activity that is an exempt resource activity for the area of regional interest.

Sections 22 to 25 of the *RPI Act* provide the exemptions for resource activities requiring a Regional Interests Development Approval (RIDA). Section 22 in particular is applicable to the CRP whereby:

- The Proponent (i.e. authority holder) is not the owner of the land (the *land owner)*;
- A conduct and compensation agreement between the Proponent and the affected land owners is required under section 279 of the *Mineral Resources Act 1989 (MR Act)*. The Proponent intends on establishing the agreement other than because of the order of the court. As per section 279 of the *MR Act*, the conditions of the agreement must be or are being complied with by the Proponent prior to the grant of the Mining Lease;
- The land owners have voluntarily entered into a written agreement with the Proponent for the carrying out of the activities associated with the CRP; and
- The CRP is not likely to have a significant impact on the PAA or area that is in the SCA because both classifications are deemed to be invalid for the CRP land. Further, the CRP occurs on freehold land which is exclusive possessions tenures that extinguish native title. On this basis, native title agreements pursuant to the *Native Title Act 1993* are not required for the Project. Accordingly, the CRP activities are not considered to have an impact on land owned by a person other than the land owners.

Given the aforementioned points, the CRP is considered to be exempt from sections 19(1) and 19(2) of the *RPI Act* and therefore does not require a RIDA from the DSDIP.

5.2 Public Notification

Pursuant to section 34(3) of the *RPI Act*, the Proponent hereby seeks an exemption from notification of the assessment application for the following reasons:

1. An application for a Site-specific Environmental Authority will be submitted to the Queensland Department of Environment & Heritage Protection (DEHP) under Chapter 5 of the *Environmental Protection Act 1994 (EP Act)*. Pursuant to Chapter 5, Part 4 of the *EP Act*, the application for the Environmental Authority and all associated application material will be publicly notified for comment;
2. The application provided to the Department of State Development, Infrastructure and Planning (DSDIP) for assessment under the *RPI Act* is given to verify that the proposed resource activities will not be located on land that is used for a PALU and further, the Project area is not classed as a Priority Agricultural Area (PAA) nor a Strategic Cropping Area (SCA); and
3. In accordance with section 13(1) of the *Regional Planning Interests Regulation 2014 (EP Reg)*, the assessment application is not notifiable as the project area is not classed as a priority living area.

6.0 CONCLUSION

Based on the review of available hardcopy, online and fieldwork resources, in conjunction with landholder verbal and written evidence, the following has been determined for the CRP area with respect to the *RPI Act*:

- The CRP area is not currently used for a PALU (The Australian Land Use and Management classes 3.3, 3.4, 3.5, 4 or 5.1);
- The CRP area has not been used for a PALU within the last 10 years;
- The CRP area is not located within a Priority Living Area, Strategic Cropping Area or Strategic Environmental Area.

The CRP area does not meet the requirements to pass PAA or SCA as outlined in RPI guidelines 02/14, 03/14 and 07/14. As such, and in addition to the exemptions outlined in section 5.0 above, a RIDA is not considered necessary for the CRP.

7.0 REFERENCES

Department of State Development, Infrastructure and Planning, RPI Act Guideline 01/14 *How to make an assessment application for a regional interests development approval under the Regional Planning Interests Act 2014*.

Department of State Development, Infrastructure and Planning, RPI Act Guideline 02/14 *Carrying out resource activities in a priority agricultural area – A guideline to assist in understanding when and how to apply for a regional interests development approval under the Regional Planning Interests Act 2014 for proposed resource activities in a priority agricultural area,* 13 June 2014.

Department of State Development, Infrastructure and Planning, RPI Act Guideline 08/14 *How to demonstrate that land in the strategic cropping area does not meet the criteria for strategic cropping land*, 13 June 2014.

Department of State Development, Infrastructure and Planning, RPI Act Guideline 03/14 *Carrying out resource activities in the strategic cropping area – A guideline to assist in understanding when and how to apply for a regional interests development approval under the Regional Planning Interests Act 2014 for proposed resource activities in the strategic cropping area,* 19 June 2014.

Department of State Development, Infrastructure and Planning, RPI Act Guideline 05/14 *Carrying out resource activities in a strategic environmental area – A guideline to assist in understanding when and how to apply for a regional interests development approval under the Regional Planning Interests Act 2014,* 21 July 2014.

Department of State Development, Infrastructure and Planning, RPI Act Guideline 04/14 *Carrying out activities in a Priority Living Area – A guideline to assist in understanding when and how to apply for a regional interests development approval under the Regional Planning Interests Act 2014 for proposed resource activities in a priority living area,* 13 June 2014.

Department of State Development, Infrastructure and Planning, RPI Act Guideline 07/14 *How to identify a priority agricultural land use (PALU) – A guideline to assist in understanding how to identify a priority agricultural land use (PALU) under the Regional Planning Interests Act 2014 for proposed resource activities in a priority agricultural area,* 13 June 2014.

Department of State Development, Infrastructure and Planning, *Regional Planning Interests Act 2014,* Assessment Application Form, V1.0, effective from 13 June 2014.

GT Environmental Pty Ltd, *Regional Planning Interests Assessment of Comet Ridge Project*, 1 October 2014.

Regional Planning Interests Act 2014

Regional Planning Interests Regulation 2014

Mineral Resources Act 1989

http://www.dsdip.qld.gov.au/infrastructure-and-planning/regional-planning-interests-act.html

APPENDIX A

Title Searches

CURRENT TITLE SEARCH

DEPT OF NATURAL RESOURCES AND MINES, QUEENSLAND

Request No: 19583003
Search Date: 15/10/2014 14:56 **Title Reference: 50576597**
Date Created: 11/10/2005

Previous Title: 40050189

REGISTERED OWNER Interest

Dealing No: 709043283 11/10/2005

STUART THOMAS DIXON 1/2
WILLIAM RICHARD DIXON 1/2

AS TENANTS IN COMMON

ESTATE AND LAND

Estate in Fee Simple

LOT 2 CROWN PLAN HT56
County of HUMBOLDT Parish of MIAMBAA
Local Government: CENTRAL HIGHLANDS

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 40050189 (Lot 2 on CP HT56)

2. MORTGAGE No 602800620 (M198757) 26/01/1982
   AUSTRALIA AND NEW ZEALAND BANKING GROUP LIMITED

3. SEC 174 NOTATION No 709042092 10/10/2005 at 14:49
   The provisions of Section 174(1), Land Act 1994 apply to a
   Transfer of the whole or part of the land

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
713635821	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	20/12/2010 11:39	CURRENT

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D APPLICATIONS CITEC CONFIRM

CURRENT STATE TENURE SEARCH

DEPT OF NATURAL RESOURCES AND MINES, QUEENSLAND

Request No: 19582829
Search Date: 15/10/2014 14:45 **Title Reference: 17645214**
Date Created: 25/10/1995

DESCRIPTION OF LAND

Tenure Reference: GHPL 37/3481

Lease Type: PERPETUAL

LOT 3 SURVEY PLAN 185510
County of HUMBOLDT Parish of MIAMBAA
Local Government: CENTRAL HIGHLANDS

Area: 5627.000000 Ha. (SURVEYED)

No Land Description

No Forestry Entitlement Area

No Future Conservation Area

Purpose for which granted:
NO PURPOSE DEFINED

TERM OF LEASE

Day of beginning of lease

Lease in perpetuity commencing on 01/10/1982

REGISTERED LESSEE Interest

Dealing No: 701576351 01/10/1996

STEPHEN CHARLES BOTTOMLEY
VICKI DELIA BOTTOMLEY JOINT TENANTS INTER SE 1/2
STEPHEN CHARLES BOTTOMLEY
VICKI DELIA BOTTOMLEY TRUSTEE 1/2
FOR THE COUNTRYCO MONASH MANAGEMENT TRUST

AS TENANTS IN COMMON

CONDITIONS

M175 Subject to the condition of Occupation as defined by the Land Act.

M177 The lessee shall carry out and perform all the conditions to which the former selection was subject.

CURRENT STATE TENURE SEARCH

DEPT OF NATURAL RESOURCES AND MINES, QUEENSLAND

Request No: 19582829
Search Date: 15/10/2014 14:45 **Title Reference: 17645214**
Date Created: 25/10/1995

ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Lease No. 17645214

2. MORTGAGE No 701576353 01/10/1996 at 08:26
   to
   NATIONAL AUSTRALIA BANK LIMITED A.C.N. 004 044 937

3. EASEMENT IN GROSS No 708609514 26/04/2005 at 14:54
   burdening the land
   ERGON ENERGY CORPORATION LIMITED A.C.N. 087 646 062
   over
   EASEMENT R ON SP173045

ADMINISTRATIVE ADVICES - NIL
UNREGISTERED DEALINGS - NIL

Corrections have occurred - Refer to Historical Search

Caution - Charges do not necessarily appear in order of priority

** End of Current State Tenure Search **

Information provided under section 34 Land Title Act(1994) or
section 281 Land Act(1994)

Requested By: D APPLICATIONS CITEC CONFIRM

APPENDIX B

GTE Environmental

'Soils & Land Suitability Assessment Report'

13 October 2014

Soils and Land Suitability Assessment

COMET RIDGE PROJECT

TECSOL Australia Pty Ltd
13 October 2014

PO Box 2462, New Farm, QLD 4005
www.gtenvironmental.com.au

Printed:	13 October 2014
Last saved:	13 October 2014 12:10 PM
File name:	CR-14 Comet Ridge Soils Rpt_Rev3
Author:	Reece McCann
Project manager:	Graham Tuck
Name of organisation:	Tecsol Australia Pty Ltd
Name of document:	Comet Ridge Project – Soils and Land Suitability Assessment

TABLE OF CONTENTS

1 INTRODUCTION

GT Environmental Pty Ltd (GTE) was commissioned by Tecsol Australia Pty Ltd (Tecsol) to complete a soil and land suitability assessment for the Comet Ridge Project (the project).

1.1 Project Details

The project area is located within the Central Bowen Basin coalfields, approximately 30 kilometres (km) southwest of Blackwater in the Central Highlands of Queensland. The project area is 1189 hectares (ha), of which proposed mining infrastructure areas consist of approximately 373 ha. The project area is outlined in Figure 1, comprising of the Mining Lease Application (MLA), and herein is referred to as the Soil Survey Area.

1.2 Scope of Report

This report provides an assessment of the soil and land suitability for the soil survey area and includes:

- a description of the regulatory requirements relevant to the project;
- a review of available background material including but not limited to regional government soils reports, surrounding local soils survey reports, EIS information, aerial photography and mapping;
- identification and description of soil mapping units within the soil survey area;
- assessment of existing land suitability classes for rain fed cropping, beef cattle grazing and Good Quality Agricultural Land (GQAL); and
- recommendations for soil stripping and reuse in rehabilitation.

1.3 Regulatory Requirements

The overarching regulatory framework for assessing soils and agricultural land in Queensland is provided by the Guidelines for Agricultural Land Evaluation in Queensland (Land Resources Branch staff, 1990) (ALE Guidelines). The Queensland government is currently revising these guidelines to incorporate recent developments in the field of soil and agricultural land assessment. A draft of the Guidelines for Agricultural Land Evaluation in Queensland: Second Edition (Draft ALE Guidelines) was released by the Queensland government in 2013.

The Draft ALE Guidelines provide an updated method of describing soils and classifying agricultural land. These guidelines draw from a range of guidance and standards that have been developed at national and state level since the original ALE Guidelines were published in 1990.

The typical approach has involved the classification of land use suitability against a range of limitations, and application of a hierarchy of Agricultural Land Classification (ALC). Application of this approach to mining projects is described in the Land Suitability Assessment Techniques (LSAT Guidelines) provided within the Technical Guidelines

for Environmental Management of Exploration and Mining in Queensland (Department of Mines and Energy, 1995 (DME, 1995)). This approach has been refined as part of the Draft ALE Guidelines. GTE has undertaken the assessment of ALC in accordance with these requirements and verbal guidance with Department of Natural Resources and Mining, Queensland Government (DNRM).

It is noted that the SPP supersedes the State Planning Policy 1/92: Development and Conservation of Good Quality Agricultural Land and State Planning Policy 2/02 Guideline, Acid Sulfate Soils, Version 2 and the recently repealed *Strategic Cropping Land Act* (SCL) (2011). Prior to the SCL Act 2011 being repealed.

The repealed SCL Act 2011 has been replaced by the Regional Planning Interests (RPI) Act 2014, which encompasses Strategic Cropping Area (SCA) and Priority Agricultural Areas (PAA) as relevant to this project. As the project area is outside the SCL trigger map (DNRM, 2014) this was not assessed as part of the fieldworks. Due to the project area being designated on the Department of State Development, Infrastructure and Planning website (DSDIP, 2014) as PAA, an assessment was conducted to confirm if the project area passes PAA as outlined in the RPI Act 2014. This assessment verified that the project area is not PAA and is outlined in the report titled Regional Planning Interests Assessment of Comet Ridge Project (GT Environmental, 2014).

The following documents and standards in investigating and describing soils have also been applied where they represent current best practice. :as follows:

- this soil survey was scoped and conducted in accordance with the *Guidelines for Surveying Soils and Land Resources* (McKenzie *et al*., 2008);
- soil characteristics and soil profiles have been described in accordance with the *Australian Soil and Land Survey Handbook* (National Committee on Soil and Terrain (NCST), 2009 and Gunn *et al*., 1988);
- soils have been grouped according to their parent material and position in the landscape and classified in accordance with the *Australian Soil Classification* (Isbell, 2002). Soils have also been correlated to soils identified within key regional soil assessments, the major ones being *Lands of the Isaac - Comet Area, Queensland* (Story *et al.*, 1967) and a DNR soils assessment along the Comet River floodplain (McCarroll 1997);
- review and assessment of Acid Sulfate Soils (ASS) followed the repealed State Planning Policy 2/02 Guideline, Acid Sulfate Soils, Version 2;
- laboratory analysis was undertaken in line with the *Land Suitability Assessment Techniques* (LSAT Guidelines) within the *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (Department of Mines and Energy, 1995);
- Agricultural Land Classes and the presence of GQAL across the soil survey area was completed with reference to the now expired *State Planning Guideline: The Identification of Good Quality*

Agricultural Land 1/92 (Qld Department of Primary Industries and Department of Housing, Local Government and Planning (DPI) (1993) ; and

- address the relevant requirements of the Department of Environment and Heritage Protection (EHP) Guideline, EM961 *Application requirements for activities with impacts to land*.

2 BACKGROUND

2.1 Land Use

The soil survey area is located within the Central Bowen Basin coalfields approximately 30 km southwest of Blackwater in the Central Highlands of Queensland and is located near the Tropic of Capricorn. The region includes a large proportion of the Bowen Basin coal fields, mineral and sapphire producing areas, and a large and diverse agricultural and pastoral industry (including cattle, cotton, grain, citrus and grapes). The soils survey area is approximately 1189 ha, of which proposed mining disturbance areas consist of approximately 373 ha.

The soil survey area is west of the Comet River and comprises flat to gently undulating plains and active drainage pathways and related floodplains associated with the Comet River, which are currently being used for beef cattle grazing. Anecdotal sources and review of Australian Land Use Management (QLUMP, 2014) land use mapping presents no evidence of rain grown or irrigated cash cropping (Queensland Government, 2014). The soil survey area has had minor clearing of original vegetation which consisted of Brigalow, Ironbark, Silver leaf Ironbark Bloodwood, Bendee, open soft scrub downs country.

Apart from periods of prolonged dry weather, droughts are a feature of the area. Droughts are described by Bourne and Tuck (1993) as an occasion when climatic variations are so severe that the risks of crop failure greatly exceed what would be considered an acceptable, manageable level of commercial risk. Existing records suggest that such events occur about once every 10 years.

2.2 Topography and Hydrology

The soil survey area is situated within the Nogoa- Mackenzie River system in the Fitzroy Region. The Comet River flows to the west of the soils survey area. Drainage pathways associated with the Comet River are located within the western section of the soil survey area. Field observations did not report any additional drainage pathways or tributaries within the soil survey area.

Bourne and Tuck (1993) described the land within the soil survey area east of the Comet River floodplain as mainly undulating plains, plateaus and low hills of sandy earths with areas of eucalypt duplex soils and shallow loamy and rocky lithosols. The majority of the site consists of gently undulating plains with slope gradients within the range of 0-4%. Several small areas included small jump-up rocky landforms with slope gradients above 3%.

3 METHODOLOGY

3.1 Desktop Review

GTE reviewed available published and unpublished soils and land resources information that was directly or indirectly applicable for the soil survey area. This information was used to develop preliminary soil mapping units and distribution for the soil survey area which assisted in the development of the field investigation.

3.1.1 Geomorphology and Geology

Surface geological mapping from the Geological Survey of Queensland (1:250,000 Series) for the soil survey area indicates the area to be dominated by mostly weathered Tertiary quartzose sandstone sedimentary rocks underlain by the Permian to Triassic Denison Trough basin fill. Three major geological units occur:

- channel and flood plain alluvium; gravel, sand, silt, clay;
- Quaternary soil, sand, gravel, scree, alluvium. May include some residual alluvium; sand dominant, with gravel and;
- tertiary sedimentary rocks and sediments.

Galloway, R.W. in Story *et al* (1967) also states that soil types are influenced mainly from source rock in addition to widespread erosion and accumulation of clays, sand and gravels which occurred throughout the Tertiary period.

3.1.2 Regional Soils Reports and Available Documentation

The CSIRO and Queensland Government have undertaken a variety of soil mapping and assessment work over the cropping areas of the Central Highlands region. The following references have been utilized to varying extents in the development of this report:

- *Lands of the Isaac-Comet Area, Queensland* (Story *et al.*, 1967);

The Lands of the Isaac-Comet Area report mapped land systems, which are landscape patterns comprised of generally uniform geology but with variable landforms, soils and vegetation. Within each land system are individual 'units' which describe the range of individual soil types and vegetation. In addition, the relative proportion of each unit in the land system is provided although they have not been mapped. The report also contains detailed geological information and discusses geomorphological processes and influence on existing soil types and landscapes.

Story *et al* described the area as undulating plains, floodplains and rugged uplands with shallow gravelly loams, sandy earths and texture contrast sandy clay soils. This summary is an accurate portrayal of soil types found in this survey.

The main value of the CSIRO reports in this survey is that it was possible to refine soil types which may be expected to occur from the land systems mapping. The presence of land systems and 'expected' soil types which Story *et al* identified proved to be basically correct however too broad a basis for soil type boundary delineation at a 1:50,000 scale.

- *Understanding and Managing Soils of the Central Highlands* (Bourne and Tuck, 1993);

Agricultural Management Units (AMUs) are described which focus on land management requirements. It is a relevant reference in the assessment of land suitability and management of soil types described.

- *Major Soils of the Raingrown Cropping Lands at Emerald*. (G.A. Tuck 1993 unpublished).

Graham Tuck (pers comm) completed soils mapping of the Emerald 1:100000 map sheet in the late 1980s. However, the work has not been published to date. Another Land Resources Officer with the Queensland Department of Primary Industries (QDPI) at that time, Mr Peter Shields, coordinated the development of this 1993 report. However, while specific soil types described by Tuck are presented, mapping in the report is restricted to broad geomorphological land units.

- *Land Resource Survey and Evaluation of the Kilcummin Area, Queensland (Shields and Williams,1991)*;

This survey is located north west of Clermont in an area dominated by basaltic soils which are not comparable with those found in the soil survey area. Nevertheless, it provides a practical application of the Land Resources Branch (1990) land suitability assessment techniques which have been used in this report.

- *Soil survey reports of the Emerald Irrigation Area from 1970 to 2003*

Officers of the QDPI produced a range of reports which mapped and described soils and land management within the Emerald Irrigation Area. This data includes detailed evaluations of soil attributes relevant to the soils survey area including soil water relationships and morphology.

Cross-references to relevant regional soil types identified within Story et al (1967), Bourne and Tuck (1993), McCarroll (1997) and Tuck (1993) are provided within Section 4.

3.1.3 Aerial Photography

Aerial photography was reviewed as part of the desktop evaluations. Initial map units and boundaries were marked using a combination of imagery reviewed below:

- Google Earth™ (12/09/2004);
- GeoEye-1 (13/10/2013); and
- SPOT6 (14/03/2013).

3.1.4 Preliminary Soils Mapping

After the detailed review of reports and aerial photography, and prior to field work, a preliminary soils map was created. This preliminary mapping provided an initial understanding of the different types of soil and landscapes likely to occur across the soil survey area providing a basis for planning the field work and refining the soil mapping units.

3.1.5 Acid Sulfate Soils Assessment

Acid sulfate assessment of soils will follow methods proposed by Powell and Ahern (1999) and Hey (1999) in DNRM Qld (1999) *Acid Sulfate Soils and their Management, Technical Papers*.

A desktop assessment to identify preliminary risk of Acid Sulfate Soils (ASS) was undertaken. Information of published online ASS maps such as Australian Soil Resources Information System (ASRIS), National Acid Sulfate Soils Atlas, elevation, geology and topography and aerial photograph patterns of ancient floodplains and swamps was reviewed.

Review of this information reported that the risk of ASS within the soil survey area was extremely low due to geological origins, elevation and landforms. Information published online at ASRIS stated the area would have a low probability of ASS being present.

Field work and observations were completed to confirm this information with results and discussion presented in section 4, soil mapping unit summaries.

3.2 Field Work

Field investigations were undertaken to confirm the information on soil types and agricultural suitability outlined in the desktop review of available soil studies, and to refine the preliminary soil mapping.

A detailed field survey was undertaken over the dates 26 to 29 May 2014. Survey techniques were based upon pre-determined sampling locations from background information, existing soils information available, preliminary soils mapping and an examination of air photo patterns.

Free survey techniques (McKenzie, 2008 and Gunn, 1988) were used to verify proposed soil types and assign boundaries pending land access or topography issues relating to pre-determined locations.

During the soil mapping and agricultural suitability assessment of the survey areas, field observations with respect to potential contaminated land sources and impact were undertaken. The field observations did not report any significant potential sources such as storage tanks, operating infrastructure, pilot workshops, cattle dips or any observed impacts such as staining, olfactory and fill (scrap material not overburden).

Approximately 373 ha classed as proposed active mining disturbance was mapped out at a 1:25,000 scale and approximately 816 ha of remaining area within the proposed mining lease was/is to be mapped at 1:50,000. This scale has been recommended by DNRM to provide an

appropriate scale for investigation and mapping of study areas which may contain both potential cropping and grazing land.

Within the soil survey area, GTE described six soil mapping units (SMUs) on the basis of 12 detailed sites and 31 observation sites. Overall, the field work included a total of 43 investigation sites over the soil survey area (Figure 1).

Detailed site descriptions and surface observations descriptions are presented within Attachment A and Attachment B.

3.2.1 Observation Sites

Observation sites provided basic information for indicative soil type, slope, surface condition, landscape characteristics and assist in refining of soil boundaries. The information collected from individual observation sites varies but generally includes:

- indicated soil type deduced from position in the landscape, soil surface and vegetation type;
- landform type, location (GDA94) and slope gradient;
- major vegetation type and cover density;
- soil surface characteristics; and
- land characteristics including disturbance, microrelief, evidence of cultivation, significant erosional features, presence of coarse fragments and estimated % rock cover and outcropping bedrock.

A total of 31 observation sites were recorded during the field investigation.

3.2.2 Detailed Sites

Detailed soil profile information was collected at the 12 detailed sites using a 75 mm diameter hand auger. This method is well established and is appropriate for sub-surface assessment and sampling for this survey. Detailed sites were augered to 1.0 m for a majority of the sites.

The location of detailed sites is presented in Figure 1. The specific locations of the detailed sites were determined in the field based on the location being a sound representation of the soil unit being described, available site access and preliminary mapping.

The information collected from detailed sites included:

- location (GDA94) and type of soil observation (e.g. erosion exposed cutting or hand auger);
- major vegetation types and land use;
- landform type, position of the site and slope gradient;
- surface condition (e.g. presence of cracks, surface crust, rocks stones and cobbles, erosion status, microrelief);
- types and vertical extent of soil horizons;

- colour (per *Munsell Soil Colour Charts*) and mottling of each horizon;
- for each horizon, observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure, consistence and pedality and moisture content;
- presence of organic matter, roots and prevalence of biological activity;
- presence of gleyed horizons, iron staining, jarosite presence and field pH for ASS assessment; and
- photographs of the soil profile and surrounding landscape.

Samples were collected from those detailed soil profiles considered most representative of the major soil units at the soil survey area. A total of 16 samples were collected during field investigations from four detailed sites. Soil sampling of profiles was conducted per NCST (2009) and Gunn *et al* (1988) Guidelines for Surveying Soil and Land Resources with samples taken from the surface (0.0-0.1m) and every horizon change within the soil profile. Samples were not collected across horizon or sub-horizon boundaries.

3.2.3 Laboratory Analysis

Samples of soils considered to be most representative of mapped soil units were submitted for laboratory analysis. Laboratory analysis was undertaken to assist in determining the the overall soils characterisation and agricultural suitability of the soils and to establish the physical and chemical limitations of surface and near-surface soils for use in rehabilitation works. Laboratory testing was also used to identify soils that may require specific management measures.

Samples were analysed at Environmental Soil Science Australia Pty Ltd (ESSA), Brisbane, certified by Australasian Soil and Plant Analysis Council (ASPAC). For each soil type, the surface soil horizon was sampled and analysed for the following parameters:

- pH (1:5);
- electrical conductivity (EC [1:5]);
- chloride content;
- bicarbonate extractable P;
- total N, Nitrates;
- exchangeable Cations, Cation Exchangable Capacity (CEC), Calcium/Magnesium (Ca/Mg) Ratio, Exchangable Sodium Percentage (ESP);
- organic matter;
- particle size assessment - Hydrometer Method;
- emerson aggregate test;

- metals - Total (Mn, B, Cu, Fe, Zn and Al);
- sulfate-S; and
- R1 dispersion.

Subsoils from the soil survey area were analysed for a limited suite of parameters (pH, EC, cation exchange capacity, exchangeable ions, bicarbonate extractable P and chloride) sufficient for reuse potential for rehabilitation of disturbed areas. In addition, calculations were undertaken to determine the exchangeable sodium percentage and the calcium to magnesium ratio. The rationale for the selection of individual analyses is presented in Table 1.

Laboratory analysis for ASS and Potential Acid Sulfate soils (PASS) which would involve SPOCAS analysis for Equivalent sulfur (%S), was not undertaken for any soil samples collected. Field observations and soil survey pH analysis with background information did not indicate a further requirement for this analysis as shown for each SMU in section 4.

The laboratory results are summarised in the SMU summaries within Section 4 and detailed in Attachment C (Laboratory Certificates).

Table 1: Analytical Program and Number of Samples

Test	Number of Samples Tested	Application	Justification
Field pH and pH, EC using portable TPS instrument	Field pH – 41 Meter pH - 23 Meter EC – 23	Indication of possible limitations from salinity and pH.	Used for 'on the spot' estimates of possible salinity or pH problems and to confirm the effective soil depth.
pH	16	Nutrient availability, nutrient fixation, toxicities (Al, Mn), liming, sodicity and correlation with other physical, chemical and biological properties	Measurement of pH is a useful indicator of various soil properties (e.g. values >8.5 usually indicate high exchangeable sodium levels and the presence of carbonates and nutrient availability limitations).
Electrical Conductivity	16	Appraisal of salinity hazard in soil substrates or groundwater and total soluble salts	The measure of electrical conductivity is used as a means of appraising soil salinity. The electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.
Chloride Content	16	The concentration of chloride is usually an indicator of the severity of potential salinity	The chloride anion is usually present in soil associated with sodium. It is highly mobile making it a valuable indicator of salt and water movement. It provides additional confirmation of salinity risk.
Bicarbonate Extractable Phosphorus	4	Measurement of the total Phosphorus in the soil	While both acid extractable P (acid extr. P) and bicarbonate extractable P (Bicarb. extr. P) are routinely measured, only Bicarb. extr. P has been used to assess P fertility. Because the Bicarb. extr. P test provides reliable and consistent data across a wide range of pH values from strongly acid to strongly alkaline, it is far more useful than the acid extr.
Available Nitrogen	4	Presence of nitrogen in an available form for plant uptake	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.

Test	Number of Samples Tested	Application	Justification
Cation Exchange Capacity (CEC), Exchangeable Ca, Mg, Na, K, (Cations), Ca/MG ratio and Exchangeable Sodium Percentage (ESP)	16	Fertile soils have moderate to high CEC. Infertile soils have low CEC. Nutrient status, calculation of ESP, assessment of other physical and chemical properties, dispersivity, shrink – swell, water movement and aeration	The amounts and relative proportions of the exchangeable cations in soil have important effects on both physical and chemical properties. High levels of exchangeable sodium cause dispersion and increased swelling, reducing water movement and affecting near surface aeration whereas exchangeable calcium flocculates colloids and will reduce swelling tendencies. Excessively high or low concentrations of one or the other of the cations may impact buffering capacity and as a result, soil nutrient availability.
Organic Matter	4	Soil organic matter comprises an accumulation of partially disintegrated and decomposed plant and animal residues and other organic compounds synthesized by the soil microbes as the decay occurs. Soil organic matter forms a substantial reserve of potentially mineralizable nitrogen, sulfur and other nutrients.	Testing for soil organic matter provides an indication of the general fertility of soils and thus suitability as a topdressing agent. It also provides information on stored potential nutrients which may not yet be accessible to plants but may become available in the future.
Particle Size Distribution (<2 mm)	4	Nutrient retention, exchange properties, erodibility, doughtiness, workability, permeability, sealing, drainage, interpretation of most other physical and chemical properties and soil qualities	Particle size distribution data provides an assessment of the composition of a soil (based upon the dominant grain size within a soil). This assists with confirmation of field observations as well as providing better grounds for identification of soil types and water holding capacity.
Emerson Aggregate Test	4	Susceptibility to surface sealing under rainfall or irrigation, effect of raindrop impact and slaking, permeability, infiltration, aeration, seedling emergence and correlation with other properties	An Emerson Aggregate Class number is determined using the results of this test. The method for this test is provided in Australian Standard (AS) 1289.3. 8.1 - 2006. Soils are divided into seven classes on the basis of their coherence in water, with a further class distinguished by the presence of calcium-rich minerals. This test provides an indication of dispersivity and slaking behavior of soil and its preponderance to becoming erosive under natural conditions. Therefore it is a useful test in assessing options for ongoing management for excavated and stockpiled materials.
Selected Metals (Mn, B, Cu, Fe and Zn)	4	Detection of heavy metals	The analysis of aluminum, copper, zinc, manganese and iron will assess potential natural concentrations of these select heavy metals in the soil as well as any phytotoxicity issues that may exist.
Sulfur	4	Measurement of total Sulfur in soil	Total levels of sulfur help identify whether organic matter or gypsum are present in a profile.
R1 Dispersion	4	Measurement of the amount of silt and clay that disperses during testing	The measure of R1 dispersion is useful when used in conjunction with ESP and the Ca/Mg ratio for predicting soil physical behaviour.

3.3 Land Suitability Assessment

Land suitability in Central Queensland is based upon the ALE land suitability class definitions (Draft ALE Guidelines, 2013), as shown in Table 2 below.

Table 2: Land Suitability Classes

Land Suitability Class	Definition
Class 1	**Suitable land with negligible limitations.** This is highly productive land requiring only simple management practices to maintain economic production.
Class 2	**Suitable land with minor limitations** which either reduce production or require more than the simple management practices of class 1 land to maintain economic production.
Class 3	**Suitable land with moderate limitations** which either further lower production or require more than those management practices of class 2 land to maintain economic production.
Class 4	**Marginal land**, which is presently considered unsuitable due to severe limitations. The long term significance of these limitations on the proposed land use is unknown or not quantified. The use of this land is dependent upon undertaking additional studies to determine whether the effect of the limitation(s) can be reduced to achieve sustained economic production.
Class 5	**Unsuitable land** with extreme limitations that preclude its use.

The LSAT Guidelines within the Department of Mines and Energy's *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (Department of Mines and Energy, 1995), provide general criteria and threshold values for assessment of a range of soil limitations to rainfed cropping and beef cattle grazing land use.

GTE has used field and laboratory data collected to assess the severity of any limitations and the land suitability class of the each soil unit against the LSAT Guidelines. Methods from Burgess (2003) and Shields and Williams (1991) have been used to support the land suitability classification of soils mapped at the soil survey area.

3.4 Agricultural Land Classes and GQAL

Agricultural land classes are described in the 2013 Draft ALE Guidelines. Table 3 summarises ALCs and illustrates the relationship between ALCs and land suitability classes for beef cattle grazing and rainfed cropping.

Reviewing the lapsed *State Planning Guideline: The Identification of Good Quality Agricultural Land (GQAL) 1/92*, GQAL is land which is capable of sustainable use for agriculture, with a reasonable level of inputs, and without causing degradation of land or other natural resources.

GQAL is assessed using ALCs presented in the Planning Guideline: The Identification of Good Quality Agricultural Land (Department of Primary Industries, 1993) which is superseded by the 2013 Draft ALE Guidelines.

Table 3: Agricultural and Land Suitability Class with Descriptions

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
A			**Crop Land** Land that is suitable for a wide range of current and potential crops with nil to moderate limitations to production.
A1	1-3	1-3	Land that is suitable for a wide range[1] of current and potential broadacre and horticulture crops with limitations to production that range from none to moderate levels.
A2	1-3	1-3	Land that is suitable for a wide range of current and potential horticultural crops only, with limitations to production that range from none to moderate levels.
B	4	1-3	**Limited Crop Land** Land that is suitable for a narrow range[2] of current and potential crops. Land that is marginal for current and potential crops due to severe limitations but is suitable for pastures. Land may be suitable for cropping with engineering and/or agronomic improvements.
C			**Pasture land** Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production. Some areas may tolerate a short period of ground disturbance for pasture establishment.
C1	5	1-2	Suitable for grazing sown pastures (with ground disturbance for establishment) or native pastures on higher fertility soils
C2	5	3	Suitable for grazing native pastures with or without the introduction of pasture species and are lower fertility soils than C1
C3	5	4	Suitable for light grazing of native pastures in accessible areas, and includes steep land more suited to forestry or catchment protection.
D	5	5	**Non-Agricultural Land** Land not suitable for agricultural uses due to extreme limitations. This includes: undisturbed land with significant conservation and/or catchment values; land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop, poor drainage, salinity, acidic drainage; severe degradation; areas within stream beds, channels; or areas of disturbed lands and water bodies (e.g. urbanised, industrial, mining voids, quarries, dams, aquaculture and feedlots etc).
A/C, A/D B/C, C/D			Land that is a complex of Class A, B, C or D land where it is not possible to delineate the land class at the map scale. The dominant class is assumed to be > 50% in area, but <70%[3] and is the first code in the sequence.

Sourced from Guidelines for Agricultural Land Evaluation in Queensland, Second Edition (2013)
1 A wide range of crops is defined as four or more existing crops of local commercial significance. In areas where there is an infrastructure requirement to support an industry, the land may only be suitable for two or more crops, providing the crop is considered to be a regionally significant crop.
2 A narrow range of crops is defined as three or less existing crops of local commercial significance, with the exception of areas where there is an infrastructure requirement to support an industry.
3 The dominant land class will be listed first in the definition. In cases where three land classes are equally dominant and none are greater than 50%, judgement will be used to identify the two most appropriate classes for the unit.

4 SOIL MAPPING UNITS

4.1 Summary

Five soil mapping units (SMUs) have been identified across the soil survey area which includes two soil variants. The SMUs have been grouped according to basic soil morphology, position in the landscape and parent material and are summarised in Table 4. Individual soil types have been classified in accordance with the *Australian Soil Classification* (Isbell, 2002). In some instances, mapped SMUs may include other associated soil types. Comparable soil types described by Story et al (1967) and McCarroll (1997) as well as AMUs of Bourne and Tuck (1993) are cross-referenced.

Figure 1 illustrates the spatial distribution of all mapped soil units within the soil survey area and detailed descriptions of each SMU are provided in the following sections.

Table 4: Soil Mapping Units

SMU	Concept	Land System (Story et al (1967)	AMU (Bourne and Tuck (1993)	Soil Type Story et al (1967)	Major Vegetation	Detailed sites (* lab site)	Area (ha)
Drainage channels and alluvial plains							
Wy-Dp Wyoming Drainage Pathway	Brownish black to dark black sandy clay, silty loams drainage paths	Junee	Isaac	Bullaroo	Flooded Coolibah, Black tea tree, Queensland bluegrass	2*	19
Uplands with sandy earths and lithosols							
Sr Sunrise	Shallow and often rocky gravelly sandy loam over lateritised bedrock	Durrandella	Highlands	Shotover	Bendee and Yapanyah	Nil[1]	15
Wy Wyoming	Hard setting brown to reddish brown sandy loam to clay loam uniform or gradational soil overlying hard ferricrete between 0.5 and 0.8m depth	Monteagle	Duckponds	Petrona	Bendee, Yapanyah, Bloodwood, Narrow leaf ironbark. Areas of Paperbark	1, 5*, 8, 9, 10, 11	829

SMU	Concept	Land System (Story et al (1967)	AMU (Bourne and Tuck (1993)	Soil Type Story et al (1967)	Major Vegetation	Detailed sites (* lab site)	Area (ha)
Wy-GSv Wyoming grey silty variant	Variant of Wyoming with grey silty loam	Monteagle	Duckponds	Bullaroo	Bendee and acacias	4*, 7	124
Wy-Rv Wyoming red colour variant	Variant of Wyoming and red in colour	Monteagle	Duckponds and Highlands	Gregory	Bendee, narrow leaf ironbark and acacias	3, 6*, 12	202

1 – No lab required as this SMU largely consists of rocky surface without topsoil, while some areas have minor topsoil, however delineating boundaries is difficult with this scale of survey. This occasional topsoil can be classed as Wyoming.

4.2 Soils of drainage channels and alluvial plains

4.2.1 Wyoming Drainage Pathway (Wy-Dp)

Overview

This SMU is associated with the active drainage pathways associated with the Comet River. Landforms are flat to very gently undulating plains with drainage lines and soils that are brownish black to dark black sandy clay loams to silty loams often with firm to hard setting surface. Soils throughout profile area are Apedal with moderate to well drainage within the first metre.

Within this SMU, one (1) detailed site was described from within the soil survey area. This detailed site was submitted for laboratory analysis which would be used to identify this SMU. Much of the area remains uncleared of the original riverine vegetation and is in good condition. It has not been developed for cropping due to susceptibility for flooding but has been used for grazing beef cattle.

Land Summary

Representative site number	Site 2		
Site type	Detailed. 75 mm hand auger.	Main vegetation	Black tea tree, Poplar Box, Spear grasses.
Location	667735mE 7364931mN	Disturbance	No effective disturbance
Landform element and pattern	Open Depression	Micro relief	None
		Permeability	Moderate permeable
Slope	1.5%	Drainage	Moderate to well drained
Surface coarse fragments	<2% 2-5mm coarse fragment	Surface condition	Surface is hard setting dry at time of investigation.
ASC Order (s) present in SMU	Brown Kandosol	Land use	Low intensity grazing.
Land System (Story et al (1967)	Comet	Substrate	Tertiary Sandstone
AMU (Bourne and Tuck (1993)	Isaac	Soil Type of Story et al (1967)	Bullaroo
Soil Type (McCarroll 1997)	nsg		
Potential / Acid Sulfate Soils	Land with elevation above 250m (Queensland Globe (2014), Google Earth™) Geological Age: Tertiary No marine or estuarine sediments No low-lying coastal wetlands, back swamp areas, waterlogged, scalded areas or coastal alluvial valleys No gleyed horizons, iron staining or jarosite was observed. Field pH assessment was above 3.5 Laboratory pH for assessment was above 3.5 Potential / Acid Sulfate Soils – Unlikely to be present		
Land suitability summary	Effective soil depth : 1.0m + Estimated soil water storage: 65mm+ Rain fed Cropping class: class 5 (susceptibility to flooding) Beef Cattle Grazing class: class 4 Agricultural Land Class: C3		

Erosion potential (Bourne and Tuck 2003)	High erosive flooding risk and moderate water runoff hazard on slopes >0.5%
Soil Resources	The topsoil is suited to support native grasses and vegetation. Recommended topsoil Strip Depth: 0.4m The subsoil is suited for capping on slopes with a dispersive rating of unlikely however with the addition of recycled organics, may be able to support vegetation. Recommended subsoil strip depth: 0.4 – 1.0m+
Land condition	Good condition
Total area (ha)	19

Soil Profile Morphology Summary

Site 2	HORIZON NAME AND DEPTH (m) BOUNDARY	COLOUR MOTTLES BLEACH	MOISTURE, Depth (m) - FIELD pH, DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.0-0.40 Abrupt	7.5YR3/2 No mottle No bleach	Dry 0.05m – 7.0pH/ 7.90pH Moderate-well drained	Sandy Clay Loam Apedal Massive Very weak	2% 2-10mm Coarse fragments No segregations Medium, common roots
	B21 0.40-1.00 Abrupt	7.5YR3/2 No mottle No bleach	Dry 0.40m – 7.0pH/ 8.34pH 0.80m – 6.5pH/ 8.36pH Moderate drainage	Silty Loam Apedal Massive Very weak	2% <5mm coarse fragments No segregations Very fine, few roots
	B22 1.00-1.20	7.5YR3/3 <5% orange mottle No bleach	Humid 1.10m – 7.0pH/ 8.48pH/ Imperfect drainage	Silty Loam Apedal Massive Very weak	2% <5mm coarse fragments No segregations No roots

Soil Chemistry

The laboratory data for Site 2 is presented below. The major chemistry trends from the available data indicate:

- fertility in the surface layer is low;
- pH is slightly acidic throughout;
- low clay content throughout profile with prominent silt fraction;
- electrical conductivity is low to very low with depth;
- low cation exchange capacity throughout profile;
- non sodic sodicity levels with depth;
- high Ca to Mg ratios throughout the profile; and
- dispersion ratio rating is very low.

Soil Chemistry Results for Representative Site 2

Representative site number: Site 2				
Sample Depth (m)	**0.00-0.10**	**0.30-0.40**	**0.70-0.80**	**1.10-1.20**
Analysis (Unit)				
Soil pH	5.7	6.2	6.5	5.6
Soil EC (dS/m)	0.1	0.03	0.03	0.03
Soil Cl (mg/kg)	64	44	39	37
P(Olsen) (mg/kg)	3	-	-	-
Exch.Ca (meq/100g)	6.1	5.4	5.5	4.3
Exch. Mg (meq/100g)	3.55	4.49	4.53	3.37
Exch. K (meq/100g)	0.62	0.52	0.49	0.51
Exch. Na (meq/100g)	0.34	0.2	0.2	<0.08
CEC (meq/100g)	10.8	10.7	10.7	8.5
Ca/Mg (ratio)	1.7	1.2	1.2	1.3
ESP %Na/CEC	3	2	2	1
Total N (%)	0.04	-	-	-
Nitrate N (%)	6	-	-	-
OrgMatter (%)	1.9	-	-	-
PSA-CS (%)	18	-	-	-
PSA-FS(%)	43	-	-	-
PSA-Silt (%)	11	-	-	-
PSA-Clay (%)	30	-	-	-
Disp Ratio (R1)	0.64	-	-	-
ADMC (%)	4.3	-	-	-
Emerson (Number)	5	-	-	-
Sulfate-S (mg/kg)	18	-	-	-
Mn (mg/kg)	79	-	-	-
Boron (mg/kg)	0.6	-	-	-
Copper (mg/kg)	1.1	-	-	-
Iron (mg/kg)	37	-	-	-
Zinc (mg/kg)	1.5	-	-	-
Al (meq/100g)	0.22	0.09	0.06	0.19
Al/CEC (%)	2	1	1	2

'-' denotes no laboratory analysis undertaken

4.3 Uplands with sandy earths and lithosols

4.3.1 Sunrise (Sr)

Overview

This SMU is located within seven small areas located throughout the soil survey area. The SMU comprises rocky lithosols and small jump-up landforms with little disturbance.

Soils are a generally shallow, gravelly and often rocky sandy loam over lateritised bedrock below 0.1m depth. Within this SMU, no detailed sites were described or samples taken as it consists almost entirely of rocky outcrops and jump ups, where minor areas with topsoil were observed this comprised shallow earths generally identical to *Wy*. Therefore no sites were submitted for laboratory analysis and chemistry could be expected to be a reasonable comparison to *Wy*. A land summary is presented based upon the observation site, Ob3 below.

Land Summary

Representative site number	Observation Site 3		
Site type	Observation	Main vegetation	Bendee, Yapunyah, Paper Bark, Lancewood, Bloodwood
Location	667742 mE 7365355mN	Disturbance	Mainly undisturbed
Landform element and pattern	Ridge, Flat	Micro relief	None
		Permeability	Slow
Slope	3%	Drainage	Slow
Surface coarse fragments	25% cover of coarse fragments. Ironstone to 25mm diameter.	Surface condition	Rocky
ASC Order (s) present in SMU	-	Land use	Grazing
Land System (Story et al (1967)	Durrandella	Substrate	Lateritised Bedrock
AMU (Bourne and Tuck (1993)	Highlands	Soil Type of Story et al (1967)	Shotover
Soil Type (McCarroll 1997)	-		
Potential / Acid Sulfate Soils	Land with elevation above 250m (Queensland Globe (2014), Google Earth™) Geological Age: Tertiary No marine or estuarine sediments No low-lying coastal wetlands, back swamp areas, waterlogged, scalded areas or coastal alluvial valleys No gleyed horizons, iron staining or jarosite was observed. Field pH assessment was above 3.5 Laboratory pH for assessment was above 3.5 Potential / Acid Sulfate Soils – Unlikely to be present		
Land suitability summary	Effective soil depth : 0 – 0.1m Estimated soil water storage: <10mm Rain fed Cropping class: 5 Beef Cattle Grazing class: 5 Agricultural Land Class: D		

Erosion potential (Bourne and Tuck 2003)	High potential if bare of vegetation
Soil resources	The topsoil is suited to support native grasses and vegetation however is very shallow <0.10m from surface. Recommended topsoil Strip Depth: nil (most areas are rocky with minimal soil depth) No subsoil is available. Recommended subsoil strip depth: nil
Land condition	Some sheet and rill erosion evident
Total area (ha)	15

Soil Profile Morphology

Site : Ob3	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH (m) DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.00 – 0.02	7.5YR3/1 No mottles No bleach	Dry No pH -	Coarse sandy loam. Massive Hard	40% ironstone gravel -
	C 0.02-0.35 +	7.5YR4/4 No mottles No bleach	Dry No pH -	Lateritised rock	-

Soil Chemistry

The SMU was considered to be a minor soil type therefore no laboratory is available. Data for *Wy* is considered appropriate for what soil exists.

4.3.2 Wyoming (Wy)

Overview

This SMU is the dominant SMU within the soil survey area with 69% cover. The SMU consists of gently undulating plains which have been significantly cleared for grazing use. Soils are a hard setting brown to grey brown silty clay loam to uniform or gradational sandy clay loam. The SMU is known for overlying hard ferricrete between 0.50 and 0.80m in depth however this expected property was not observed during the site visit.

Within this SMU, six detailed sites were described, one site was submitted for laboratory analysis, site 5. A land summary, soil profile morphology and major laboratory data are presented below.

Land Summary

Representative site number	Site 5		
Site type	Detailed. 75 mm hand auger.	Main vegetation	Bendee, Yapanyah, Bloodwood, Narrow leaf ironbark. Areas of Paperbark
Location	669767mE 7365568mN	Disturbance	None
Landform element and pattern	GUP, Alluvial plain	Micro relief	None
		Permeability	Rapid
Slope	<0.5%	Drainage	Rapid
Surface coarse fragments	No coarse fragments	Surface condition	Firm
ASC Order (s) present in SMU	Kandosol	Land use	Grazing
Land System (Story et al (1967)	Monteagle	Substrate	Ferricrete
AMU (Bourne and Tuck (1993)	Duckponds	Soil Type of Story et al (1967)	Bullaroo
Soil Type (McCarroll 1997)	4KTx		
Potential / Acid Sulfate Soils	Land with elevation above 250m (Queensland Globe (2014), Google Earth™) Geological Age: Tertiary No marine or estuarine sediments No low-lying coastal wetlands, back swamp areas, waterlogged, scalded areas or coastal alluvial valleys No gleyed horizons, iron staining or jarosite was observed. Field pH assessment was above 3.5 Laboratory pH for assessment was above 3.5 Potential / Acid Sulfate Soils – Unlikely to be present		
Land suitability summary	Effective soil depth: 1.00m Estimated soil water storage: 62mm Rain fed Cropping class: 5 Beef Cattle Grazing class: 4 Agricultural Land Class: C3		
Erosion potential (Bourne and Tuck 2003)	Moderate if surface is bare		

Soil resources	The topsoil is suitable all rehabilitation situation but low fertility may require management including using recycled organics if required. Recommended topsoil Strip Depth: 0.50m The subsoil below 0.5m only suitable as capping layer due to hard setting quality. Recommended subsoil strip depth: 0.50-0.80m+ (capping material only)
Land condition	Good condition
Total area (ha)	829

Soil Profile Morphology

Site 5	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.0-0.50 Abrupt	10YR3/1 No mottle No Bleach	Dry 0.10m - 6.17pH 0.30m - 6.5pH Well drained	Silty Clay Loam Moderate, sub angular blocky Weak	No coarse fragments No segregations Very fine, few roots
	B2 0.50-1.35	10YR3/1 No mottle No Bleach	Dry 0.60m - 6.89pH 0.90m - 6.46pH 1.1m - 6.25pH Well drained	Sandy Clay Loam Moderate, sub angular blocky Weak	<5% <2mm coarse fragments No segregations No roots

Soil Chemistry

The laboratory data for Site 5 presented below. The major chemistry trends from the available data indicate the following:

- the soil profile is strongly acidic throughout;
- electrical conductivity and chloride are very low throughout;
- low cation exchange capacity levels throughout profile;
- Ca to Mg ratio is very high decreasing with depth;
- non sodic conditions throughout the soil profile;
- low overall fertility;
- dispersion ratio rating increases with depth from very low to moderate within the B2 horizon; and
- particle size analysis confirms field textures of a sand dominated profile.

Soil Chemistry Results for Representative Site 5

Representative site number: Site 5					
Sample Depth (m)	**0.00-0.10**	**0.30-0.40**	**0.60-0.70**	**0.90-1.00**	**1.10-1.20**
Analysis (Unit)					
Soil pH	4.5	4.5	4.6	4.7	4.7
Soil EC (dS/m)	0.13	0.05	0.04	0.03	0.03
Soil Cl (mg/kg)	41	18	28	28	31
P(Olsen) (mg/kg)	11	-	-	-	-
Exch.Ca (meq/100g)	1.5	0.5	0.2	0.1	0.1
Exch. Mg (meq/100g)	0.84	0.34	0.31	0.33	0.34
Exch. K (meq/100g)	0.97	0.79	0.69	0.67	0.6
Exch. Na (meq/100g)	<0.08	<0.08	<0.08	<0.08	<0.08
CEC (meq/100g)	6.3	6.3	6.7	5.7	4.6
Ca/Mg (ratio)	1.8	1.4	0.7	0.3	0.2
ESP %Na/CEC	1	1	1	1	1
Total N (%)	0.2	-	-	-	-
Nitrate N (%)	36	-	-	-	-
OrgMatter (%)	6.1	-	-	-	-
PSA-CS (%)	22	-	-	-	-
PSA-FS(%)	34	-	-	-	-
PSA-Silt (%)	19	-	-	-	-
PSA-Clay (%)	27	-	-	-	-
Disp Ratio (R1)	0.73	-	-	-	-
ADMC (%)	11.4	-	-	-	-
Emerson (Number)	5	-	-	-	-
Sulfate-S (mg/kg)	10	-	-	-	-
Mn (mg/kg)	6.5	-	-	-	-
Boron (mg/kg)	0.3	-	-	-	-
Copper (mg/kg)	0.4	-	-	-	-
Iron (mg/kg)	261	-	-	-	-
Zinc (mg/kg)	1.2	-	-	-	-
Al (meq/100g)	2.92	4.64	5.43	4.58	3.61
Al/CEC (%)	46	74	81	80	78

'-' denotes no laboratory analysis undertaken

4.3.3 Wyoming Grey Silty Variant (Wy-GSv)

Overview

This SMU is minor associate of the larger *Wyoming* SMU and located throughout the soil survey area. The SMU is located in gently undulating plains and is currently used for low intensity grazing.

The soils are a variant of *Wyoming* with grey silty loam. Within this SMU, one detailed sites was described and submitted for laboratory analysis, site 4. A land summary, soil profile morphology and major laboratory data are presented below.

Land Summary

Representative site number	Site 4		
Site type	Detailed. 75 mm hand auger.	Main vegetation	Narrow leaf ironbark, Acacias Paperbark
Location	669035mE 7364978mN	Disturbance	Minor clearing in some areas
Landform element and pattern	GUP, mid slope	Micro relief	Nil
		Permeability	Slow
Slope	<1.0%	Drainage	Poor
Surface coarse fragments	Coarse fragments <20%	Surface condition	Hard setting sandy loam
ASC Order (s) present in SMU	Grey Kandosol	Land use	Low intensity grazing
Land System (Story et al (1967)	Monteagle	Substrate	Ferricrete
AMU (Bourne and Tuck (1993)	Duckponds	Soil Type of Story et al (1967)	Bullaroo
Soil Type (McCarroll 1997)	-		
Potential / Acid Sulfate Soils	Land with elevation above 250m (Queensland Globe (2014), Google Earth™) Geological Age: Tertiary No marine or estuarine sediments No low-lying coastal wetlands, back swamp areas, waterlogged, scalded areas or coastal alluvial valleys No gleyed horizons, iron staining or jarosite was observed. Field pH assessment was above 3.5 Laboratory pH for assessment was above 3.5 Potential / Acid Sulfate Soils – Unlikely to be present		
Land suitability summary	Effective soil depth : 0.70m Estimated soil water storage:. 40 - 50mm Rain fed Cropping class: 5 Beef Cattle Grazing class: 4 Agricultural Land Class: C3		
Erosion potential (Bourne and Tuck 2003)	High susceptibility to erosion if surface exposed		
Soil resources	The topsoil is suited to support native grasses and vegetation. The topsoil layer is unlikely to possibly dispersive so monitoring would be required. Recommended topsoil strip depth: 0.50m Useable as substrate in reinstated soil profile but low quality. Recommended subsoil strip depth: 0.50-0.80m		

Land condition	Good condition
Total area (ha)	124

Soil Profile Morphology

Site 4	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A11 0.0-0.10 Abrupt	10YR4/3 No mottle No bleach	Dry 0.10m – 7.28pH Well drained	Sandy Loam Polyhedral Weak	2% 2-5mm coarse fragments No segregations No roots
	A12 0.10-0.45 Abrupt	10YR6/2 No mottle No bleach	Dry 0.30m – 7.10pH Well drained	Sandy Loam Polyhedral Weak	2% 2-5mm coarse fragments No segregations No roots
	B2 0.45-0.70	10YR5/3 No mottle No bleach	Dry 0.60m - 7.43pH Moderately drained	Sandy Loam Massive Weak	10% 5-10mm coarse fragments Second attempt, no recovery/refusal at 0.70m

Soil Chemistry

The laboratory data for Site 4 presented below. The major chemistry trends from the available data indicate the following:

- strongly acidic trend;
- electrical conductivity and chloride are very low throughout the profile;
- low cation exchange capacity levels throughout profile;
- high Ca to Mg ratio at 0.1m depth but very low by 0.6m;
- non sodic to slightly sodic conditions with depth;
- dispersion ratio rating is low within the top soil horizon to moderate within the B2 horizon;
- particle size analysis confirms field textures of a uniform sandy loam profile, and
- overall fertility is low.

Soil Chemistry Results for Representative Site 4

Representative site number: Site 4			
Sample Depth (m)	**0.00-0.10**	**0.30-0.40**	**0.60-0.70**
Analysis (Unit)			
Soil pH	4.5	4.7	5.2
Soil EC (dS/m)	0.04	0.03	0.03
Soil Cl (mg/kg)	21	25	43
P(Olsen) (mg/kg)	4	-	-
Exch.Ca (meq/100g)	0.5	0.1	<0.01
Exch. Mg (meq/100g)	0.41	1.03	2.48
Exch. K (meq/100g)	0.14	0.12	0.09
Exch. Na (meq/100g)	0.09	0.16	0.46
CEC (meq/100g)	3.7	3.9	4.7
Ca/Mg (ratio)	1.2	0.1	<0.1
ESP %Na/CEC	3	4	10
Total N (%)	0.14	-	-
Nitrate N (%)	3	-	-
OrgMatter (%)	2.3	-	-
PSA-CS (%)	21	-	-
PSA-FS(%)	44	-	-
PSA-Silt (%)	11	-	-
PSA-Clay (%)	27	-	-
Disp Ratio (R1)	0.66	-	-
ADMC (%)	6.4	-	-
Emerson (Number)	5	-	-
Sulfate-S (mg/kg)	11	-	-
Mn (mg/kg)	1.7	-	-
Boron (mg/kg)	0.2	-	-
Copper (mg/kg)	0.4	-	-
Iron (mg/kg)	174	-	-
Zinc (mg/kg)	0.3	-	-
Al (meq/100g)	2.54	2.49	1.62
Al/CEC (%)	70	64	35

'-' denotes no laboratory analysis undertaken

4.3.4 Wyoming Red Colour Variant (Wy-Rv)

Overview

This SMU is a minor variant of the larger *Wyoming* SMU. The SMU covers approximately the same area as the Wy-GSv SMU and is located along eleven separate areas varying in size. The areas are generally gently undulating plains and are currently being used for grazing.

Soils are generally a variant of *Wyoming* however red to red brown in colour. Within this SMU, three detailed sites were described and one site was submitted for laboratory analysis, site 3. A land summary, soil profile morphology and major laboratory data are presented below.

Land Summary

Representative site number	Site 3		
Site type	Detailed. 75 mm hand auger.	Main vegetation	Bloodwood Wattles regrowth Red Ash Bendee and lancewood
Location	668982mE 7364975mN	Disturbance	Significant clearing
Landform element and pattern	Gentle undulating plain, upper slope	Micro relief	None
		Permeability	Slow
Slope	3.0%	Drainage	Rapid
Surface coarse fragments	No coarse fragments	Surface condition	Firm, minor cracking observed
ASC Order (s) present in SMU	Red Kandosol	Land use	Grazing
Land System (Story et al (1967)	Monteagle	Substrate	Ferricrete
AMU (Bourne and Tuck (1993)	Highlands / Duckponds	Soil Type of Story et al (1967)	Gregory
Soil Type (McCarroll 1997)	-		
Potential / Acid Sulfate Soils	Land with elevation above 250m (Queensland Globe (2014), Google Earth™) Geological Age: Tertiary No marine or estuarine sediments No low-lying coastal wetlands, back swamp areas, waterlogged, scalded areas or coastal alluvial valleys No gleyed horizons, iron staining or jarosite was observed. Field pH assessment was above 3.5 Laboratory pH for assessment was above 3.5 Potential / Acid Sulfate Soils – Unlikely to be present		
Land suitability summary	Effective soil depth : 0.60-1.00m Estimated soil water storage: 71mm Rain fed Cropping class: 5 Beef Cattle Grazing class: 4 Agricultural Land Class: C3		
Erosion potential (Bourne and Tuck 2003)	Low to moderate		

Soil resource	The topsoil is suited to support native grasses and vegetation. The topsoil layer is unlikely to be dispersive. Recommended topsoil Strip Depth: 0.60m Useable as substrate in reinstated soil profile but low quality. Recommended subsoil strip depth: 0.60-0.80m+ pending area
Land condition	Good condition
Total area (ha)	202

Soil Profile Morphology

Site 3	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A11 0.0-0.57 abrupt	5YR3/4 No mottle No bleach	Dry 0.05m – 5.5pH 0.30m – 5.60pH Moderate drainage	Sandy Clay Loam Massive very weak	No coarse fragments No segregations No roots
	A12 0.57-0.90	5YR4/4 No mottle No bleach	Dry 0.70m – 5.55pH 1.00m – 5.89pH Moderate drainage	Silty Loam Polyhedral Weak	No coarse fragments No segregations No roots

Soil Chemistry

The laboratory data for Site 3 presented below. The major chemistry trends from the available data indicate the following:

- strongly acidic trends with depth;
- electrical conductivity and chloride are moderate and low throughout;
- very low cation exchange capacity levels throughout profile;
- low overall fertility;
- very high Ca to Mg ratio within topsoil to low levels within A12 horizon;
- non sodic conditions throughout;
- dispersion ratio rating increases with depth from very low to moderate within the B2 horizon; and
- particle size analysis confirms field textures of a uniform sandy loam profile.

Soil Chemistry Results for Representative Site 3

Representative site number: Site 3				
Sample Depth (m)	**0.00-0.10**	**0.30-0.40**	**0.60-0.70**	**0.80-0.90**
Analysis (Unit)				
Soil pH	3.9	3.9	4.1	4.2
Soil EC (dS/m)	0.3	0.19	0.13	0.16
Soil Cl (mg/kg)	84	71	98	119
P(Olsen) (mg/kg)	5	-	-	-
Exch.Ca (meq/100g)	2.2	1.7	0.9	0.9
Exch. Mg (meq/100g)	1.05	1.62	4.48	6.08
Exch. K (meq/100g)	0.38	0.31	0.21	0.22
Exch. Na (meq/100g)	0.23	0.27	0.54	0.76
CEC (meq/100g)	6.4	7.3	10.0	12.4
Ca/Mg (ratio)	2.1	1.0	0.2	0.2
ESP %Na/CEC	4	4	5	6
Total N (%)	0.05	-	-	-
Nitrate N (%)	75	-	-	-
OrgMatter (%)	1.7	-	-	-
PSA-CS (%)	17	-	-	-
PSA-FS(%)	52	-	-	-
PSA-Silt (%)	7	-	-	-
PSA-Clay (%)	25	-	-	-
Disp Ratio (R1)	0.57	-	-	-
ADMC (%)	3.5	-	-	-
Emerson (Number)	5	-	-	-
Sulfate-S (mg/kg)	46	-	-	-
Mn (mg/kg)	11.2	-	-	-
Boron (mg/kg)	0.4	-	-	-
Copper (mg/kg)	0.4	-	-	-
Iron (mg/kg)	47	-	-	-
Zinc (mg/kg)	0.3	-	-	-
Al (meq/100g)	2.52	3.46	3.95	4.46
Al/CEC (%)	40	47	39	36

'-' denotes no laboratory analysis undertaken

4.4 Soil Resource Management

The measures to ensure that topsoil and subsoil resources are maintained in a suitable condition during the construction and operation of the project are discussed below.

4.4.1 Discussion

Areas of the site will be subject to ground disturbance due to construction and operations activities associated with the transport corridors, infrastructure areas and mining activities which include pits, dumps, dams and stockpiles. The major type of land disturbance will initially involve land clearing and preparation for construction of access roads and lay down areas ahead of the construction of infrastructure and commencement of mining operations.

Areas to be significantly disturbed will require stripping of topsoil and possibly subsoil for reuse in rehabilitation programs. Therefore, all soils within the study area have been assessed to determine their suitability for stripping and reuse in rehabilitation of these areas.

The soils survey area includes significant topsoil reserves with beneficial material for rehabilitation in many areas. Recommendations have been provided for 'double' stripping which refers to the removal of the best quality 'topsoil' layer followed by subsequent removal of suitable quality 'subsoil'. This practice can enhance the volumes of materials available for rehabilitation and return a soil profile similar to that which existed before disturbance. The upper soil layer should be stockpiled and managed separately from the lower material as the upper layer is generally:

- more fertile,
- finer (better) structured and drained, and
- includes pasture seeds and higher organic content.

It is recommended that the 'subsoil' and 'topsoil' materials be placed in the original layering when reused for mine site rehabilitation. Some soils have subsoil materials which are marginal as a plant growth medium (i.e. 'topsoil') but may be stockpiled for capping of poorer material or reinstatement of the original profile.

It is recommended that the each SMU be stockpiled separately (and subsequently the topsoil and subsoil layers) however if project space, time or cost do not allow this, the stockpile options will be summarised in section 4.5.4 below.

The following section 4.5.2 is included to assist management decisions for topsoil and subsoil.

4.4.2 Specific soil type quality and recommendations

The soil survey area was identified containing five SMUs. The sections below give specific recommendations for each of the soils identified.

The rehabilitation objective across all SMUs will be to re-create the pre-disturbance land suitability for agriculture. The amount of disturbance within the soil survey area due to proposed pits, dumps, infrastructure and access roads is summarised in Table 5 for each SMU. This will necessitate sound management of removed soil.

Soil stripping management measures are detailed below in section 4.5.4 for general SMU management detailing recommended stripping of topsoil and subsoil, stockpiling of soil resources, respreading and erosion control measures.

Gradational and duplex sandy to loamy earths (*Wy, Wy-GSv, Wy-Rv, Wy-Dp*)

The SMU *Wy* encompasses shallow to mid depth red, brown and grey earths (*Wy-GSv and Wy-Rv)* as well as soils located within drainage pathways *(Wy-Dp*). The SMUs are generally hard setting uniform to gradational sandy loams to clay loam soils.

These soils are generally low in fertility status with topsoil stripping depths ranging between 0.4m-0.6m and subsoil stripping to 0.7m and 0.8m.

SMU *Wy*

These silty and sandy clay loam soils are better suited to supporting both native grasses and vegetation with application on lower sloping sites for rehabilitation due to the moderate erosion potential.

The topsoil layer to 0.50m exhibits very low dispersive qualities and would not require any additional amelioration for rehabilitation use for the site. This material may be stockpiled separately from the subsoils.

The subsoil layer of 0.50-0.80m consists of moderately dispersive sandy clay loams. The subsoil shall be stockpiled separately and recommended to be reused with the original topsoil. If reuse of subsoil is required separately from the topsoil, it is recommended it is used as a capping layer due to its hard setting quality. Agricultural Dolomite may be applied to ameliorate the soil further if required.

SMU *Wy-GSv*

This sandy loam variant of *Wy* is suited for supporting both native grasses and vegetation with application on lower sloping to flat sites for rehabilitation due to high susceptibility for erosion potential.

The topsoil layer to 0.50m exhibits low dispersive qualities due to the Ca/Mg ratio within laboratory results. If stockpiled topsoil shows visual signs of erosion such rill erosion, Agricultural Dolomite is recommended to increase the Ca/Mg ratio which should stabilise the soil. This material may be stockpiled separately from the subsoils.

The subsoil layer of 0.50-0.80m consists of a Ca/Mg ratio below one and an ESP of layer of ten which indicates moderate

dispersion qualities. The subsoil reused with the topsoil in rehabilitation reuse would be recommended. If reuse of subsoil is required separately from the topsoil, it is recommended that Agricultural Dolomite to ameliorate the soil with recycled organics to facilitate plant growth.

SMU *Wy-Rv*

The sandy clay loam soils within the topsoil layer are better suited to supporting both native grasses and vegetation with application on sloping sites for rehabilitation due to the low to moderate erosion potential.

The topsoil layer to 0.60m indicates very low levels of dispersive behavior due to Ca/Mg ratio above 2. If stockpiled topsoil shows visual signs of erosion such rill erosion, Agricultural Dolomite is recommended to increase the Ca/Mg ratio which should stabilise the soil. The pH of the soil is also the lowest within the six SMUs. Agriculutral Dolomite will assist in increasing this pH value however the SMU is capable of supporting native grasses and vegetation. This material may be stockpiled separately from the subsoils.

The subsoil layer of 0.60-0.80m of silty loam consists of a low Ca/Mg ratio which increases its dispersive qualities over the topsoil layer. The subsoil reused with the topsoil in rehabilitation reuse should have no issues. If reuse of subsoil is required separately from the topsoil, it is recommended that Agricultural Dolomite to ameliorate the soil with recycled organics to facilitate plant growth.

SMU *Wy-Dp*

The sandy clay loam soils within the topsoil layer are better suited to supporting both native grasses and vegetation with application on lower sloping sites for rehabilitation due to the moderate erosion potential.

The topsoil layer to 0.40m and subsoil layer from 0.40-1.0m are both unlikely to be dispersive due to low ESP and greater than one Ca/Mg ratios. As stated, the topsoil layer will be better suited to support vegetation however the subsoil would be capable with the additional of recycled organics were used. This material may be stockpiled separately from the subsoils.

Shallow sandy loams over laterised bedrock (*Sr*)

Soil mapping unit *Sr* is a shallow gravelly sandy loam overlying outcropping lateritised formations. The landform is rugged with jump ups and steeper slopes which would limit the access to amount of topsoil able to be recovered. Laboratory data of the representative site indicated minimal topsoil resources with stripping usually limited to 0.10m based on depth to the laterite.

4.4.3 Stripping Depth Volumes

Table 5 presents the recommended stripping depths for each SMU and total estimated available topsoil and subsoil reserves within the proposed disturbance footprint of the soil survey area. These stripping depths are shown in Figure 2.

Table 5 shows that an estimated total volume of 1,893,000 m^3 high quality topsoil material from the disturbance footprint of the soil survey area is available for rehabilitation. A further 1,067,000 m^3 of suitable subsoil material is available for additional capping of poor quality substrate material or as general enhancement of the replaced soil profile.

Table 5: Recommended Stripping Depths and Volumes Available – Proposed Disturbance Footprint

SMU	Recommended Topsoil Stripping Depth (mbgl)	Recommended Subsoil Stripping Depth (mbgl)	Proposed Disturbance Area (ha)	Approximate Topsoil Volume (m^3)	Approximate Subsoil Volume (m^3)
Wy-Dp Wyoming drainage pathway	0.4	0.4-1.0	4	16,000	24,000
Sr Sunrise	-	-	4	0	0
Wy Wyoming	0.5	0.5-0.8	286	1,430,000	858,000
Wy-GSv Wyoming grey silty variant	0.5	0.5-0.8	27	135,000	81,000
Wy-Rv Wyoming Red variant	0.6	0.6-0.8	52	312,000	104,000
TOTAL FOR DISTURBANCE AREA			373	1,893,000	1,067,000

4.4.4 Soil Resource Management Measures

These management measures will assist in prevent excessive soil deterioration and correct application of soils for rehabilitation.

The following soil handling techniques include the recommended stripping of topsoils and subsoils by earthmoving operators, the stockpiling of materials to ensure minimal loss of soils, retaining the topsoil organic matter for plant propagation after rehabilitation reuse, the respreading of soil layers correctly and erosion control measures.

Stripping of topsoil and subsoil

- prior to the commencement of stripping, areas will be cleared of vegetation;
- earthmoving plant operators will be trained and/or supervised to ensure that stripping operations are conducted in accordance with stripping plans and in situ soil conditions. This will ensure that all suitable topsoil and subsoil material resources are salvaged and that the quality of the stripped soil is not reduced through contamination with unsuitable soils; and
- care will be taken to ensure soil moisture conditions are appropriate, i.e. neither too wet or dry, during stripping, stockpiling, and respreading to ensure that structural

degradation of the soil is avoided and that excessive compaction does not occur during placement or through stockpiling.

Stockpiling topsoil and subsoil

As stated in section 4.5.1, it is recommended that the each SMU be stockpiled separately and subsequently the topsoil and subsoil layers. This may not be an option given project space, time or cost. Table 6 details the recommended stockpiling.

Table 6: Recommended Stockpiling Plan of SMUs[1]

SMU	Topsoil is recommended to be stockpiled separately	Topsoil may be stockpiled with the following SMU if required	Subsoil is recommended to be stockpiled separately	Subsoil may be stockpiled with the following SMU if required
Wy-Dp Wyoming drainage pathway	-	Wy	Yes	-
Sr Sunrise	Yes	-	-	-
Wy Wyoming	-	Wy-Dp	-	Wy-Rv
Wy-GSv Wyoming grey silty variant	Yes	-	Yes	-
Wy-Rv Wyoming Red variant	Yes	-	-	Wy

1. The following stockpile recommendations are based upon but not limited to dispersive indexes (such as Texture, ESP and Ca/Mg ratio), laboratory results for nutrients and suggested amelioration requirements.

- stripped soil shall be stored in stockpiles until it is used;
- soil material stockpiles will be located in areas that are outside the construction footprint area and away from drainage lines;
- drainage from higher areas will be diverted around stockpiles to prevent erosion;
- sediment control (hay bales or sediment traps) will be installed downstream of the stockpiles to collect any washed sediment;
- topsoil stockpiles will be formed in low mounds up to a maximum height of approximately 3 m and subsoil stockpiles up to a maximum height of approximately 6 m, consistent with the storage area available. Long term stockpiles, not used for over 6 months will be deep ripped and sown with local grass seed-stock and legumes in order to keep the soil healthy and maintain biological activity;
- soil stockpiles will be clearly mapped with GPS technology for easy identification and to avoid any inadvertent losses;
- establishment of weeds on the stockpiles will also be monitored and controlled; and

- an inventory of available material, including soil types, will be maintained to ensure adequate materials are available for planned rehabilitation activities.

Re-spreading

Rehabilitation planning will include topsoil and subsoil material respreading considerations including:

- balancing required rehabilitation topsoil and subsoil quantities against stored stockpile inventories; and
- selective placement of more erodible soil materials on flatter areas and not on steeper slopes, to minimise erosion.

During the removal of soils from the stockpiles, care will be taken to minimise structural degradation of the soils. The respreading process will result in some mixing of the upper and lower sections of the stockpiles, promoting the spread of the seed stock and microfauna through the lower sections of the stockpile. Soil material will be respread in even layers at a thickness appropriate for the intended land use of the area to be rehabilitated and volume of soil available. The rehabilitation strategy will include the following measures that are designed to minimise the loss of soil material respread on rehabilitated areas:

- contour ripping to encourage rainfall infiltration and minimise runoff;
- reseeding soon after respreading to establish a vegetation cover as early as possible;
- installation of slope drainage control to limit slope lengths and runoff velocities; and
- installation of collection drains and catches dams to collect runoff and remove suspended sediment.

Erosion Control Measures

The SMUs within the soil survey area include soil horizons which exhibit a slight potential for dispersion. These are the topsoil of SMU *Wy-GSv* and subsoils of *Wy, Wy-GSv* and *Wy-Rv.* They may be subject to sheet, rill and gully erosion if left exposed and unprotected during construction or operations. Proposed erosion and sediment control measures for the construction and operations are as follows:

- infrastructure construction erosion and sediment controls, which will be implemented during construction, are as follows:
    - vegetation clearing will be conducted progressively so that the minimum area necessary for construction is cleared at any time;
    - runoff from higher areas will be directed around construction sites;
    - runoff from bare earthworks areas will be collected in drains and directed through sediment traps and settling

ponds to remove suspended sediment prior to discharge from the site;

- stockpiles of topsoil and any excess cut material will be sown with grass seed and have side slopes reduced to at least a 4:1 gradient;
- earthworks batters will be constructed to stable slopes and vegetated soon after construction; and
- earthworks areas will be landscaped and vegetated as soon as possible after construction is completed.

5 AGRICULTURAL LAND SUITABILITY ASSESSMENT

Land suitability in Queensland is primarily based upon the classifications provided within the LSAT Guidelines within the Department of Mines and Energy (DME) Technical Guidelines for Environmental Management of Exploration and Mining in Queensland (DME, 1995). This approach is further discussed in the recent Draft ALE Guidelines and associated Regional Land Suitability Frameworks for Queensland, 2013. GTE has undertaken the assessment of the ALC in accordance with these requirements. .

Relevant to the LSAT guidelines are the lapsed Queensland Government's State Planning Policies (SPPs) on Good Quality Agricultural Land (GQAL), SPP 1/92 Development and Conservation of Agricultural Land, and accompanying Planning Guideline: The Identification of Good Quality Agricultural Land (DPI, 1993). This policy requires that future land use planning in the State should not alienate or diminish areas designated as GQAL unless there is an overriding community benefit.

5.1 Land Suitability Classes

The ALE land suitability class definitions (Draft ALE Guidelines, 2013), as shown in Table 7, were employed to assist in determination of land suitability across the study area.

Table 7: Land Suitability Classes

Land Suitability Class	Definition
Class 1	**Suitable land with negligible limitations.** This is highly productive land requiring only simple management practices to maintain economic production.
Class 2	**Suitable land with minor limitations** which either reduce production or require more than the simple management practices of class 1 land to maintain economic production.
Class 3	**Suitable land with moderate limitations** which either further lower production or require more than those management practices of class 2 land to maintain economic production.
Class 4	**Marginal land**, which is presently considered unsuitable due to severe limitations. The long term significance of these limitations on the proposed land use is unknown or not quantified. The use of this land is dependent upon undertaking additional studies to determine whether the effect of the limitation(s) can be reduced to achieve sustained economic production.
Class 5	**Unsuitable land** with extreme limitations that preclude its use.

The LSAT Guidelines (DME, 1995) also provide general criteria and threshold values for assessment of a range of soil limitations to rainfed broadacre cropping and beef cattle grazing land use.

The cropping classification evaluates the broad acre potential for growing non-irrigated cash and forage crops which would be mainly sorghum, wheat and sunflower. Only major limiting factors have been considered, including:

- plant Available Water Capacity (PAWC) (m)
- nutrient deficiency (n)
- Soil Physical Factors (p)
- salinity (s)

- rockiness (r)
- microrelief (g)
- susceptibility to Water erosion (e)
- topography (t)
- flooding (f)

Grazing suitability used the same approach as cropping but with varied interpretation of severity of limiting factors.

Field and laboratory data collected was used to assess the severity of any limitations and the land suitability class of the each soil unit against the LSAT Guidelines. Methods from Burgess (2003) and Shields and Williams (1991) have been used to support the land suitability classification of soils mapped at the project site.

The suitability of each SMU for rainfed cropping and beef cattle grazing has been assessed and presented in Table 8. Suitability classes and major limiting factors of each SMU for rainfed cropping and grazing is shown in Figure 3 and Figure 4.

Table 8: Suitability classes for rainfed broadacre crops and grazing for SMUs

Soil Mapping Unit	Description	Cropping		Grazing	
		Major Limitations and Severity	Class	Major limitations and severity	Class
Wy-Dp Wyoming drainage pathway	Brownish black to dark black sandy clay, silty loams drainage paths	moisture –m5 nutrients –n4 physical factors –p3 salinity –s1 rockiness –r1 microrelief –g1 topography –t4 erosion - e1 flooding –f5	5	moisture –m4 nutrients –n4 physical factors –p2 salinity –s1 rockiness – r1 microrelief –g1 pH –1 ESP – 1 erosion - 1 flooding –f4	4
Sr Sunrise	Shallow and often rocky gravelly sandy loam over lateritised bedrock	moisture – n/a nutrients – n/a physical factors – p3 salinity – n/a rockiness – r5 microrelief – g1 topography – t5 erosion - e1 flooding – f1	5	moisture – n/a nutrients – n/a physical factors – p2 salinity – n/a rockiness – r5 microrelief – g1 pH – n/a ESP – n/a erosion - e1 flooding – f1	5
Wy Wyoming	Hard setting brown to reddish brown sandy loam to clay loam uniform or gradational soil overlying hard ferricrete between 0.5 and 0.8m depth	moisture – m5 nutrients – n1 physical factors – p1 salinity – s1 rockiness – r1 microrelief – g1 topography – t1 erosion - e3 flooding – f2	5	moisture – m4[1] nutrients – n2 physical factors – p1 salinity – s1 rockiness – r1 microrelief – g1 pH – 4 ESP – 1 erosion - e2 flooding – f2	4[1]
Wy-GSv Wyoming grey silty	Variant of Wyoming with grey silty loam	moisture – m5 nutrients – n4 physical factors – p3	5	moisture – m5[1] nutrients – n4 physical factors – p2	4[1]

Soil Mapping Unit	Description	Cropping		Grazing	
		Major Limitations and Severity	Class	Major limitations and severity	Class
variant		salinity – s1 rockiness – r2 microrelief – g1 topography – t1 erosion - e2 flooding – f1		salinity – s1 rockiness – r1 microrelief – g1 pH – 4 ESP – 1 erosion - e1 flooding – f1	
Wy-Rv Wyoming Red variant	Variant of Wyoming and red in colour	moisture – m5 nutrients – n4 physical factors – p1 salinity – s2 rockiness – r1 microrelief – g1 topography – t1 erosion - e3 flooding – f1	5	moisture – m5[1] nutrients – n3 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 pH – 5 ESP – 1 erosion - e2 flooding – f1	4[1]

1- DME (1995) assigns uniform sands and loams which are <75mm deep with <50mm water storage potential as class 5 grazing which is unsuitable for that use. Despite this, GTE considers that much of the Wyoming SMU and associated colour variants to be suitable for low intensity grazing and the land has been used for this purpose for many years without degradation. The sands can facilitate immediate pasture growth responses from short term thunderstorm type rain and landholders have incorporated this country into the overall property grazing management regime by utilising opportunities as they arise. For this reason, class 4 grazing suitability has been assigned to Wyoming SMU and variants.

5.1.1 Rainfed Broadacre Cropping

Plant Available Water Capacity (m)

Plant available water capacity (PAWC) is a significant soil property in this locality as cropping is based on fallow storage of moisture in the soil profile. Effective rooting depth is defined as the depth to which approximately 90% of plant roots will extract water. It is normally limited either by the presence of underlying rock or other hard materials or by chemical or physical attributes within the subsoil that restrict root growth (Land Resources Branch, QDPI 1990).

Field morphology observations and chemical data used included soil texture and barriers to root growth such as high sodium, bedrock, poor soil structure, high electrical conductivity and chloride. PAWC is classically defined as the moisture present between field capacity and permanent wilting point (15 bars). In addition, field assessments of effective soil depth, and subsequently soil water storage, was undertaken which followed the method used by Burgess (2003) in the Windeyers Hill survey. This involved estimates of field texture combined with field pH, electrical conductivity and depths to hard soil horizons.

Table 9 presents the criteria which Shields and Williams (1991) proposed for assessment of the moisture availability limitation for crops in the Kilcummin area. Table 10 presents PAWC limitation severity for each SMU.

SMUs containing shallow earths and clay loams overlying gravel and weathered basalt horizons were deemed not suitable for cropping.

Table 9: Criteria for PAWC limitations for cropping (Shields and Williams 1991)

Limitation Level	PAWC (MM)	Effective Rooting Depth	Predicted Cropping Success
2	>130	900 mm	70-75%
3	100-130	600 mm	40-70%
4	75-100	400 mm	<40%
5	<75	<400mm	<30%

Table 10 PAWC limitation levels for SMUs

Soil Unit	Concept	Est. effective rooting depth (m)	PAWC (mm)*	Dryland cropping limitation level	Grazing limitation level
Wy-Dp Wyoming drainage pathway	Brownish black to dark black sandy clay, silty loams drainage paths	1.00	68	5	4
Sr Sunrise	Shallow and often rocky gravelly sandy loam over lateritised bedrock	0 - 0.2	-	5	5
Wy Wyoming	Hard setting brown to reddish brown sandy loam to clay loam uniform or gradational soil	0.25-0.55	>60	5	4
Wy-GSv Wyoming grey silty variant	Variant of Wyoming with grey silty loam	0.4-0.7	>50	5	4
Wy-Rv Wyoming Red variant	Variant of Wyoming and red in colour	0.6	>70	5	4

* Deduced from SCL Act Guidelines Table 9 in addition to comments / findings of Burgess (2003) and Irvine (1999).

Nutrient deficiency (n)

Laboratory data related to nutrients for this project shows quite wide variation in some attributes, particularly phosphorus. According to DME (1995), levels of nutrient deficiency found in this survey fluctuate between favourable, reasonable and not favourable.

SMU *Wy-Dp* reported the least favourable levels of nutrient deficiency. *Wy* reported the highest levels of Bicarbonate P however, the nutrient limitation levels for grazing and cropping have been considered irrelevant for many years. The Department of Environment and Heritage Protection (EHP) take the view that nutrients are irrelevant in this classification as they can be readily rectified with fertiliser. The remaining SMUs were considered favourable in their nutrient levels.

Soil Physical Factors (p)

This limitation deals with conditions which determine sufficient seed contact with moist soil to prevent desiccation prior to germination and establishment. In this soil survey it was found that the five (5) SMUs, *Sr*, *Wy-GSv*, Gy and Wy-Dp had moderate levels of limitation due to the hard setting surfaces when dry.

The remaining SMU's Wy and Wy-Rv reported less significant limitations of this nature.

Salinity (s)

This refers to the reduction in dry matter yield as a result of soluble salt in the soil profile. It also contributes to reduced water availability limitation.

One SMU which indicated moderate salinity levels at depth was *Gy* where electrical conductivity was reported at 0.64(ds/m) with chloride reported at 690mg/kg at one metre depth. All other SMUs did not indicate any salinity limitations.

Rockiness

This refers to the amount of coarse fragments located on the surface of the soil profile, the size and percentage. One SMU *Sr* indicated that the surface coarse fragments were 25% including Ironstone up to 25mm diameter.

The remaining SMUs observed did not exceed the criteria, '10-20% coarse surface gravel and rock outcrop' within the soil survey area.

Microrelief (g)

Microrelief (commonly referred to as gilgai or melon holes) refers to localised depressions along the land surface (McDonald et al., 1984). In the soil survey area, microrelief was not observed as a significant limitation.

Topography (t)

Topography is assessed in terms of gully dissection, depth and slope. Slope may limit the effective and safe use of machinery and contribute to erosion hazard. Topography limitations were evident in steep escarpment areas, rocky lithosol areas (*Sr*) and alluvial flood areas i.e. SMU *Wy-Dp*.

Susceptibility to Water erosion (e)

The risk of soil loss from water erosion magnifies with increased water velocity when land is devoid of vegetation for cropping. Such effects are directly proportional to slope gradient. The better soils occur along gently undulating plains generally less than 2% slope but sufficient to increase soil erosion risk under a cropping use.

Assessment against the water erosion criteria indicated SMUs *Wy and Wy-Rv* reporting the highest limitations.

Flooding (f)

Flooding is assessed in terms flooding events including inundation of an area and frequency of during stream flow. Flooding limitations were only evident in the alluvial flood areas i.e. SMU *Wy-Dp*.

5.1.2 Grazing

Class 1 to 3 grazing land is considered suitable for significant pasture improvement, class 4 offers marginal potential for pasture improvement, and class 5 is not suitable for improvement and restricted to grazing of native pastures with low productivity.

The SMUs with gradational, duplex and shallow clays, *Sr, Wy, Wy-GSv, Wy-Rv* and *Wy-Dp* may be least productive due to severe limitations from restricted soil water availability. Nutrient deficiency also impacts on these SMUs and pH also was acidic across the SMUs however all other land suitability classes were very favourable with no significant limitations to a grazing use.

5.2 Agricultural Land Classification and GQAL

Agricultural land classes are described in the 2013 Draft ALE Guidelines. Table 10 summarises ALCs and illustrates the relationship between ALCs and land suitability classes for beef cattle grazing and rainfed cropping.

GQAL is assessed using the ALCs presented in the *Planning Guideline: The Identification of Good Quality Agricultural Land* (Qld Department of Primary Industries and Department of Housing, Local Government and Planning, 1993).

Table 11 describes ALC's and their relationship with Land Suitability Classes for grazing and cropping. Table 12 describes the relationship between the lapsed GQAL and land suitability classes.

Table 11: Agricultural and Land Suitability Class with Descriptions

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
A			**Crop Land** Land that is suitable for a wide range of current and potential crops with nil to moderate limitations to production.
A1	1-3	1-3	Land that is suitable for a wide range[1] of current and potential broadacre and horticulture crops with limitations to production that range from none to moderate levels.
A2	1-3	1-3	Land that is suitable for a wide range of current and potential horticultural crops only, with limitations to production that range from none to moderate levels.
B	4	1-3	**Limited Crop Land** Land that is suitable for a narrow range[2] of current and potential crops. Land that is marginal for current and potential crops due to severe limitations but is suitable for pastures. Land may be suitable for cropping with engineering and/or agronomic improvements.
C			**Pasture land** Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production. Some areas may tolerate a short period of ground disturbance for pasture establishment.
C1	5	1-2	Suitable for grazing sown pastures (with ground disturbance for establishment) or native pastures on higher fertility soils
C2	5	3	Suitable for grazing native pastures with or without the introduction of pasture species and are lower fertility soils than C1
C3	5	4	Suitable for light grazing of native pastures in accessible areas, and includes steep land more suited to forestry or catchment protection.
D	5	5	**Non-Agricultural Land** Land not suitable for agricultural uses due to extreme limitations. This

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
			includes: undisturbed land with significant conservation and/or catchment values; land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop, poor drainage, salinity, acidic drainage; severe degradation; areas within stream beds, channels; or areas of disturbed lands and water bodies (e.g. urbanised, industrial, mining voids, quarries, dams, aquaculture and feedlots etc).
A/C, A/D B/C, C/D			Land that is a complex of Class A, B, C or D land where it is not possible to delineate the land class at the map scale. The dominant class is assumed to be > 50% in area, but <70%[3] and is the first code in the sequence.

Sourced from Guidelines for Agricultural Land Evaluation in Queensland, Second Edition (2013)
[1] A wide range of crops is defined as four or more existing crops of local commercial significance. In areas where there is an infrastructure requirement to support an industry, the land may only be suitable for two or more crops, providing the crop is considered to be a regionally significant crop.
[2] A narrow range of crops is defined as three or less existing crops of local commercial significance, with the exception of areas where there is an infrastructure requirement to support an industry.
[3] The dominant land class will be listed first in the definition. In cases where three land classes are equally dominant and none are greater than 50%, judgement will be used to identify the two most appropriate classes for the unit.

Table 12: Relationship between lapsed GQAL and Land Suitability Class

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
A	1-3	1-3	**Crop land** - Land that is suitable for current and potential crops with limitations to production that range from none to moderate levels.
B	4	1-3	**Limited crop land** - Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
C	Sub categories are as follows:		**Pasture land** - Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
C1	5	1-2	Land suitable for improved pastures. In some circumstances may be considered as good quality agricultural land.
C2	5	3	Land suitable for native pastures.
C3	5	4	Land suitable for limited grazing of native pastures.
D	5	5	Non-agricultural land - Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.

Sourced from *Planning Guideline: The Identification of Good Quality Agricultural Land* (Department of Primary Industries, 1993) *and Land Resources Branch* (QDPI 1990)

Following the assessment of ALCs on the basis of this survey, GTE has classified ALC boundaries (refer Figure 5). Table 13 aligns the appropriate ALC with the SMUs. Table 14 aligns the appropriate lapsed GQAL with the SMUs. Figure 6 presents the lapsed GQAL classes across the soil survey area.

Table 13: Summary of ALCs by SMU

ALC	DESCRIPTION	SMU
A	**Crop land** – Land that is suitable for a wide range of current and potential crops with nil to moderate limitations to production.	-
A1	Land that is suitable for a wide range1 of current and potential broadacre and horticulture crops with limitations to production that range from none to moderate lev els.	-
A2	Land that is suitable for a wide range of current and potential horticultural crops only, with limitations to production that range from none to moderate levels.	-

ALC	DESCRIPTION	SMU
B	**Limited Crop Land** – Land that is suitable for a narrow range[2] of current and potential crops. Land that is marginal for current and potential crops due to severe limitations but is suitable for pastures. Land may be suitable for cropping with engineering and/or agronomic improvements.	-
C	**Pasture land** Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production. Some areas may tolerate a short period of ground disturbance for pasture establishment.	-
C1	Suitable for grazing sown pastures (with ground disturbance for establishment) or native pastures on higher fertility soils	-
C2	Suitable for grazing native pastures with or without the introduction of pasture species and are lower fertility soils than C1	-
C3	Suitable for light grazing of native pastures in accessible areas, and includes steep land more suited to forestry or catchment protection.	Wy, Wy-GSv, Wy-Rv, Wy-Dp
D	**Non-Agricultural Land** Land not suitable for agricultural uses due to extreme limitations. This includes: undisturbed land with significant conservation and/or catchment values; land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop, poor drainage, salinity, acidic drainage; severe degradation; areas within stream beds, channels; or areas of disturbed lands and water bodies (e.g. urbanised, industrial, mining voids, quarries, dams, aquaculture and feedlots etc).	Sr

Table 14: Lapsed GQAL class and SMUs

GQAL CLASS	DESCRIPTION	SMU
A	**Crop land** – Land suitable for current and potential crops with limitations to production which range from non to moderate levels.	-
B	**Limited Crop Land** – Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.	-
C1	**Land suitable for improved pastures**. In some circumstances may be considered as good quality agricultural land	-
C2	**Land suitable for native pastures**.	-
C3	**Land suitable for limited grazing of native pastures**	*Wy*, *Wy-GSv*, *Wy-Rv, Wy-Dp*
D	**Non-agricultural Land** – Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage	*Sr*

5.3 Summary of Land Suitability Areas

Table 15 provides a summary of the SMUs, areas of agricultural land suitability, ALCs and lapsed GQAL on the soil survey area.

Table 15: Areas (ha) for classes of cropping, grazing, lapsed GQAL and ALC land

Land Suitability – Cropping			Land Suitability – Grazing			GQAL and ALC		
Class	SMU	Area (Ha)	Class	SMU	Area (Ha)	ALC[1]	SMU	Area (Ha)
1	-	0	1	-	0	A	-	0
2	-	0	2	-	0	B	-	0
3	-	0	3	-	0	C1	-	0
4	-	0	4	*Wy-Dp, Wy, Wy-GSv, Wy-Rv*	1174	C2	-	0

Land Suitability – Cropping			Land Suitability – Grazing			GQAL and ALC		
Class	SMU	Area (Ha)	Class	SMU	Area (Ha)	ALC[1]	SMU	Area (Ha)
5	*Wy-Dp, Wy, Wy-GSv, Wy-Rv, Sr*	1189	5	*Sr*	15	C3	*Wy-Dp, Wy, Wy-GSv, Wy-Rv*	1174
						D	Sr	15
TOTAL		**1189**			**1189**			**1189**

1 – GQAL aligns with the ALC

6 POST MINING LAND USE SUITABILITY

6.1 Project Disturbances

The soil survey will require mine rehabilitation programs for areas which are disturbed by mining activities which include but not limited to pits, pads, stockpiles, access roads and infrastructure. Current mine planning indicates that changes in pre-mining land use and suitability will only involve approximately 373 ha or 31.4 % of the soil survey site.

Areas requiring rehabilitation within the soil survey area will include the following:

- Boundary North and South Pits;
- Triumph Pits;
- George Pits;
- Co-disposal facility;
- Rom pad;
- CPP;
- CP-TLO; and
- Workshop and Offices.

The remainder of the soil survey site (approximately 816 ha) will either not be disturbed or will have minimal disturbance from subsidence and associated access roads, minor infrastructure and associated creek disturbance.

6.2 Proposed Post Mining Land Use

The majority of the land disturbed by the project will consist of large pit, dump co-disposal and dam areas. These areas will be considered heavily disturbed and pending the final mining activities completed, will require intensive rehabilitation to achieve the current land suitability use. Minor areas of disturbance such as infrastructure and access roads should only require minimal rehabilitation to be undertaken.

With the appropriate soil conservation and rehabilitation methods utilised, it is envisaged that the land suitability class and subsequently loss of stock rates should be insignificant for post mining land use.

6.2.1 Post Mining Land Suitability Requirements

The requirements for the rehabilitation methods for post mining land use to remain at 'limited grazing' will require the final landform design to not exceed criteria outlined in Class 4 (DME, 1995). If rehabilitation of the soil survey area does not adhere to these criteria and is within the land suitability class 5 criteria, the post mining land suitability may change. This criteria is presented below in Table 16.

Table 16: Land Suitability Criteria and Limitations

Limitation	Requirement for current and post mining land suitability class	Requirements for 'Not suitable for grazing'
	Land suitability Class 4	Land suitability Class 5
Water availability	Plant and water capacity of 50-75mm	Plant and water capacity of <50mm
Nutrient deficiency	Sands and loams at least 75cm deep or overlying rock at shallow depth with Bicarbonate P 5-10ppm or bicarbonate less than or equal to 4ppm	-
Salinity	Rootzone EC 0.9-1.2 mS/cm or Rootzone Cl 900-1500ppm	Rootzone EC >1.2 mS/cm or Rootzone Cl >1500ppm
Rockiness	>90% surface cobble and rock outcrop	Rock outcrop and surface coarse fragments cover total area
pH (1:5)	9.0-10.0 4.0-4.5	>10.0 <4.0
ESP (10cm)% Exchangeable Sodium Percentage	15-30	>30
Wetness	-	Permanent Lakes or deep swamps
Topography	Many deep gullies make cultivation for sowing pastures impractical, or Slopes >15% make cultivation along contours impractical	Strongly dissected terrain over >75% of the area prevernting adequate heard management
Water erosion	Slopes 6-12% on sodic rigid soils or Slopes 9-15% on cracking clays or Slopes 20-45% on non-sodic rigid soils	Slopes >45%

'-' denotes no limitation criteria

In order to maintain the requirements for limited grazing (Class 4), the following recommendations may be considered for the separate mining areas. It is assumed the topsoil and subsoil resources from the disturbance areas have been stored correctly and is available for use.

The soil handling techniques and management of these soil resources will be important to ensure post mining land use returns to existing land classes. Section 4.4 outlines the following stages of stripping, re-spreading and erosion controls.

6.2.1 Pit and Dump Areas

Pit and dump areas shall be formed according to a landform specification for final mine closure based upon current and projected mining activities including but not limited to the removal of soil resources, spoil product and coal product. This includes calculating spoil volumes in relation to backfilling and re-grading pit voids.

In order to meet the required land suitability class, it is expected that topography and water erosion assists in the final relative levels (RLs) for these areas for topography and water erosion. If the slopes of these areas are greater than 15%, land suitability class may have to be re-defined for these areas.

Areas considered for long term water storage within the pit and dump areas may be classified as land suitability class 5, pending final mine closure design.

6.2.2 Co disposal Facility

As with the pit and dump areas, a landform specification for final mine closure based upon the mining activities would be required. The appropriate backfilling of tailings of this area would be undertaken with final RLs within the land suitability class 4 criteria.

6.2.3 Water dams and creek diversions

Most water control structures will be retained as drainage pathways or permanent storages for use for cattle and wildlife in post mining landforms. Where this isn't deemed appropriate, suitable rehabilitation of the areas will be undertaken to either re-divert pathways or backfill water dam areas.

6.2.4 CPP, CPP-TLO, Rom pad, workshop and offices

Built structures such as the CPP, CPP TLO and Rom Pad will be removed from site. When demolition is to be undertaken – all of the structure including concrete slabs will be removed. These areas including hardstands will be de compacted by deep ripping, then topsoiled with available soil resources.

The workshops and offices may also be removed unless negotiated are handed over to the future landholder of the site to support grazing/rural use.

All areas once removed shall be subject to a soil contamination inspection prior to rehabilitation.

6.2.5 Access tracks and haul roads

Access tracks and haul roads will be de compacted by dozer ripping, soil resources will be respread.

The rehabilitation of these areas will take into account many uncertainties as detailed in Section 6.2.1, however if they adhere to the following criteria and recommendations, the land suitability will not change.

Table 17 and Figure 7, Figure 8, Figure 9 and Figure 10 present the distribution of rainfed cropping, beef grazing, the ALC and lapsed GQAL post-mining land suitability classes.

Table 17:Post Mining Land Suitability Changes

Land Suitability – Cropping			Land Suitability – Grazing			ALC / GQAL		
Class	Existing (ha)	Post mining (ha)	Class	Existing (ha)	Post mining (ha)	Class	Existing (ha)	Post mining (ha)
1	0	0	1	0	0	A	0	0
2	0	0	2	0	0	B	0	0
3	0	0	3	0	0	C1	0	0
4	0	0	4	1174	1174	C2	0	0
5	1189	1189	5	15	15	C3	1174	1174
						D	15	15
Total	1189	1189		1189	1189		1189	1189

6.3 Post mining uncertainties and Mine Closure Plan

The proposed post mining land use is based upon the mine planning and activities that occur during the life and closure of the mining operation however some of these are considered uncertain and/or subject to change during the mines lifecycle. Therefore, the post mining landuse of limited grazing may be reviewed and amended against these uncertainties to ensure the final land suitability returns to the existing conditions. The factors which may influence change in the post mining land suitability are the following:

- what type/s of coal may be economically mined during the mines life cycle;
- the amount, location and quality of mine spoil volumes produced;
- mining methods utilised;
- environmental monitoring of the project disturbances;
- closure of the mine objectives/environmental management plan;
- current environmental regulatory requirements; and
- corporate and stakeholder consultation.

In order to ensure that the final land use of limited grazing is achievable, GTE recommend a Mine Closure Plan (MCP) be developed for the project area taking into account the information within this report. The first MCP should reflect what is envisaged and recommended above in Section 6.2. The MCP will include indicators and criteria which would measure the progress towards the objectives of the rehabilitation and final land suitability class.

The MCP should be reviewed annually so that changes to the above bullet points may be taken into account which may affect the post mining land use. The MCP should include contingencies where if limited grazing cannot be achieved, that self-sustaining stable natural bush land is the end result.

7 CONCLUSION

Based on the scope of the report, the following is concluded and summarised in Table 18:

- five soil mapping units are present within the soil survey area, *Wyoming (Wy), Wyoming Grey Silty Variant (Wy-GSv), Wyoming Red Variant (Wy-Rv, Wyoming Drainage Pathway variant (Wy-Dp) and Sunrise (Sr)*;
- the area of the soil survey area is dominated by areas of shallow red, brown and grey sandy earths, loams *Wy* (69.7 % coverage), *Wy-GSv* (10.4 % coverage) and *Wy-Rv* (17.0 % coverage). Active drainage pathways and related floodplains of the Comet River on weathered tertiary sandstone *Wy-Dp* (1.6 % coverage) and steep generally shallow, gravelly and often rocky sandy loam over lateritised bedrock *Sr* (1.3% coverage), make up the remaining areas;
- the assessment of ALC reported four SMUs *Wy, Wy-GSv*, *Wy-Rv*, *Wy-Dp* were suited for limited grazing (class C3). The only remaining SMU *Sr*, was considered not suitable for agricultural uses due to extreme limitations (class D). No rain grown or irrigated cash cropping was found during the desktop evaluations of aerial photography, Australian Land Use Management (ALUM) land use mapping, observed during the fieldworks or anecdotally by the land owner;
- review of this information reported regarding the risk of ASS within the soil survey area was unlikely due to geological origins, elevation, landforms, field observations and field pH testing;
- the estimated proposed area of active disturbance by infrastructure and mining activities is 373 hectares. Suitable soil materials for rehabilitation of disturbed areas (topsoil and subsoil) within this area are conservatively estimated at 1,893,000 m^3 and 1,067,000 m^3 respectively. Therefore volumes of topsoil and capping materials available from within the project's disturbance area significantly exceed expected requirements for complete rehabilitation to pre-disturbance land suitability; and
- proper management of soil resources and rehabilitation during the pre-mining and post mining stages will ensure the post mining land suitability classes for limited grazing remains.

Table 18: Soil Mapping Unit Summary

SMU	Area (ha)	% of area	Description	Land Suitability Class (DME 1995)				Agricultural Land Class / Lapsed GQAL	
				Cropping		Grazing			
				Existing	Post Mining	Existing	Post Mining	Existing	Post Mining
Wy-Dp Wyoming drainage pathway	19	1.7	Brownish black to dark black sandy clay, silty loams drainage paths	5	5	4	4	C3	C3
Sr Sunrise	15	1.4	Shallow and often rocky gravelly sandy loam over lateritised bedrock	5	5	5	5	D	D
Wy Wyoming	629	67.1	Hard setting brown to reddish brown sandy loam to clay loam uniform or gradational soil overlying hard ferricrete between 0.5 and 0.8m depth	5	5	4	4	C3	C3
Wy-GSv Wyoming grey silty variant	124	10.8	Variant of Wyoming with grey silty loam	5	5	4	4	C3	C3
Wy-Rv Wyoming Red variant	202	18.4	Variant of Wyoming and red in colour	5	5	4	4	C3	C3

8 REFERENCES

Australian Soil Resource Information System, CSIRO, accessed 5 June 2014, <www.asris.csiro.au>

Baker, D.E. and Eldershaw, V.J. (1993) Interpreting Soil Analysis for agricultural use in Queensland. QDPI QO93014.

Bourne,G.F. and Tuck, G.A. (1993) Understanding and Managing Soils in the Central Highlands. QDPI QE93002. Brisbane.

Bruce, R.C. and Rayment, G.F. (1982). Analytical Methods and interpretations used by the Agricultural chemical Branch, QDPI, for soil and land use surveys. QDPI Bulletin QB82004.

Bruce, R.C. and Rayment, G.F. (1984). Soil Testing and Some Test Interpretations used by the QDPI. QDPI Bulletin QI84029.

Burgess, J.W. (2003) Land Resource Assessment of the Windeyers Hill Area, Isaac–Connors and Mackenzie River Catchments, Central Queensland, Queensland Department of Natural Resources & Mines. Report QNRM02189.

Department of Mines and Energy (1995), Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland – Land Suitability Assessment Techniques, Environmental Protection Agency, Brisbane.

Department of State Development, Infrastructure and Planning (DSDIP), 2014, Priority Agricultural Areas - Central Queensland, accessed 29 August 2014, http://www.dsdip.qld.gov.au/resources/map/central-queensland/paa-cq-breakdown.pdf

Google Earth 2014, CNES/Astrium/Spot Image, 7365004mS 670464mE (GDA94 Zone 53), elevation 268m, <http://www.google.com/earth/index.html> [Viewed 20 May 2014]

GT Environmental Pty Ltd (2014), Regional Planning Interests Assessment of Comet Ridge Project, Brisbane QLD.

Gunn, R.H, Beattie, J.A., Reid, R.E. and van de Graff, R. (1988). Australian Soil and Land Survey: Guidelines for Conducting Surveys. Inkata Press. Melb.

Isbell, R.F. (2002), The Australian Soil Classification, CSIRO Publishing, Collingwood VIC.

Irvine, S.A. (1999) Site Characterisation Report Gindie Group, 'Juanita'. Sustainable Farming Systems Publication no.13. DNR, Queensland.

Land Resources Branch Staff (1990). Guidelines for agricultural land evaluation in Queensland. Queensland Department of Primary Industries. QI9005

McCarroll, (1997). Agricultural land and soils of key transects of the Comet River.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. (1990). Australian Soil and Land Survey: Field Handbook, 2nd Edition. Inkata Press, Melbourne.

McKenzie, N.J., Grundy,M.J., Webster. R. Ringrose-Voase. A.J. (2008) Guidelines for Surveying Soils and Land Resources . Second Edition. CSIRO Publishing.

National Committee on Soil and Terrain (2009), Australian Soil and Land Survey: Field Handbook (Third Edition), CSIRO Publishing, Melbourne.

Queensland Department of Primary Industries and Department of Housing, Local Government and Planning (1993), Planning Guidelines: The Identification of Good Quality Agricultural Land.

Queensland Government, 2014, Queensland Land use Mapping Program (QLUMP), accessed 29 August 2014, http://www.qld.gov.au/environment/land/vegetation/mapping/qlump/

Queensland Government 2014, *Regional Planning Interests Act, Act No 11*, Queensland Government, Brisbane, Qld.

Queensland Government 2011, *Strategic Cropping Land Act, Act No. 47,* Queensland Government, Brisbane, Qld.

Rayment, G.E. and Lyons, D.J. (2011), Soil Chemical Methods – Australasia, CSIRO Publishing, Collingwood VIC.

Rayment, G.E. and Higginson, F.R. (1992). Australian Soil and Land Survey Handbook – Australian Laboratory Handbook of soil and water chemical methods. Inkata Press, Melbourne.

Shields and Williams (1991) Soils and Land Suitability for the Kilcummin Area, Central Queensland. QDPI Brisbane.

Story, R., Galloway, R.W., Gunn, R.H. and Fitzpatrick, E.A. (1967), Lands of the Isaac-Comet Area, Queensland, CSIRO Publishing, Melbourne.

Tuck, G.A. (1993 unpublished). Major Soils of the Raingrown Cropping Areas at Emerald. QDPI, Brisbane.

9 GLOSSARY OF TERMS

The following descriptions are of terms used in the text of this report.

ALC. Agricultural Land Classification

ASC. Australian soil class

Alluvial. Describes material deposited by, or in transit in, flowing water.

Apedal. Describes a soil in which none of the soil material occurs in the form of peds or soil aggregates in the moist state.

Cation Exchange Capacity (CEC). The maximum positive charge required to balance the negative charge on colloids (clays and other charged particles). The units are milli-equivalents per 100 grams of material or centimoles of charge per kilogram of exchanger.

Clay. A soil material composed of particles finer than 0.002 mm. When used as a soil texture group such soils contain at least 35% clay.

Dispersion. A process by which species in solution mix with a second solution, thus reducing in concentration. In the case of sodic soils it will predispose the soil material to lose structure and disseminate into the solution.

Electrical Conductivity (EC). The EC of water is a measure of its ability to conduct an electric current. This property is related to the ionic content of the sample, which is in turn a function of the total dissolved (ionisable) solids (TDS) concentration. An estimate of TDS in fresh water can be obtained by multiplying EC by 0.65.

ESP. Exchangeable sodium percentage. It is calculated by dividing the exchangeable sodium by the cation exchange capacity (CEC), multiplied by 100. ESP values greater than 6% are considered sodic, with values greater than 15% considered very sodic.

Gradational. The lower boundary between soil layers (horizons) has a gradual transition to the next layer. The solum (soil horizon) becomes gradually more clayey with depth.

Gradient. The rate of inclination of a slope. The degree of deviation from the horizontal.

Gully erosion. The displacement of soil by running water that forms clearly defined, narrow channels that generally carry water only during or after heavy rain.

Horizon. An individual soil layer, based on texture and colour, which differs from those above and below.

Infiltration. The passage of water, under the influence of gravity, from the land surface into the subsurface.

Loam. A medium textured soil of approximate composition 10-25% clay, 25-50% silt and >50% sand.

Massive. Refers to the condition of the soil layer in which the layer appears to be as a coherent or solid mass which is largely devoid of peds.

MCP. A living document which outlines the strategies and goals to achieve mine closure with minimal disturbance and to pre-existing conditions.

Mottles. Areas of contrasting colour within the overall soil colour which are caused by anerobic conditions as a result of poor aeration. Usually an indicator of poor drainage and retention of water.

Ped. An individual natural soil aggregate. In an undisturbed state peds will group together to form larger aggregates.

Pedal. Describes a soil in which some or all of the soil material occurs in the form of peds in the moist state.

pH. A logarithmic index for the concentration of hydrogen ions in an aqueous solution, which is used as a measure of acidity.

Profile. The solum. This includes the soil A and B horizons and is basically the depth of soil to weathered rock.

Representative Site. A location deemed very representative of the soil mapping unit for which detailed characterisation is to be done.

SMU. Soil Mapping Unit. Soils grouped into a single management unit on the basis of similar morphology, position on the landscape, substrate and chemistry.

Sheet erosion. The removal of surface material from a wide area of gently sloping or graded land by broad continuous sheets of running water rather than by streams.

Sodic. A term given to soil with a level of exchangeable sodium cations greater than 10-15% of the soils cation exchange capacity (CEC), or soluble sodium cations greater than 10-15 times the square root of soluble calcium and magnesium cations. These terms are known as exchangeable sodium percentage (ESP) and sodium adsorption ratio (SAR) respectively.

Soil phase. A subdivision of a profile class based on attributes that have particular significance for land use and potentially influences its suitability for a particular land use.

Soil Variant. A soil with one or more profile attributes outside the usual range for a defined soil profile class, but because of its restricted distribution (or because the varying properties are not considered to have particular management significance), it is not defined as a separate soil profile class.

Subsoil. Subsurface material comprising the B and C horizons of soils with distinct profiles. They often have brighter colours and higher clay content than topsoils.

Texture. The size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.

Topsoil. Part of the soil profile, typically the A1 horizon, containing material which is usually darker, more fertile and better structured than the underlying layers.

10 FIGURES

Figure 1: Soil Mapping Units

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend

- Mining Lease Application
- Disturbance Area
- Detailed Site
- Observation Site

- Wyoming Drainage Pathway (Wy-Dp) - Brownish black to dark black sandy clay, silty loams, drainage paths
- Sunrise (Sr) - Shallow and often rocky, gravelly sandy loam over laterised bedrock
- Wyoming (Wy) - Hard setting brown to reddish brown sandy loam to clay loam or gradational soil overlyng hard ferricrete between 0.5 and 0.8m depth
- Wyoming Grey Silty Variant (Wy-GSv) - Variant of Wyoming with grey silty loam
- Wyoming Red Variant (Wy-Rv) - Variant of Wyoming with red colour

GTenvironmental

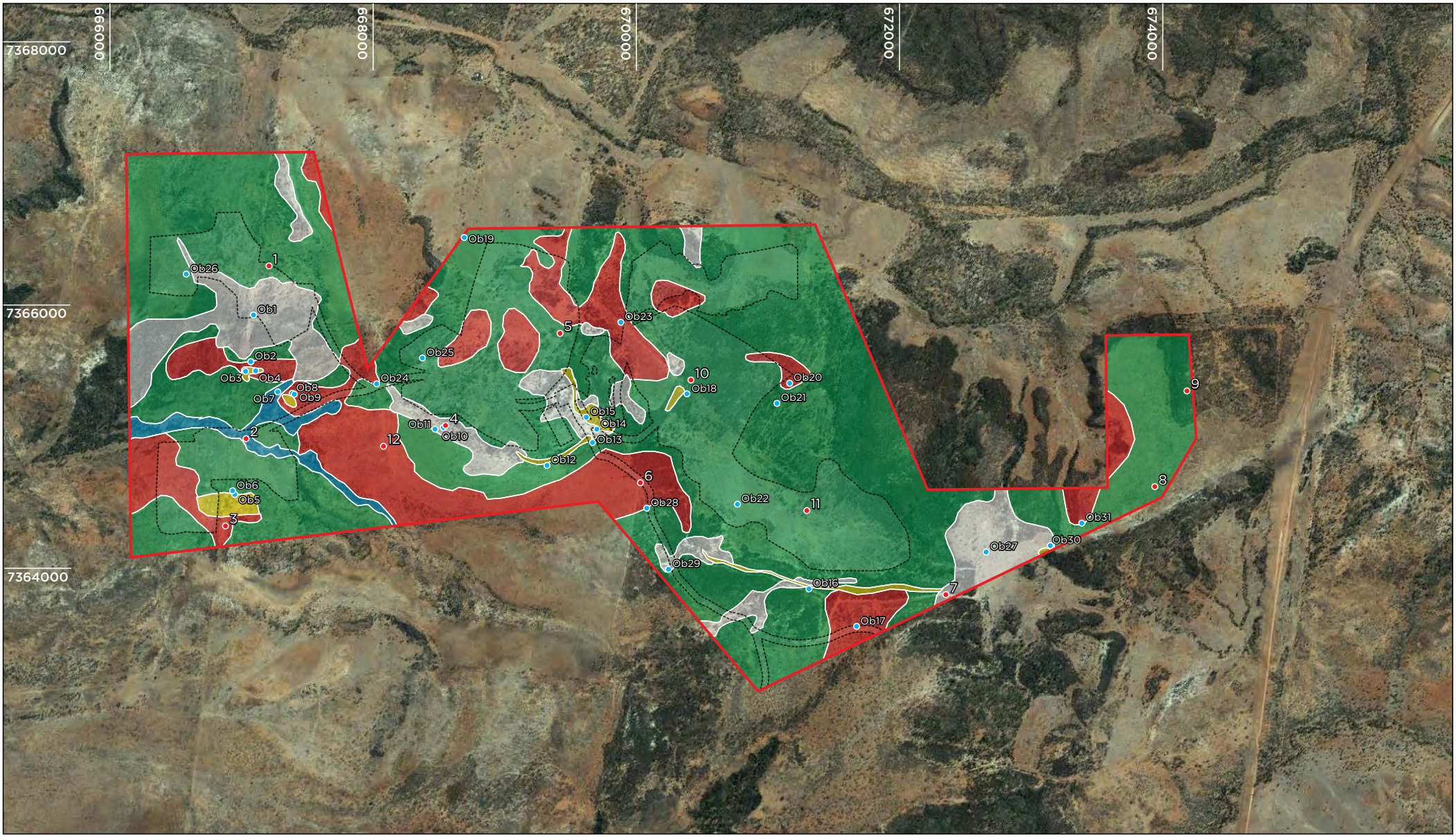


Figure 2: Topsoil Stripping Depths

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend

- Mining Lease Application
- Disturbance Area
- 0.0 metres
- 0.4 metres
- 0.5 metres
- 0.6 metres

GTenvironmental

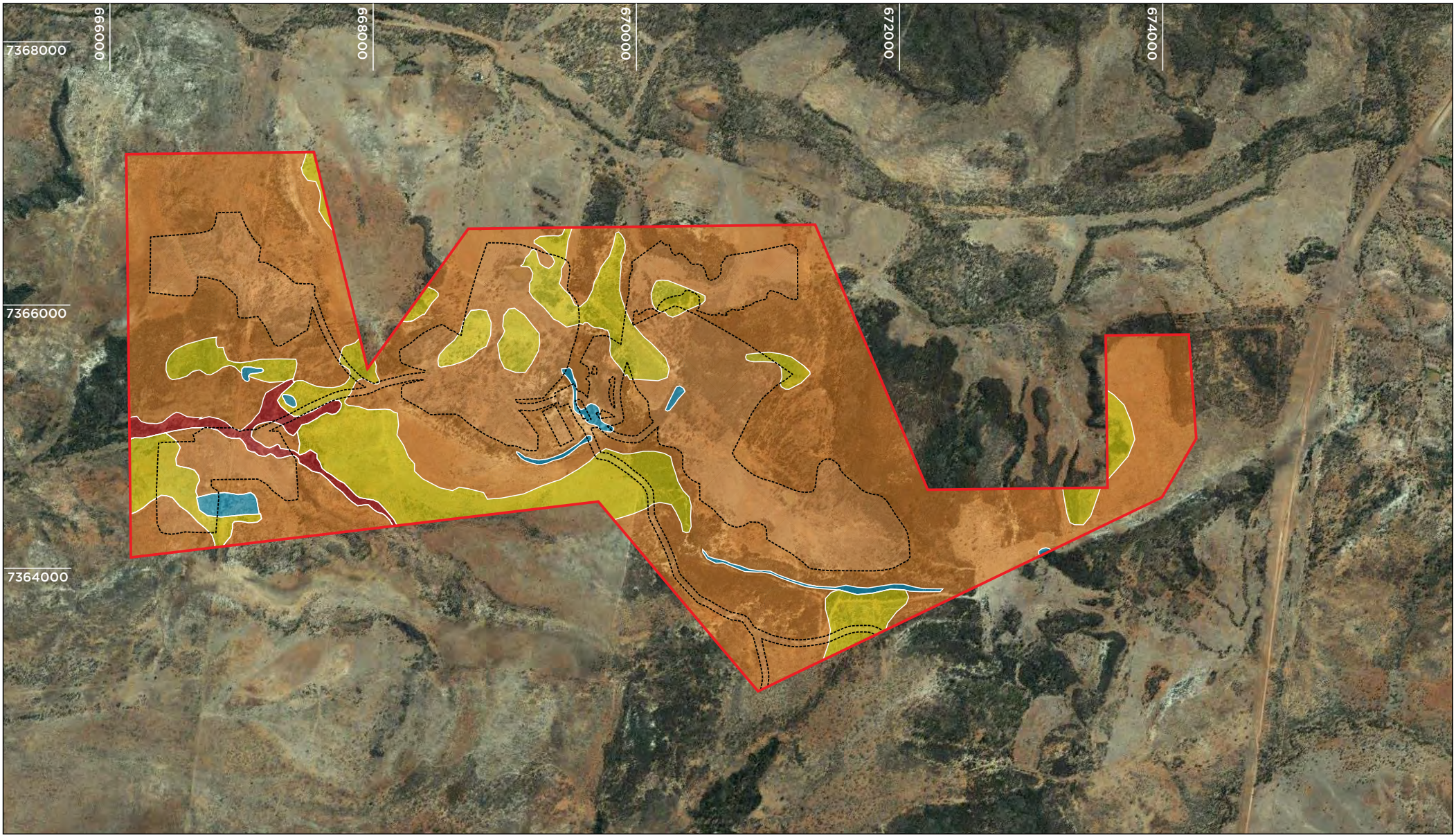


Figure 3: Existing Land Suitability - Rainfed Cropping

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class 5

GTenvironmental

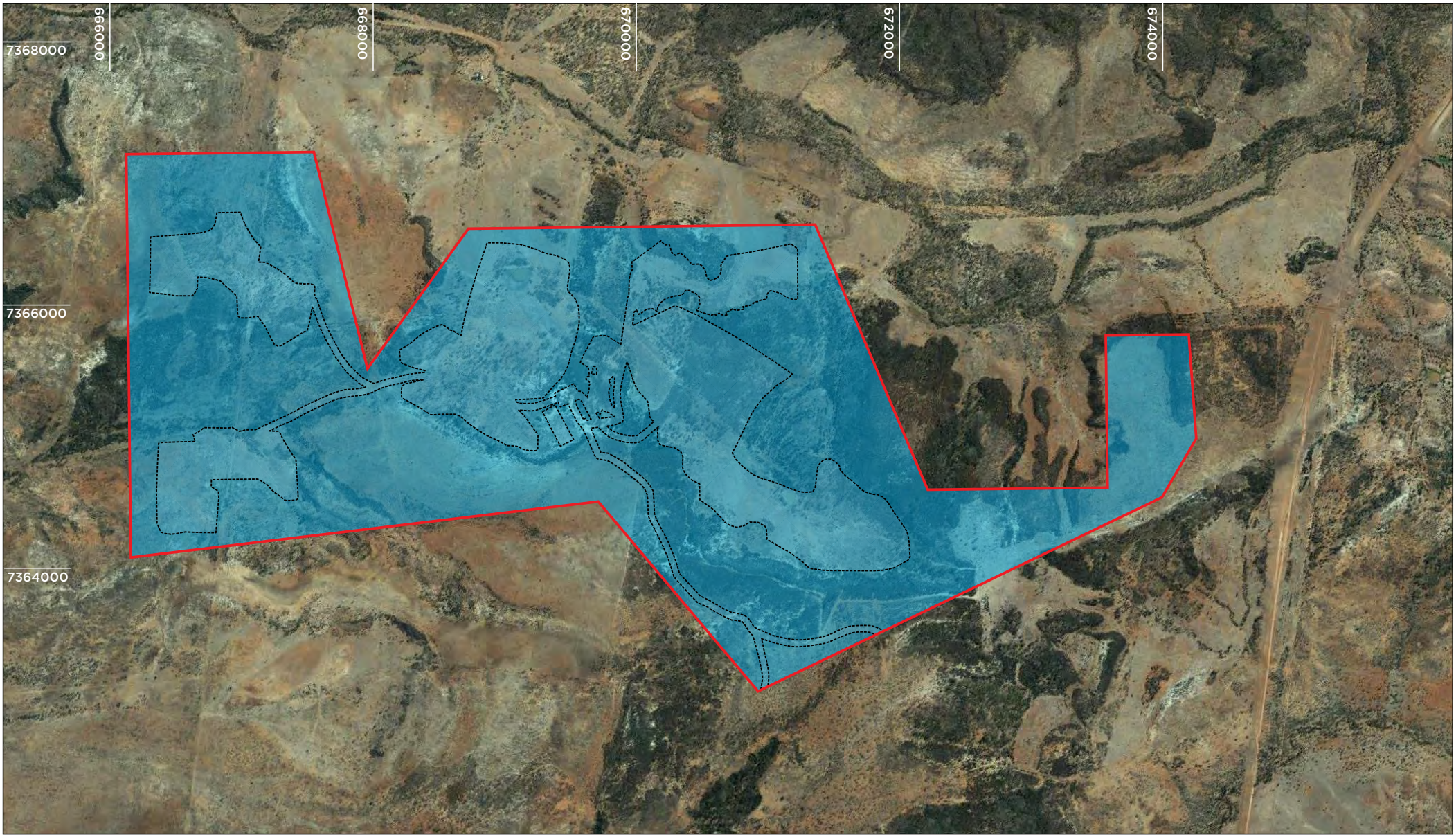


Figure 4: Existing Land Suitability - Beef Cattle Grazing

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class 4
- Class 5

GTenvironmental

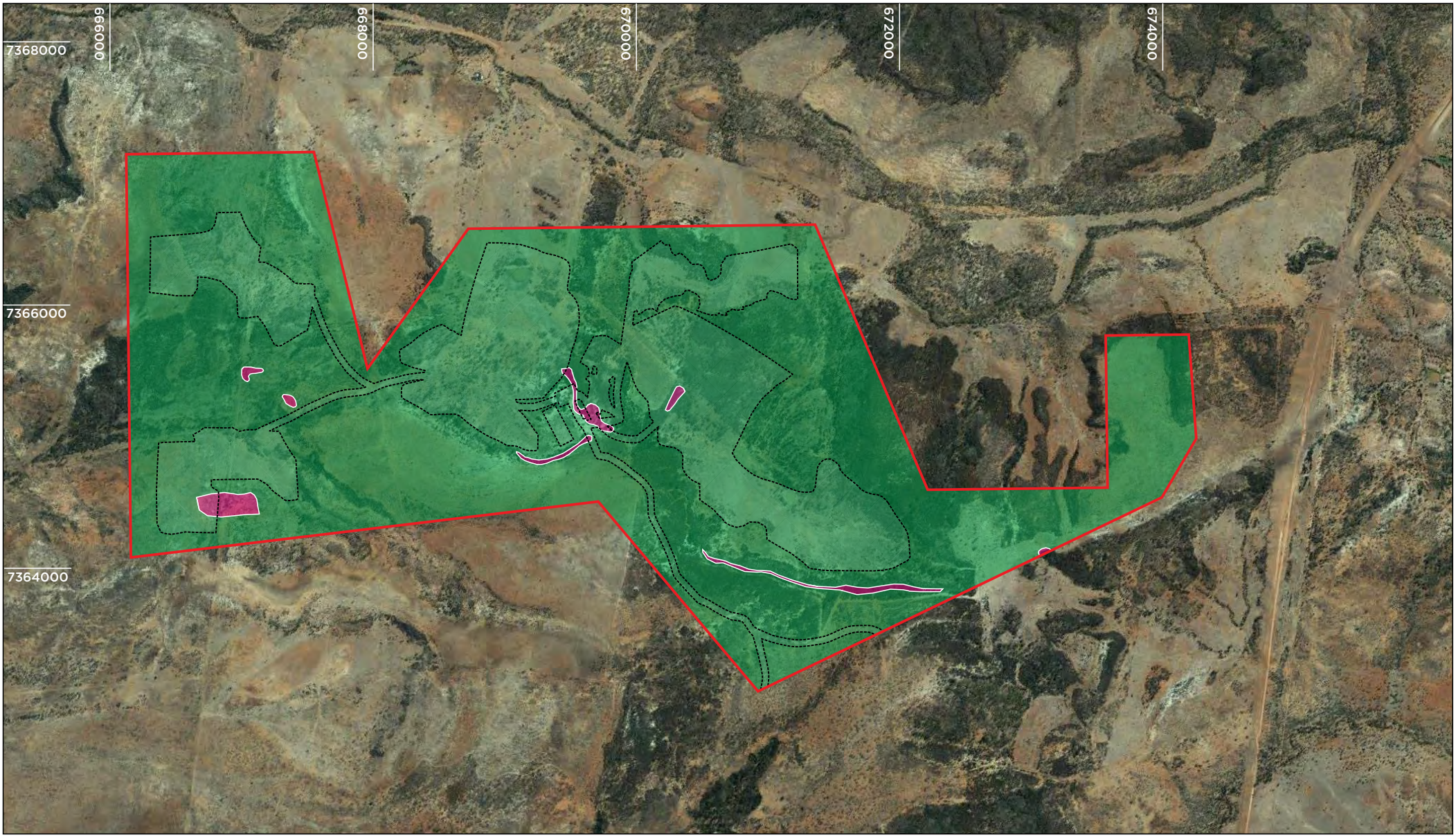


Figure 5: Existing Land Suitability - Agricultural Land Classification

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class C3
- Class D

GTenvironmental

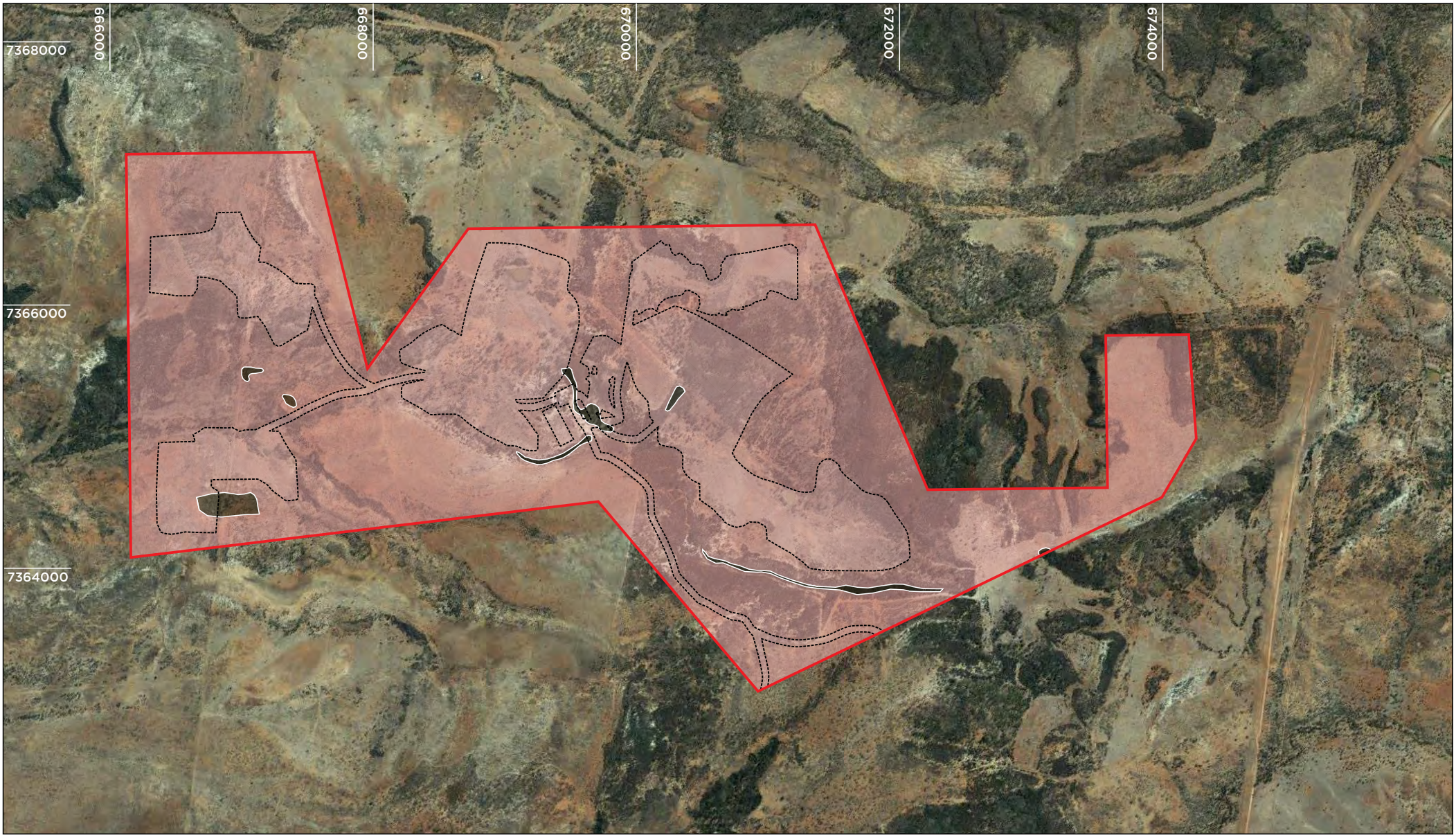


Figure 6: Existing Land Suitability - GQAL

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class C3
- Class D

GTenvironmental

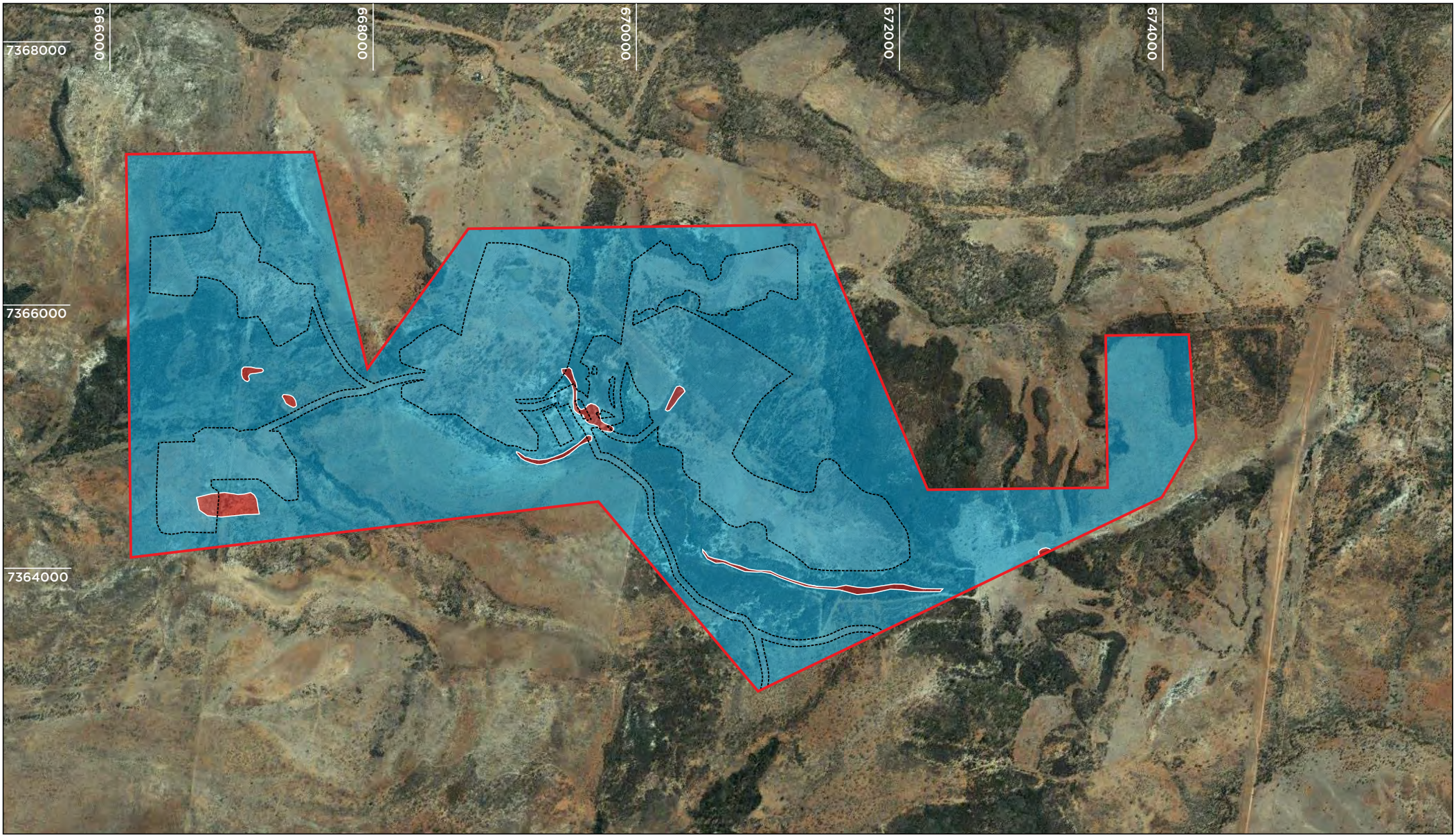


Figure 7: Post Mining Land Suitability - Rainfed Cropping

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class 5

GTenvironmental

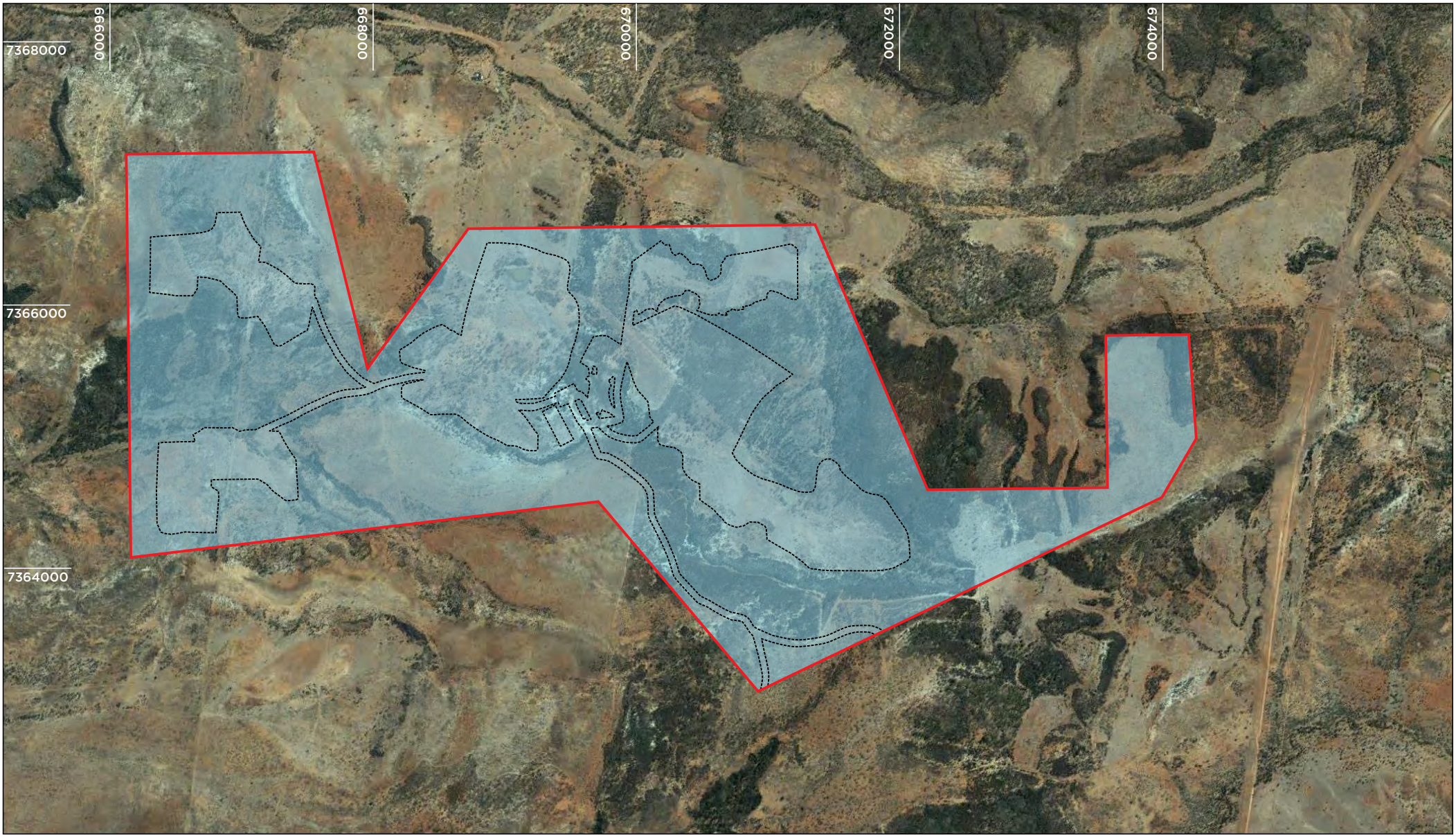


Figure 8: Post Mining Land Suitability - Beef Cattle Grazing

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class 4
- Class 5

GTenvironmental

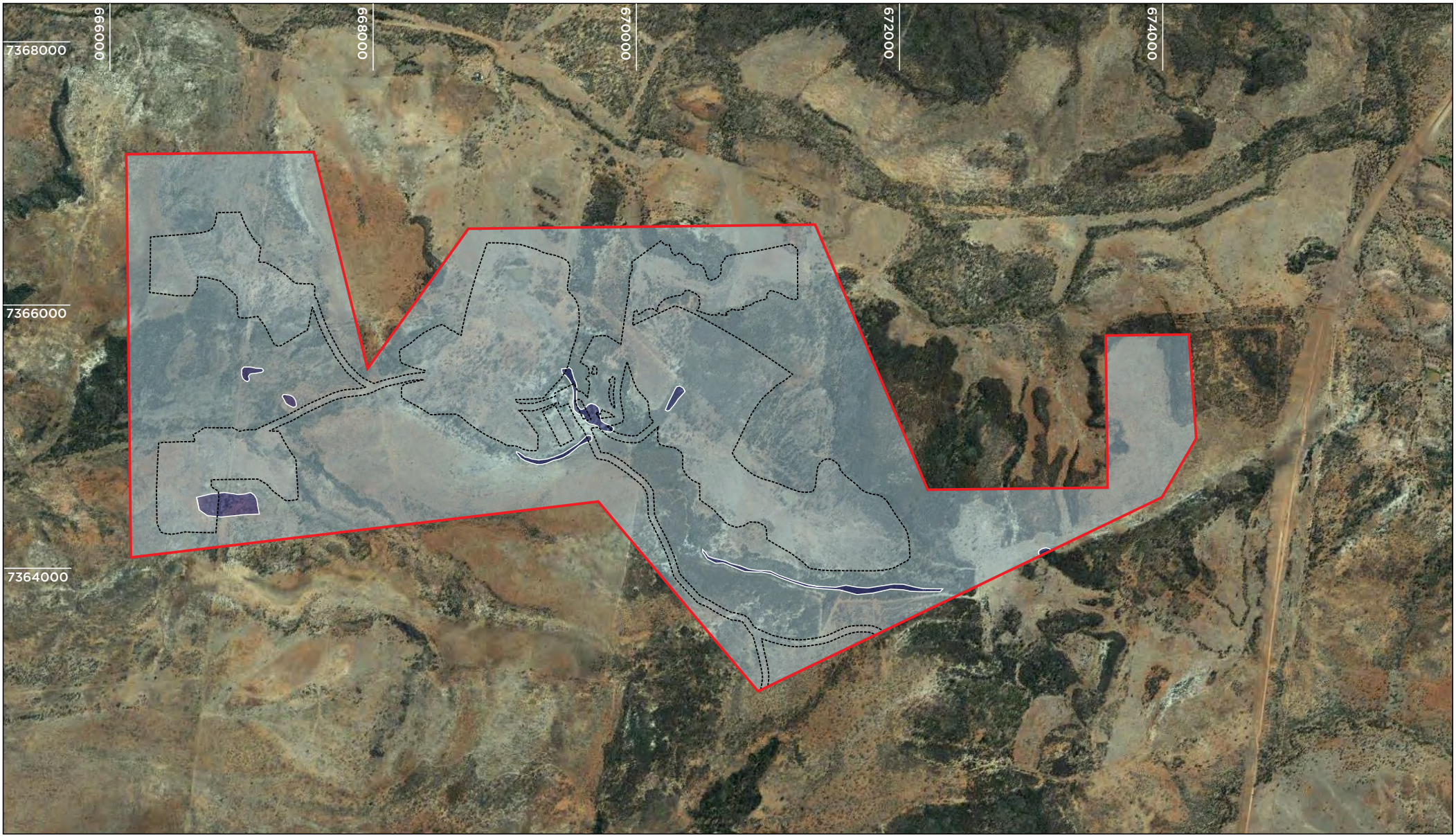


Figure 9: Post Mining Land Suitability - Agricultural Land Classification

Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class C3
- Class D

GTenvironmental

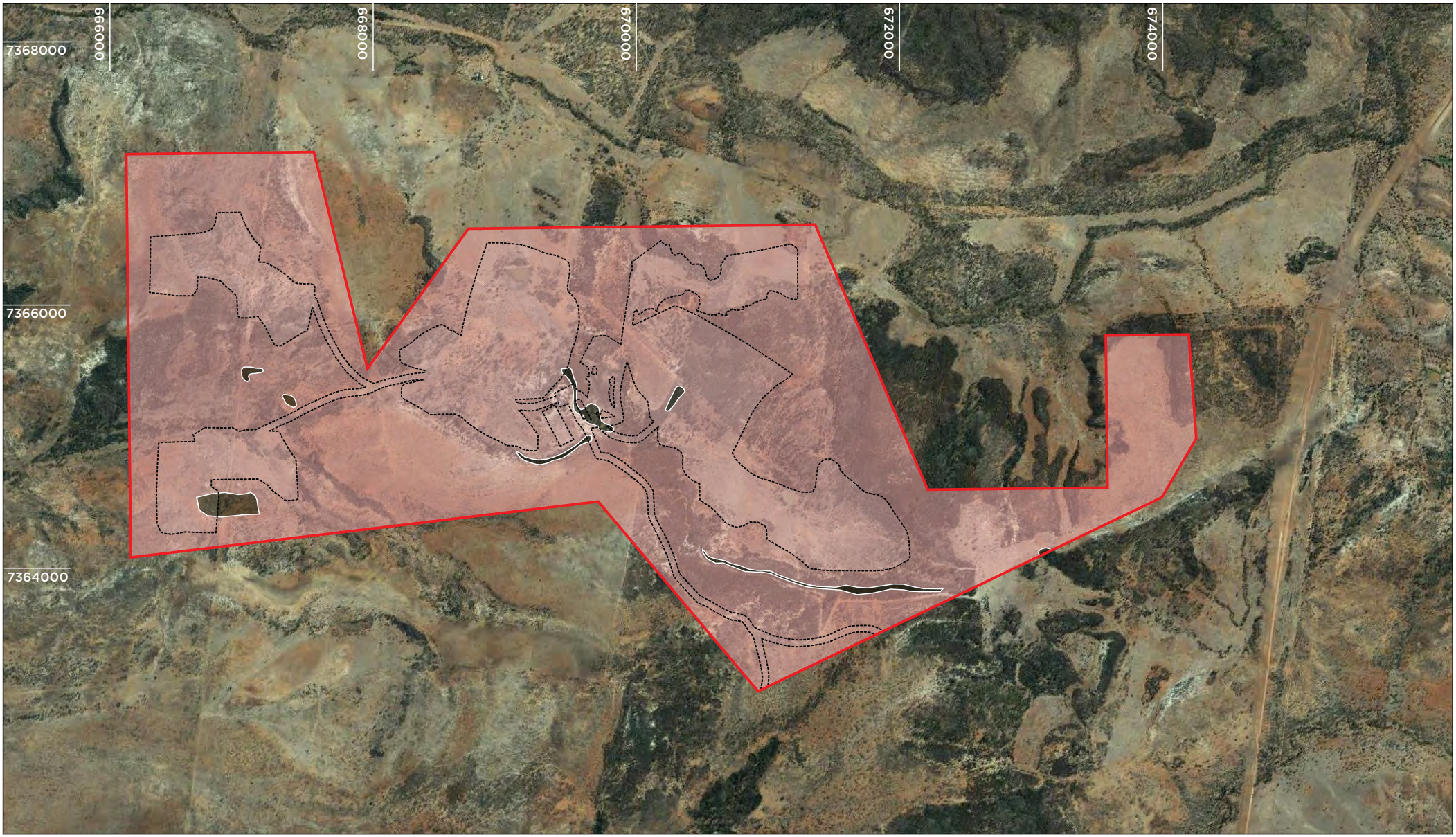


Figure 10: Post Mining Land Suitability - GQAL

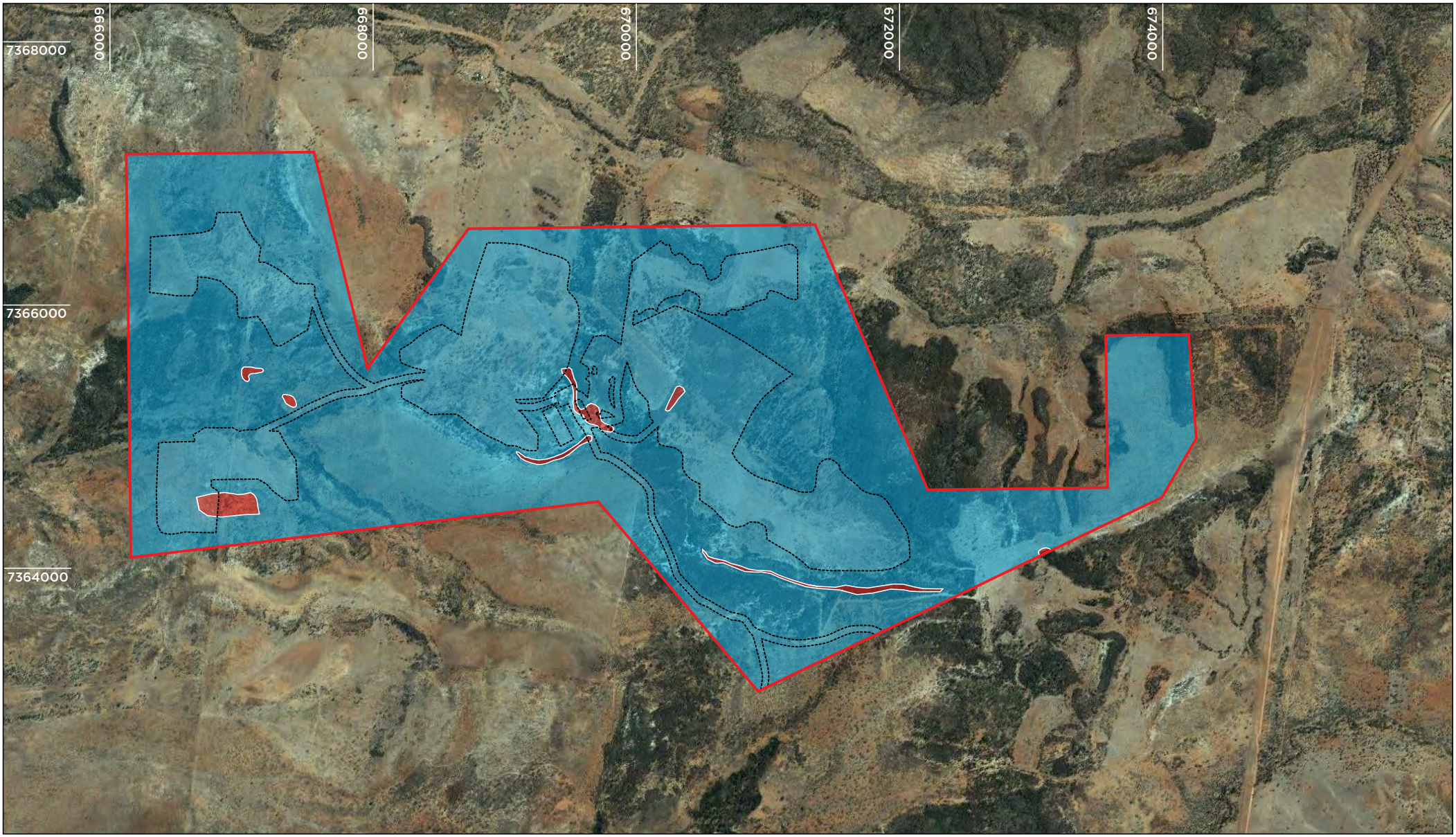
Soils and Land Suitability Assessment
COMET RIDGE PROJECT

Revision 2 15/09/2014
Scale: 1 : 30,000 Page: A4

0 1000
Metres
Projection: GDA94 Zone 55

Legend
- Mining Lease Application
- Disturbance Area
- Class C3
- Class D

GTenvironmental



11 ATTACHMENTS

Attachment A	Detailed site descriptions
Attachment B	Observation site descriptions
Attachment C	Laboratory Certificates

SITE 1

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming (Wy)	Duckponds	667895mE 7366044mN	Kandosol	Detailed - 75mm soil core	27/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing, Mid slope 4.0%	Lancewood	Nil microrelief Nil Disturbance Sheet Erosion (minor)	Firm to hard setting 5-10% gravels 2-10mm	A11 0.0-0.25 Abrupt	Sandy Loam	Apedal Massive, Very weak	2% coarse fragments No roots	10YR3/2 No mottle	Dry	Moderate-Well drained	0.05m - 6.0pH/ 6.36pH/ 0.03EC	0.0-0.10	
				A12 0.25-0.55 Diffuse	Sandy Loam	Apedal Massive, Very weak	30% coarse fragments 10-20mm No roots	7.5YR2.5/2 No mottle	Dry	Moderate-Well drained	0.30m – 5.5pH/ 6.52pH/ 0.01EC	0.30-0.40	
				A21 0.55-0.80 Abrupt	Sandy Clay Loam	Apedal Massive, Very weak	2% coarse fragments 2-5mm	7.5YR3/2 <5% mottle	Dry	Moderate-Well drained	0.60m – 5.5pH/ 6.53pH/ 0.00EC	0.60-0.70	
				A22 0.80-1.10	Sandy Clay Loam	Apedal Massive, Very weak	2% coarse fragments 2-5mm	5YR4/4 <5% mottle	Dry	Imperfect drainage	0.90m – 5.5pH/ 5.48pH/ 0.00EC	0.90-1.00	

SITE 2

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming Drainage Pathway(Wy-Dp)	Isaac	667735mE 7364931mN	Brown Kandosol	Detailed - 75mm soil core	27/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing Open Depress-ion 1.5%	Poplar Box Native grasses	Nil microrelief Nil disturbance Gully with aggraded erosion	Hard setting <2% 2-5mm coarse fragment	A1 0.0-0.40 Abrupt	Sandy Clay Loam	Apedal Massive, Very weak	2% 2-10mm Coarse fragments Medium, common roots	7.5YR3/2 No mottle	Dry	Moderate-well drained	0.05m – 7.0pH/ 7.90pH 0.00EC	0.0-0.10	-
				B21 0.40-1.00 Abrupt	Silty Loam	Apedal Massive, Very weak	2% <5mm coarse fragments Very fine, few roots	7.5YR3/2 No mottle	Dry	Moderate drainage	0.40m – 7.0pH/ 8.34pH 0.00EC 0.80m – 6.5pH/ 8.36pH 0.00EC	0.40-0.5 0.70-0.80	
				B22 1.00-1.20	Silty Loam	Apedal Massive, Very weak	2% <5mm coarse fragments No roots	7.5YR3/3 <5% orange mottle	Humid	Imperfect drainage	1.10m – 7.0pH/ 8.48pH/ 0.00EC	1.10-1.20	

SITE 3

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming Red Colour Variant (Wy-Rv)	Highlands / Duckponds	668982mE 7364975mN	Red Kandosol	Detailed - 75mm soil core	27/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing Gentle undulat-ing plain, upper slope 3%	Native Grasses, small shrubs	No microrelief No disturbance No erosion	Firm Cracking (minor surface)	A11 0.0-0.57 abrupt	Sandy Clay Loam	Massive, very weak	No inclusions or segregations No roots	5YR3/4 No mottle	Dry	Moderate drainage	0.05m – 5.5pH/ 5.71pH/ 0.07EC 0.30m – 6.0pH/ 5.60pH/ 0.02EC	0.0-0.10 0.30-0.40	Red earth surface
				A12 0.57-0.90	Silty Loam	Weak, polyhe-dral	No inclusions or segregations No roots	5YR4/4 No mottle	Dry	Moderate drainage	0.70m – 7.0pH/ 5.55pH/ 0.01EC 1.00m – 6.5pH/ 5.89pH/ 0.03EC	0.60-0.70 0.80-0.90	

SITE 4

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming Grey Silty Variant (Wy-GSv)	Duckponds	669035mE 7364978mN	Grey Kandosol	Detailed - 75mm soil core	27/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing Gentle undulat-ing plains, mid slope 1%	-	No microrelief No disturbance No erosion	Hard setting <20% 2-10mm coarse fragment	A11 0.0-0.10 Abrupt	Sandy Loam	Weak, Polyhed-ral	2% 2-5mm coarse fragments	10YR4/3 No mottle	Dry	Well drained	0.10m – 6.5pH/ 7.28pH/ 0.00EC	0.0-0.10	Second attempt, no recovery at 0.70m First attempt at Observation site 11. Wy-GSv
				A12 0.10-0.45 Abrupt	Sandy Loam	Weak, Polyhed-ral	2% 2-5mm coarse fragments	10YR6/2 No mottle	Dry	Well drained	0.30m – 6.0pH/ 7.10pH 0.00EC	0.30-0.40	
				A2 0.45-0.70	Sandy Loam	Massive, weak	10% 5-10mm coarse fragments	10YR5/3 No mottle	Dry	Moderate drainage	0.60m – 6.0pH/ 7.43pH/ 0.00EC	0.60-0.70	

SITE 5

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming (Wy)	Duckponds	669767mE 7365568mN	Kandosol	Detailed - 75mm soil core	27/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing Gentle undulating plain, Alluvial plain <0.5%	Eucalypts	No microrelief No disturbance No erosion	Firm, <5% 0-5mm coarse fragment	A1 0.0-0.50 Abrupt	Silty Clay Loam	Moderate, sub angular blocky, Weak	No coarse fragments Very fine, few roots	10YR3/1 No mottle	Dry	Well drained	0.10m - 6.0pH/ 6.17pH/ 0.00EC 0.30m - 6.0pH/ 6.5pH/ 0.00EC	0.0-0.10	
				A2 0.50-1.35	Sandy Clay Loam	Moderate, sub angular blocky, weak	<5% <2mm coarse fragments No roots	10YR3/1 No mottle	Dry	Well drained	0.60m - 6.0pH/ 6.89pH/ 0.00EC 0.90m - 6.0pH/ 6.46pH 0.00EC 1.1m - 6.0pH/ 6.25pH/ 0.00EC	0.30-0.40 0.60-0.70 0.9-1.0	

SITE 6

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming Red Colour Variant (Wy-Rv)	Highlands / Duckponds	670259mE 7364648mN	Red Kandosol	Detailed - 75mm soil core	28/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing Flat Plain <0.5%	Ironbark, Eucalypts	No microrelief No disturbance No erosion	Firm to hard setting 2% <2mm coarse fragment	A11 0.00-0.10 Abrupt	Sandy Clay Loam	Weak	2% 5-10mm coarse fragments	5YR3/3 No mottle	Dry	Moderate drainage	0.10m - 6.0pH/ 6.02pH/ 0.00 EC	0.0-0.10	Wy Rv
				A12 0.10-0.60 Abrupt	Sandy Clay loam	Weak	2% 10-20mm coarse fragments	5YR3/4 No mottle	Dry	Moderate drainage	0.30m - 6.0pH/ 5.97pH/ 0.00EC	0.30-0.40	
				A2 0.60-0.70+	Silty Loam	Weak	2% 5-10mm coarse fragments	5YR3/4 No mottle	Dry	Moderate drainage	0.60m - 6.0pH/ 6.16pH/ 0.00EC	0.60-0.70	

SITE 7

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming Grey Silty Variant (Wy-GSv)	Duckponds	672199mE 7363887mN	Grey Kandosol	Detailed - 75mm soil core	28/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH	Sample	Observations
Grazing, Ridgeline, 3%	Bendee, odd Yapunyah, Virgin scrub lands	Nil microrelief Nil disturbance Nil erosion	Firm, no coarse frag-ments	A1 0.0-0.50 Abrupt	Silty loam	Massive	5% small quartz	7.5YR5/2	Dry	Moderate-ly well drained	pH – 6.0	0.0-0.10	
				R 0.50+	Hard gravel	-	-	-	-	Poorly drained	-	-	

SITE 8

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming (Wy)	Duckponds	673558mE 7364512mN	Kandosol	Detailed - 75mm soil core	28/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH	Sample	Observations
Grazing Flat Plain <0.5%	Native grasses	Nil microrelief Nil disturbance Nil erosion	Hard setting <10% gravels	A11 0.00-0.10 Abrupt	Sandy Clay Loam	Weak Polyhed-ral	None	Grey Brown No mottle	Dry	Moderate drainage	0.05m - 6.5pH	-	Third attempt successful First attempt, refusal at 0.10m Second attempt refusal at 0.10m
				A12 0.10-0.50 Abrupt	Sandy Clay Loam	Weak Polyhed-ral	None	Brown orange	Dry	Moderate drainage	0.30m - 6.5pH		
				A2 0.50-1.00	Silty Loam	Weak Polyhed-ral	<5% 0-5mm gravels	Brown orange Red mottle	Humid	Moderate drainage	0.60m - 6.5pH 0.90m - 6.5pH		

SITE 9

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming (Wy)	Duckponds	673758mE 7365163mN	Kandosol	Detailed - 75mm soil core	28/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH	Sample	Observations
Grazing Gentle undulating plain Mid-slope 2.0%	-	Nil microrelief Nil disturbance Nil erosion	Hard setting <2% coarse fragment <2mm	A11 0.00-0.15 Abrupt	Sandy Loam	Weak Polyhed-ral	None	Light red Brown No mottle	Dry	Moderate drainage	0.05m - 6.5pH	-	No recovery of material from 0.70m
				A12 0.15-0.45 Abrupt	Sandy Loam	Massive	None	Brown No mottle	Dry	Moderate drainage	0.30m - 6.0pH		
				A2 0.45-0.70+	Sandy Clay Loam	Weak Polyhed-ral	<5% <5mm gravels	Red brown No mottle	Humid	Moderate drainage	0.60m - 6.0pH		

SITE 10

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming (Wy)	Duckponds	670583mE 7365250mN	Kandosol	Detailed - 75mm soil core	28/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing Flat plain <0.5%	-	Nil microrelief Nil disturbance Nil erosion	Hard setting <5% gravels	A1 0.00-0.40 Abrupt	Sandy Clay Loam	Weak Polyhed-ral	None	Light grey Brown No mottle	Dry	Moderate drainage	0.05m - 6.5pH	-	Profile taken from fallen tree

SITE 11

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming (Wy)	Duckponds	671301mE 7364450mN	Kandosol	Detailed - 75mm soil core	28/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Meter pH Meter / EC (dS/m)	Sample	Observations
Grazing Gentle undulating plain Lower slope 2%	Silverleaf Ironbark Eucalypts	Nil microrelief Historical clearing however no recent disturbance Nil erosion	Firm surface with minor surface flake observed	A1 0.0-0.40 Abrupt	Sandy Clay Loam	Moderate, sub angular blocky	No coarse fragments Very fine, few roots	Dark grey	Dry	Well drained	0.10m - 6.0pH 0.30m - 6.0pH	0.0-0.10 0.30-0.40	As per site 5
				A2 0.40-1.35	Silty Clay Loam	Moderate, sub angular blocky	<5% <2mm coarse fragments No roots		Dry	Well drained	0.60m - 6.0pH 0.90m - 6.0pH 1.10m - 6.0pH	0.60-0.70 0.9-1.0	

SITE 12

Soil Mapping Unit:	AMU of Bourne and Tuck (1993):	Location (GDA94):	Aust. Soil Class. :	Site Survey Type:	Date:
Wyoming Red Colour Variant (Wy-Rv)	Highlands / Duckponds	668633mE 7364867mN	Red Kandosol	Detailed - 75mm soil core	28/05/2014

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH	Sample	Observations
Grazing Gentle undulating plain Mid-slope 2.5%	Paperbark Eucalypts, sparse shrubs	Nil microrelief Historical clearing however no recent disturbance Nil erosion	Hard setting <2% <5mm gravels	A1 0.00-0.30 Abrupt	Sandy Loam	Moderate, sub angular blocky	None Fine, few roots	Red brown	Dry	Well drained	0.10m - 6.0pH	-	As per site 5
				A21 0.30-0.60 Abrupt	Sandy Clay Loam	Moderate, sub angular blocky	<2% coarse fragments Very fine, few roots	Red brown	Dry	Moderate drainage	0.30m - 6.0pH 0.60m - 6.0pH		
				A22 0.60-1.00	Silty Loam	Moderate, sub angular blocky	<2% coarse fragments No roots	Red brown	Dry	Moderate drainage	0.90m - 6.0pH		

Site No.	Location (GDA94)	Soil Mapping Unit	Surface	Landform	Comments
Ob1	667791 mE 7365703 mN	Wyoming Grey Silty Variant	Hard setting, 30% rock, minor sheet erosion	Gently undulating plains, upper slope, 2.5%	
Ob2	667774 mE 7365416 mN	Boundary: Wyoming / Wyoming Red Variant	Hard setting, 30% rock	Gently undulating plains, mid slope, 4%	-
Ob3	667742 mE 7365355 mN	Sunrise	Exposed rock, ferricrete	3% slope	
Ob4	667785 mE 7365351 mN	Sunrise	Exposed rock	3% slope, land use: grazing	-

Site No.	Location (GDA94)	Soil Mapping Unit	Surface	Landform	Comments
Ob5	667670 mE 7364578 mN	Wyoming	Hard setting, 30% rock 5-200mm	Gently undulating plains, mid slope, 4%	
Ob6	667665 mE 7364589 mN	Boundary: Sunrise (south) / Wyoming (west)	Hard setting, no surface rock or course fragments	Boundary to rocky outcrop to the south	-
Ob7	667940 mE 7365212 mN	Wyoming Drainage Pathway	Ferricrete exposed	Open depression	Ghost Gum, gully erosion
					

Site No.	Location (GDA94)	Soil Mapping Unit	Surface	Landform	Comments
Ob8	668021 mE 7365202 mN	Sunrise	Hard setting, sheet erosion,10% rocks, Very fine, very few roots within shallow layer	Upper slope, 4%	
Ob9	668022 mE 7365202 mN	Boundary: Sunrise (south) / Wyoming Red Variant (north)	Hard setting, 30% rock	Mid slope, 2%	Land use: grazing
Ob10	669035 mE 7364978 mN	Wyoming Grey Silty Variant	Hard setting	-	Laterite evident on surface in small isolated areas
Ob11	667608 mE 7364376 mN	Wyoming Grey Silty Variant	Hard setting, 30% coarse fragments 2-5mm	Mid slope 1%	Hand auger refusal at 0.3m 0 – 0.3m Texture: Sandy loam
	  				
Ob12	669683 mE 7364726 mN	Wyoming	Hard setting, 30% coarse fragments 2-5mm	Mid slope 1%	-

Site No.	Location (GDA94)	Soil Mapping Unit	Surface	Landform	Comments
Ob13	669966 mE 7364879 mN	Wyoming (Sunrise 15m to the west)	Hard setting, minor sheet erosion	Undulating Plain 5%	-
Ob14	669986 mE 7364951 mN	Wyoming Grey Silty Variant	Hard setting, 5% course fragments 2-5mm, minor sheet erosion	Gently undulating plains, mid slope, 2%	Lancewood evident: shallow rocks below top soil
Ob15	669914 mE 7365044 mN	Sunrise	Rock outcrops	Gently undulating plains, upper slope, 2%	Lancewood evident: shallow rocks below top soil upwards to surface
Ob16	671335 mE 7363927 mN	Wyoming	Hard setting, <5% course fragments 2-5mm, surface red in colour	Mid slope 2%	-
Ob17	671621 mE 7363674 mN	Wyoming Red Variant	Hard setting, <5% course fragments 2-5mm, surface red in colour	Mid slope 2%	-
Ob18	670566 mE 7365183 mN	Boundary: Sunrise (south) / Wyoming (north-east)	Rocky jump up to the south	-	-
Ob19	669158 mE 7366199 mN	Boundary: Wyoming (South) / Gy (north)	Hard setting	Lower slope going uphill into Wyoming SMU	-
Ob20	671231 mE 7365241 mN	Wyoming Red Variant	Hard setting, <5% course fragments 2-5mm, surface red in colour	Mid slope 2%	-
Ob21	671132 mE 7365097 mN	Wyoming	Hard setting, 30% coarse fragments 2-5mm	Mid slope 1%	-
Ob22	670879 mE 7364467 mN	Wyoming	Hard setting, <5% coarse fragments 2-5mm	Mid slope 2.5%	-
Ob23	670132 mE 7365645 mN	Wyoming Red Variant	Hard setting, <5% course fragments 2-5mm, surface red in colour	Mid slope <1%	Minor isolated rocky outcrops in area
Ob24	668596 mE 7365264 mN	Boundary: Wyoming (south) / Wyoming Red Variant (north)	Hard setting, <5% course fragments 2-5mm	Lower slope, flat plain <0.5%	Surface red in colour, changing to yellow/brown towards the south

Site No.	Location (GDA94)	Soil Mapping Unit	Surface	Landform	Comments
Ob25	668883 mE 7365438 mN	Wyoming	Hard setting, 30% coarse fragments 2-5mm	Mid slope 1%	-
Ob26	667402 mE 7365960 mN	Boundary: Wyoming (west) / Wyoming Grey Silty Variant (east)	Hard setting 2% coarse fragments <6mm	Mid slope 1.5%	Surface changes in colour from light grey to yellow brown towards the west
Ob27	672456 mE 7364152 mN	Wyoming Grey Silty Variant	Hard setting, <2% course fragments 2-5mm	Mid slope 1%	Light grey surface, nearby uprooted trees confirm light grey subsoil
Ob28	670307 mE 7364436 mN	Boundary: Wyoming (south) / Wyoming Red Variant (north)	-	-	Surface changes in colour from red to yellow brown towards the south
Ob29	670452 mE 7364059 mN	Boundary: Wyoming Grey Silty Variant (north) / Wyoming (south)	-	Mid slope <1%	Surface changes in colour from light grey to yellow brown towards the south east. This area of light grey surface only apparent for 100-200m wide area – surrounded by Wyoming/Yellow Brown soil type.
Ob30	672883 mE 7364191 mN	Wyoming Grey Silty Variant	Hard setting	-	Light grey surface.
Ob31	673078 mE 7364315 mN	Boundary: Wyoming (south) / Wyoming Red Variant (north)	-	-	Surface changes in colour from red to yellow brown towards the south

ESSA /Phosyn Pty Ltd **(ASPAC Approved)**

Soil Analysis Report
Batch Number: 14/43:73958

Date Received: 05/06/2014
Date Completed:20/06/2014

Client: GTE Comet Ridge- Results Page 1 of 2

ESSA Ref	field ref	Soil pH	Soil EC	Soil Cl	P(Olsen)	Exch.Ca	Exch. Mg	Exch.K	Exch. Na	CEC	Ca/Mg	ESP	Total N	Nitrate N	OrgMatter
	depth (cm)		dS/m	mg/kg	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	Ratio	%Na/CEC	%	(%)	(%)
SBC3521	2 0.00-0.10	5.7	0.1	64	3	6.1	3.55	0.62	0.34	10.8	1.7	3	0.04	6	1.9
SBC3522	2-0.30-0.40 (0.4-(	6.2	0.03	44		5.4	4.49	0.52	0.2	10.7	1.2	2			
SBC3523	2 0.70-0.80	6.5	0.03	39		5.5	4.53	0.49	0.2	10.7	1.2	2			
SBC3524	2 1.10-1.20	5.6	0.03	37		4.3	3.37	0.51	<0.08	8.5	1.3	1			
SBC3525	3 0.00-0.10	3.9	0.3	84	5	2.2	1.05	0.38	0.23	6.4	2.1	4	0.05	75	1.7
SBC3826	3 0.30-0.40	3.9	0.19	71		1.7	1.62	0.31	0.27	7.3	1.0	4			
SBC3527	3 0.60-0.70	4.1	0.13	98		0.9	4.48	0.21	0.54	10.0	0.2	5			
SBC3528	3 0.80-0.90	4.2	0.16	119		0.9	6.08	0.22	0.76	12.4	0.2	6			
SBC2529	4 0.00-0.10	4.5	0.04	21	4	0.5	0.41	0.14	0.09	3.7	1.2	3	0.14	3	2.3
SBC3530	4 0.30-0.40	4.7	0.03	25		0.1	1.03	0.12	0.16	3.9	0.1	4			
SBC3531	4 0.60-0.70	5.2	0.03	43		<0.01	2.48	0.09	0.46	4.7	<0.1	10			
SBC3532	5 0.00-0.10	4.5	0.13	41	11	1.5	0.84	0.97	<0.08	6.3	1.8	1	0.2	36	6.1
SBC3533	5 0.30-0.40	4.5	0.05	18		0.5	0.34	0.79	<0.08	6.3	1.4	1			
SBC3534	5 0.60-0.70	4.6	0.04	28		0.2	0.31	0.69	<0.08	6.7	0.7	1			
SBC3535	5 0.90-1.00	4.7	0.03	28		0.1	0.33	0.67	<0.08	5.7	0.3	1			
SBC3836	5 1.10-1.20	4.7	0.03	31		0.1	0.34	0.6	<0.08	4.6	0.2	1			
SBC3537	13 0.00-0.10	5.3	0.06	31	4	3.8	2.99	0.54	0.29	8.2	1.3	4	0.11	3	3.5
SBC3538	13 0.25-0.35	4.9	0.1	92		2.6	4.2	0.31	0.64	9.3	0.6	7			
SBC2539	13 0.60-0.70	4.9	0.31	333		0.5	8.52	0.17	2.76	13.1	0.1	21			
SBC3540	13 0.90-1.00	4.8	0.64	690		0.3	11.78	0.23	5.26	18.3	0.0	29			

Client: GTES Stone - Results Page 2 of 2

Lab No	Sample No	PSA-CS	PSA-FS	PSA-Silt	PSA-Clay	Disp Ratio	ADMC	Emerson	Sulfate-S	Mn	Boron	Copper	Iron	Zinc	Al	Al/CEC(%)
	Depth (cm)	%	%	%	%	R1	%	Number	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	meq/100g	%
SBC3521	2 0.00-0.10	18	43	11	30	0.64	4.3	5	18	79	0.6	1.1	37	1.5	0.22	2
SBC3522	2-0.30-0.40 (0.4-0.5 ON BAG)														0.09	1
SBC3523	2 0.70-0.80														0.06	1
SBC3524	2 1.10-1.20														0.19	2
SBC3525	3 0.00-0.10	17	52	7	25	0.57	3.5	5	46	11.2	0.4	0.4	47	0.3	2.52	40
SBC3826	3 0.30-0.40														3.46	47
SBC3527	3 0.60-0.70														3.95	39
SBC3528	3 0.80-0.90														4.46	36
SBC2529	4 0.00-0.10	21	44	11	27	0.66	6.4	5	11	1.7	0.2	0.4	174	0.3	2.54	70
SBC3530	4 0.30-0.40														2.49	64
SBC3531	4 0.60-0.70														1.62	35
SBC3532	5 0.00-0.10	22	34	19	27	0.73	11.4	5	10	6.5	0.3	0.4	261	1.2	2.92	46
SBC3533	5 0.30-0.40														4.64	74
SBC3534	5 0.60-0.70														5.43	81
SBC3535	5 0.90-1.00														4.58	80
SBC3836	5 1.10-1.20														3.61	78
SBC3537	13 0.00-0.10	23	35	13	32	0.65	5.3	5	8	13	0.2	0.5	137	1	0.63	8
SBC3538	13 0.25-0.35														1.58	17
SBC2539	13 0.60-0.70														1.2	9
SBC3540	13 0.90-1.00														0.7	4

All results for particle size analysis and R1 are reported on oven-dried basis (no pre-treatment applied to test samples)

ESSA Ref		SBC3521	SBC3522	SBC3523	SBC3524	SBC3525	SBC3826	SBC3527	SBC3528	SBC2529	SBC3530	SBC3531	SBC3532	SBC3533
field ref	depth (cm)	2 0.00-0.10	2-0.30-0.40 (0.	2 0.70-0.80	2 1.10-1.20	3 0.00-0.10	3 0.30-0.40	3 0.60-0.70	3 0.80-0.90	4 0.00-0.10	4 0.30-0.40	4 0.60-0.70	5 0.00-0.10	5 0.30-0.40
Soil pH		5.7	6.2	6.5	5.6	3.9	3.9	4.1	4.2	4.5	4.7	5.2	4.5	4.5
Soil EC	dS/m	0.1	0.03	0.03	0.03	0.3	0.19	0.13	0.16	0.04	0.03	0.03	0.13	0.05
Soil Cl	mg/kg	64	44	39	37	84	71	98	119	21	25	43	41	18
P(Olsen)	mg/kg	3				5				4			11	
Exch.Ca	meq/100g	6.1	5.4	5.5	4.3	2.2	1.7	0.9	0.9	0.5	0.1	<0.01	1.5	0.5
Exch. Mg	meq/100g	3.55	4.49	4.53	3.37	1.05	1.62	4.48	6.08	0.41	1.03	2.48	0.84	0.34
Exch.K	meq/100g	0.62	0.52	0.49	0.51	0.38	0.31	0.21	0.22	0.14	0.12	0.09	0.97	0.79
Exch. Na	meq/100g	0.34	0.2	0.2	<0.08	0.23	0.27	0.54	0.76	0.09	0.16	0.46	<0.08	<0.08
CEC	meq/100g	10.8	10.7	10.7	8.5	6.4	7.3	10.0	12.4	3.7	3.9	4.7	6.3	6.3
Ca/Mg	Ratio	1.7	1.2	1.2	1.3	2.1	1.0	0.2	0.2	1.2	0.1	<0.1	1.8	1.4
ESP	%Na/CEC	3	2	2	1	4	4	5	6	3	4	10	1	1
Total N	%	0.04				0.05				0.14			0.2	
Nitrate N	(%)	6				75				3			36	
OrgMatter	(%)	1.9				1.7				2.3			6.1	

Lab No		SBC3521	SBC3522	SBC3523	SBC3524	SBC3525	SBC3826	SBC3527	SBC3528	SBC2529	SBC3530	SBC3531	SBC3532	SBC3533	SBC3534
Sample No	Depth (cm)	2 0.00-0.10	2-0.30-0.40 (0	2 0.70-0.80	2 1.10-1.20	3 0.00-0.10	3 0.30-0.40	3 0.60-0.70	3 0.80-0.90	4 0.00-0.10	4 0.30-0.40	4 0.60-0.70	5 0.00-0.10	5 0.30-0.40	5 0.60-0.70
PSA-CS	%	18				17				21			22		
PSA-FS	%	43				52				44			34		
PSA-Silt	%	11				7				11			19		
PSA-Clay	%	30				25				27			27		
Disp Ratio	R1	0.64				0.57				0.66			0.73		
ADMC	%	4.3				3.5				6.4			11.4		
Emerson	Number	5				5				5			5		
Sulfate-S	mg/kg	18				46				11			10		
Mn	mg/kg	79				11.2				1.7			6.5		
Boron	mg/kg	0.6				0.4				0.2			0.3		
Copper	mg/kg	1.1				0.4				0.4			0.4		
Iron	mg/kg	37				47				174			261		
Zinc	mg/kg	1.5				0.3				0.3			1.2		
Al	meq/100g	0.22	0.09	0.06	0.19	2.52	3.46	3.95	4.46	2.54	2.49	1.62	2.92	4.64	5.43
Al/CEC(%)	%	2	1	1	2	40	47	39	36	70	64	35	46	74	81

SBC3534	SBC3535	SBC3836	SBC3537	SBC3538	SBC2539	SBC3540
5 0.60-0.70	5 0.90-1.00	5 1.10-1.20	13 0.00-0.10	13 0.25-0.35	13 0.60-0.70	13 0.90-1.00
4.6	4.7	4.7	5.3	4.9	4.9	4.8
0.04	0.03	0.03	0.06	0.1	0.31	0.64
28	28	31	31	92	333	690
			4			
0.2	0.1	0.1	3.8	2.6	0.5	0.3
0.31	0.33	0.34	2.99	4.2	8.52	11.78
0.69	0.67	0.6	0.54	0.31	0.17	0.23
<0.08	<0.08	<0.08	0.29	0.64	2.76	5.26
6.7	5.7	4.6	8.2	9.3	13.1	18.3
0.7	0.3	0.2	1.3	0.6	0.1	0.0
1	1	1	4	7	21	29
			0.11			
			3			
			3.5			

SBC3535	SBC3836	SBC3537	SBC3538	SBC2539	SBC3540
5 0.90-1.00	5 1.10-1.20	13 0.00-0.10	13 0.25-0.35	13 0.60-0.70	13 0.90-1.00
		23			
		35			
		13			
		32			
		0.65			
		5.3			
		5			
		8			
		13			
		0.2			
		0.5			
		137			
		1			
4.58	3.61	0.63	1.58	1.2	0.7
80	78	8	17	9	4

ESSA / Phosyn Pty Ltd (ASPAC Approved)

METHOD DESCRIPTIONS

Soil

Methods used to Analyse Samples

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
pH	4A1	1.1	0.1	pH	pH	1:5 water extr, pH meter
EC	3A1	5.4	0.01	dS/m	Electrical conductivity	1:5 water extr, EC meter
Cl	5A2	10.0	10.0	mg/kg	Chloride	1:5 water extr, (AA) colorimetric
NO3-N	7C2	6.7	1.0	mg/kg	Nitrate-nitrogen	1:5 water extr, (AA) colorimetric
NH4-N	7C2	7.8	0.6	mg/kg	Ammonium-nitrogen	1M KCl extr, (AA) colorimetric
Bicarb.P	9B2	16.8	1.0	mg/kg	Bicarb.ext.phosphorus	0.5M NaHCO3 @ pH 8.5, (AA) colorimetric
Exch.Ca	15C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0 leach, AAS
Exch.Mg	15C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH4OAc @ pH 7.0 leach, AAS
Exch.Na	15C1	9.6	0.09	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0 leach, AAS
Exch.K	15C1	4.8	0.02	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0 leach, AAS
CEC	15I3	5.7	1.0	meq/100g	Cation Exchange Capacity	KNO3 + Ca(NO3)2 extr, (AA) colorimetric
DTPA-Cu	12A1	17.1	0.26	mg/kg	DTPA ext. copper	DTPA extraction, AAS
DTPA-Zn	12A1	16.4	0.10	mg/kg	DTPA ext. zinc	DTPA extraction, AAS
DTPA-Mn	12A1	9.0	0.32	mg/kg	DTPA ext. manganese	DTPA extraction, AAS
DTPA-Fe	12A1	13.0	0.23	mg/kg	DTPA ext. iron	DTPA extraction, AAS
ADMC	2A1	11.9	0.4	%	Air Dried Moisture Content	Gravimetric oven dry @ 105C
R1	NA	20.2	NA		Dispersion Ratio	Ratio [Aqueous dispersible (Silt + Clay):Total (Silt + Clay)]
SO4-S	10B3	11.5	0.6	mg/kg	Sulfate sulfur	Ca(H2PO4)2 @ pH 4.0 extractable sulfate-sulfur, ICPOES
Sand	no ref	22.1	1.0	%	Particle size, sand	Hydrometer, gravimetric & Sieve
Silt	no ref	16.6	1.0	%	Particle size, silt	Hydrometer, gravimetric
Clay	no ref	12.7	1.0	%	Particle size, clay	Hydrometer, gravimetric
TN	7A2	12.9	0.01	%	Total Kjeldahl Nitrogen	Sulphuric acid digest, (AA) colorimetric

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

For Manager Analytical Services: **D E Baker BSc MASSSI**

ESSA / Phosyn Pty Ltd(ASPAC Approved)

QUALITY CONTROL DATA

Soil

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

Test Method	Units		Actual Value	Acceptance Criteria [Range]
pH	pH	B		5.0 - 5.3
EC	dS/m	B		0.27 - 0.32
Cl	mg/kg	B		10 - 35
NO3-N	mg/kg	B		10 - 16
NH4-N	mg/kg	NA		NA
Bicarb.P	mg/kg	B		51 -75
Total Kjeldahl N	%	ASPAC 34	0.110	.100 - .120
Total P	%	ASPAC 34	0.02	.019 - .021
Organic Carbon	%	B		1.82 - 2.3
Ca (Exch. cations)pH7	meq/100g	B		6.96 - 8.04
Mg (Exch. cations)pH7	meq/100g	B		1.88 - 2.22
Na (Exch. cations)pH7	meq/100g	B		.057 - .182
K (Exch. cations)pH7	meq/100g	B		1.209 - 1.411
Exch. Acidity	meq/100g			NA
ECEC	meq/100g	A		NA
CEC	meq/100g	S12		58 - 73
ESP	%	A		NA
Coarse sand	%	B	17.0	17.3 - 22.4
Fine Sand	%	B	22.0	20.0 - 25.7
Silt	%	B	16.0	10.5 - 19.8
Clay	%	B	44.0	37.9 - 48.9
R1		B		0.23 - 0.38

Test Method	Units	Test Soil	Actual Value	Acceptance Criteria [Range]
DTPA-Cu	mg/kg	SB		2.37 - 3.25
DTPA-Zn	mg/kg	SB		3.15 - 3.81
DTPA-Mn	mg/kg	SB		97.7 - 149.0
DTPA-Fe	mg/kg	SB		24.3 - 32.6
0.33 Bar	%	G		32 - 51
15 Bar	%	G		23 - 30
Ca (Exch. cations)pH8.5	meq/100g	S12		27.7 - 35.4
Mg (Exch. cations)pH8.5	meq/100g	S12		22.88 - 24.5
Na (Exch. cations)pH8.5	meq/100g	S12		2.0 - 2.28
K (Exch. cations)pH8.5	meq/100g	S12		1.64 - 2.09

APPENDIX C

Historical Imagery Figures 1 - 20

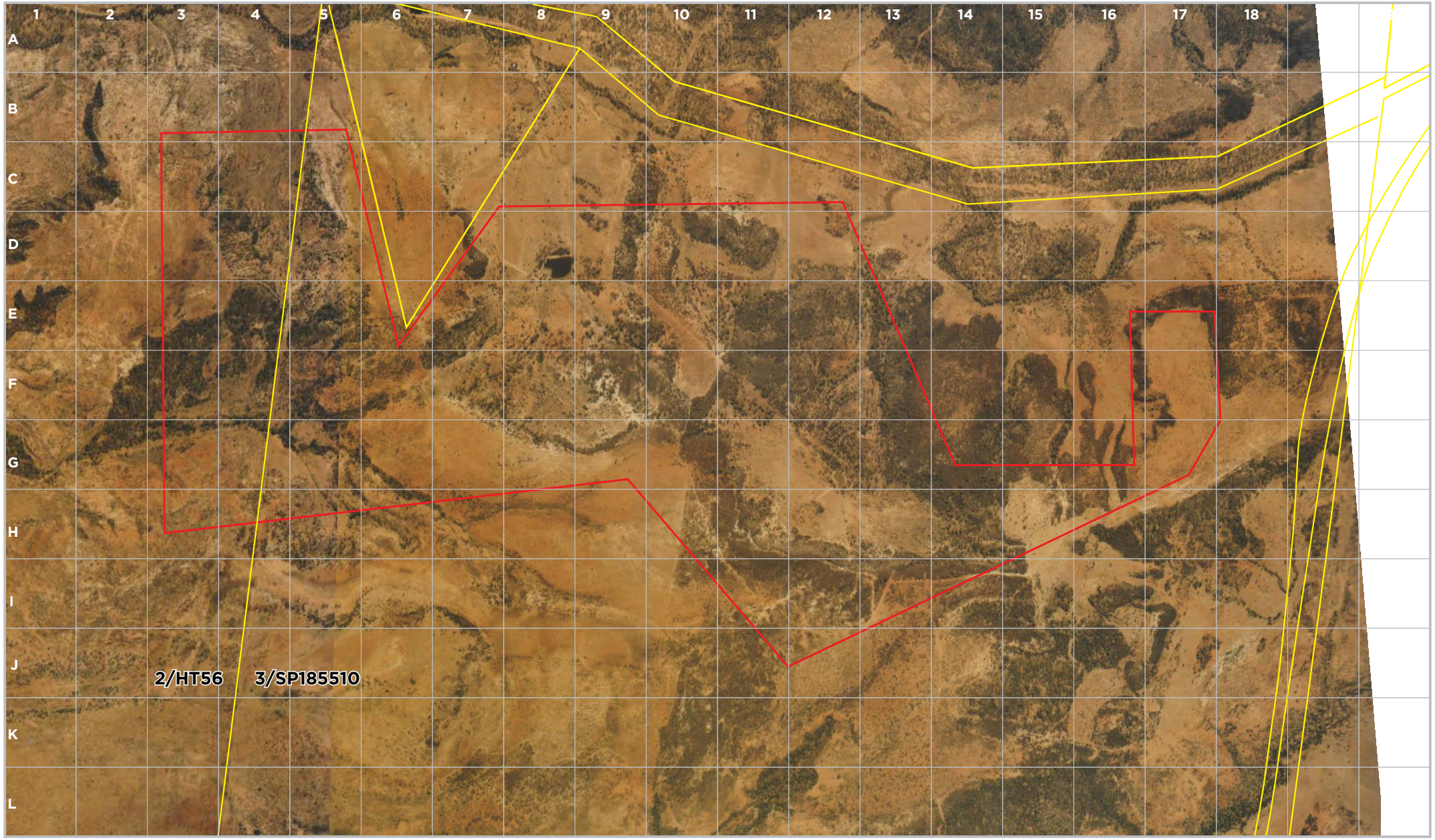


Figure 1: Historical Imagery Assessment (17/05/2004)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: Queensland Department of Natural Resources and Mines (DNRM)
Not to scale
26/09/2014

Legend
- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

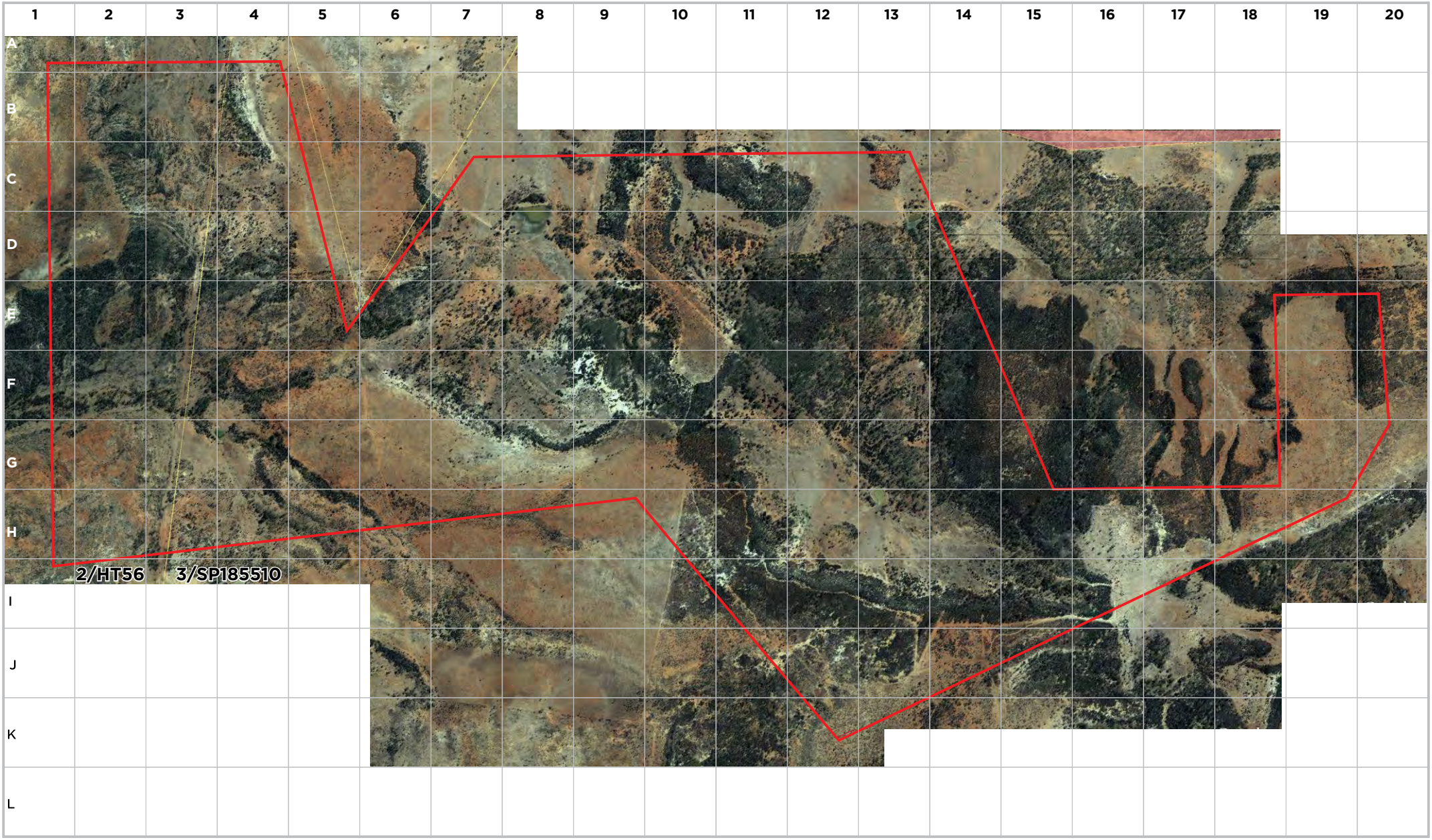


Figure 2: Historical Imagery Assessment (12/09/2004)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: DigitalGlobe (Google Earth)
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

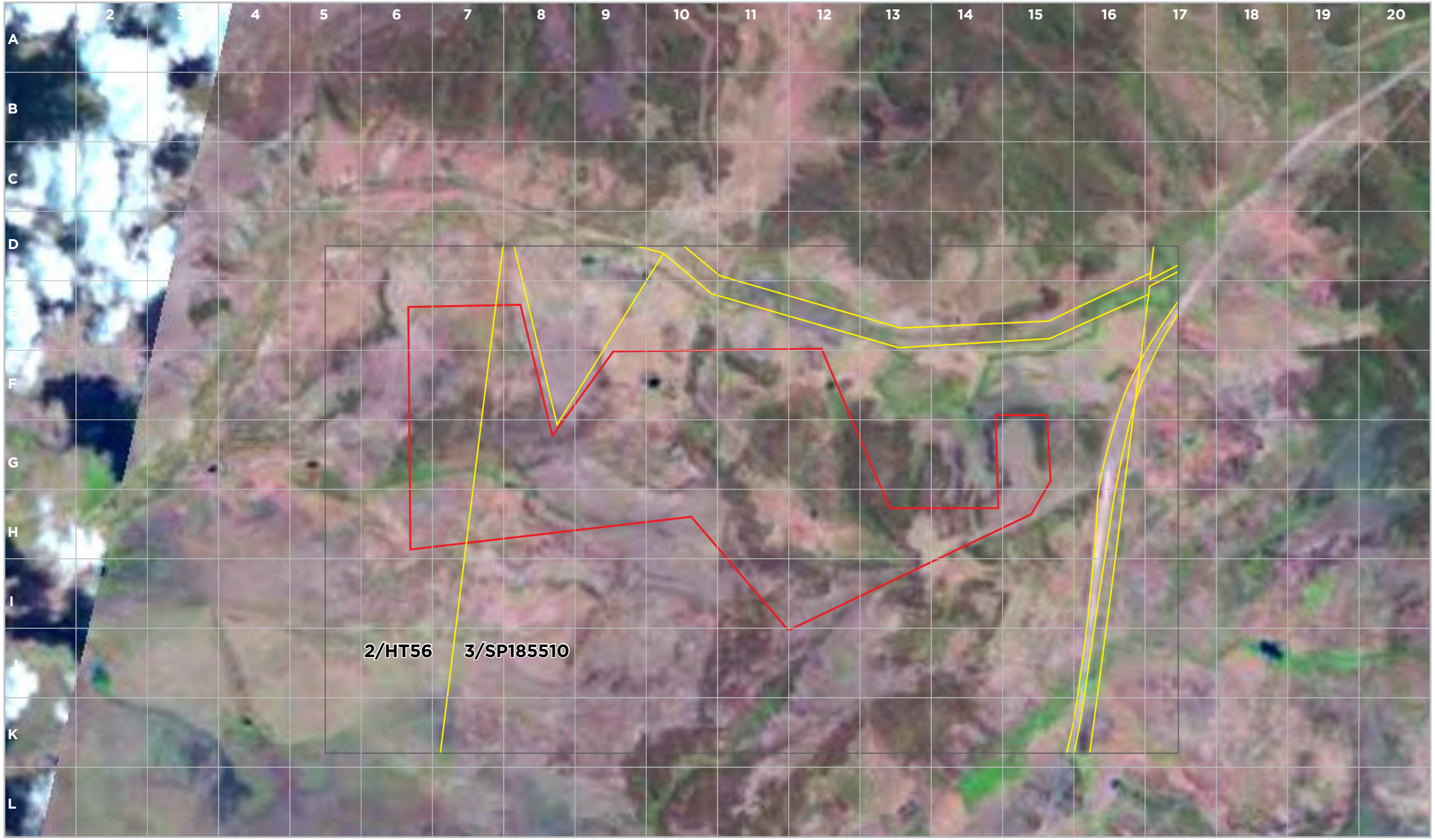


Figure 3: Historical Imagery Assessment (25/03/2005)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend
- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

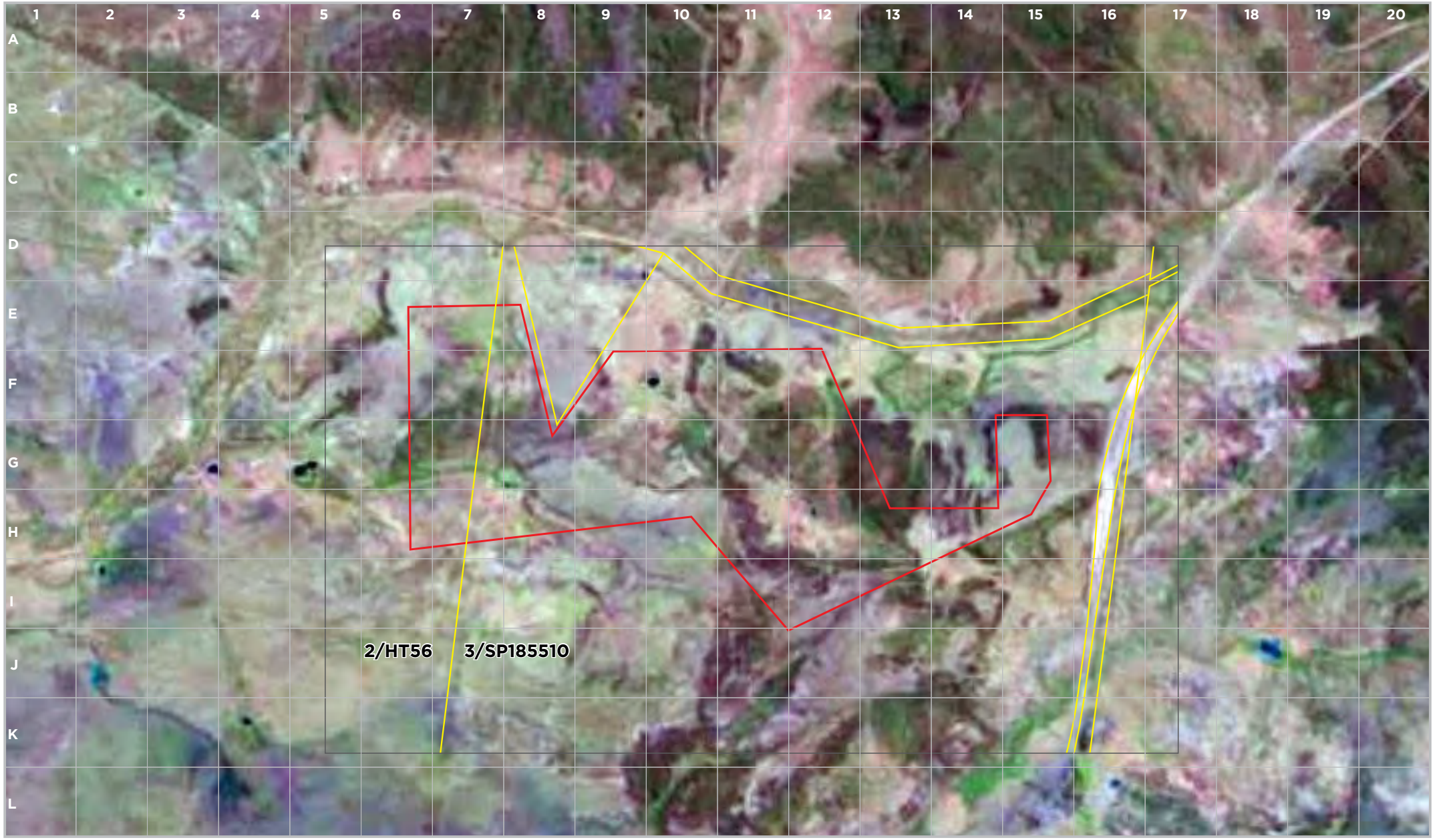


Figure 4: Historical Imagery Assessment (24/09/2005)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

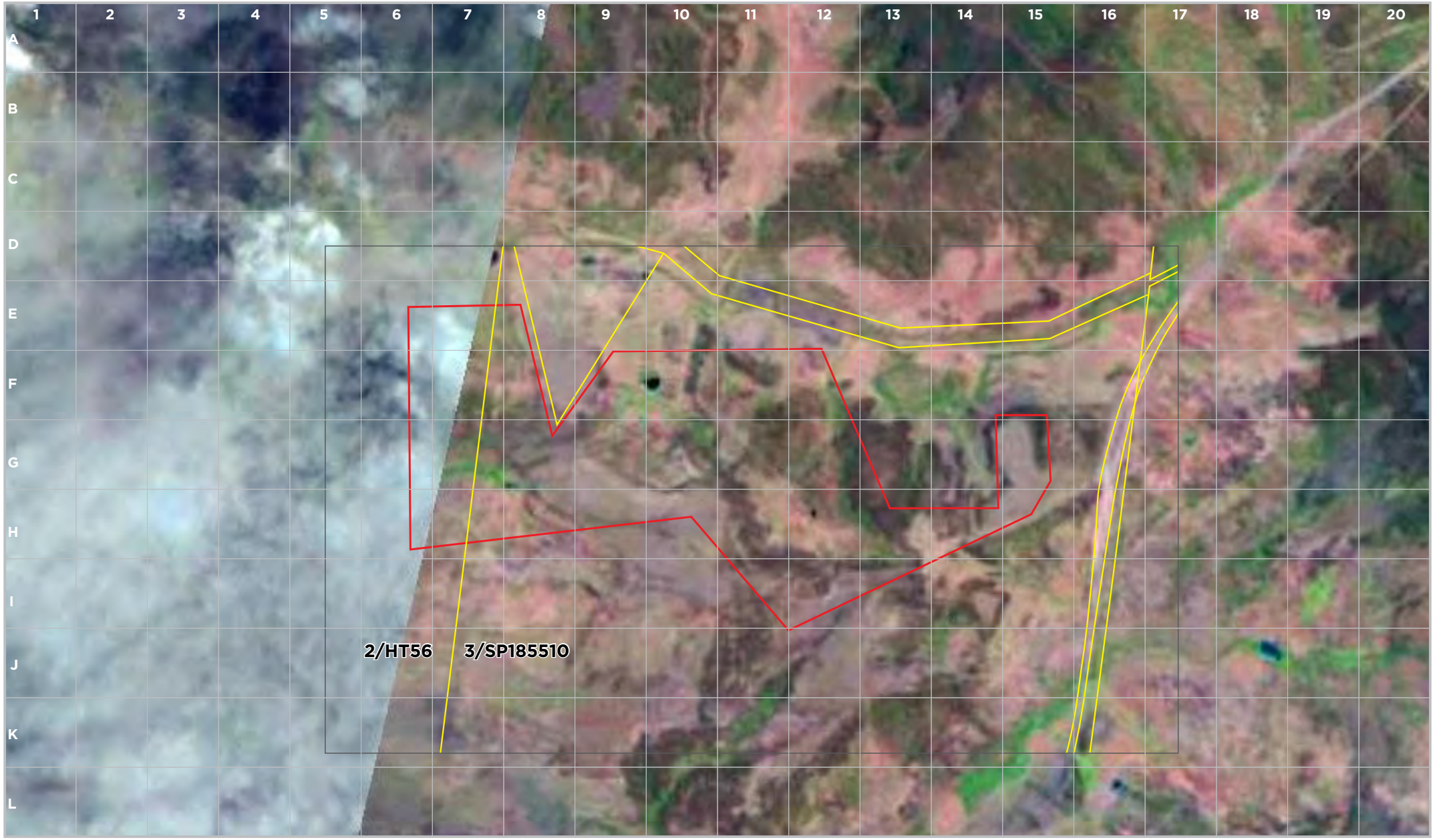


Figure 5: Historical Imagery Assessment (24/02/2006)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

Figure 6: Historical Imagery Assessment (06/10/2006)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: DigitalGlobe (Google Earth)
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

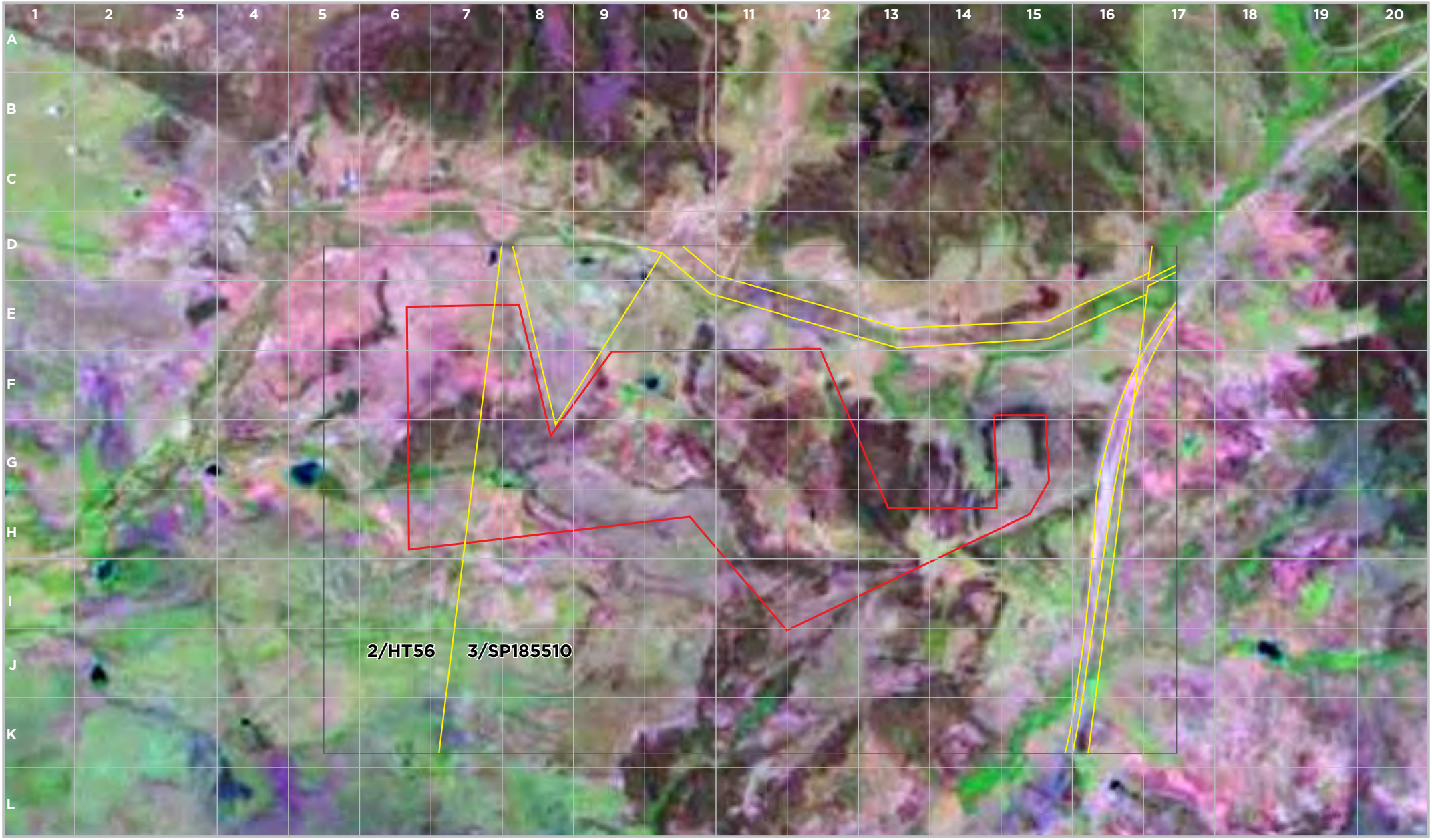


Figure 7: Historical Imagery Assessment (15/03/2007)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

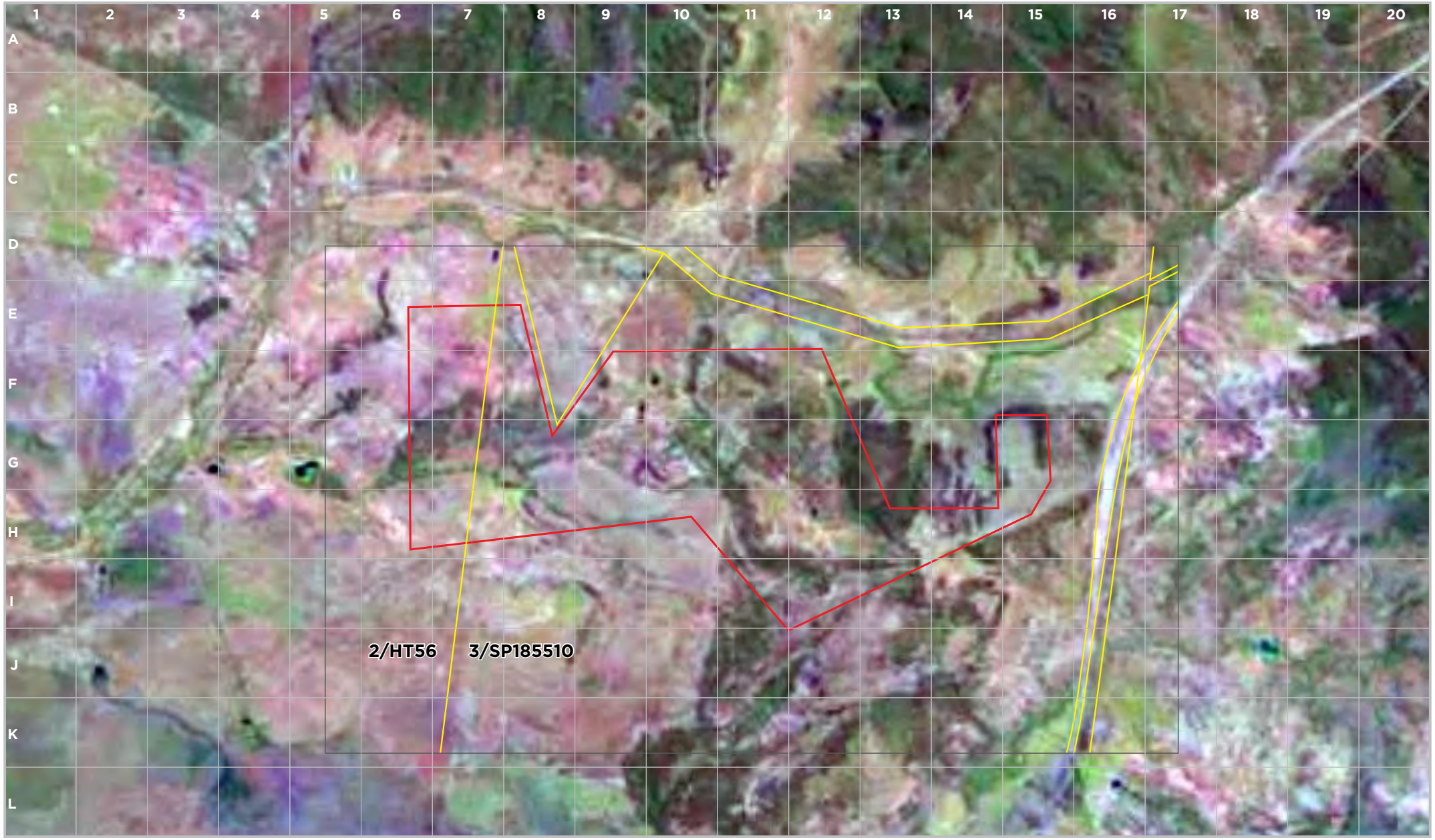


Figure 8: Historical Imagery Assessment (14/09/2007)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

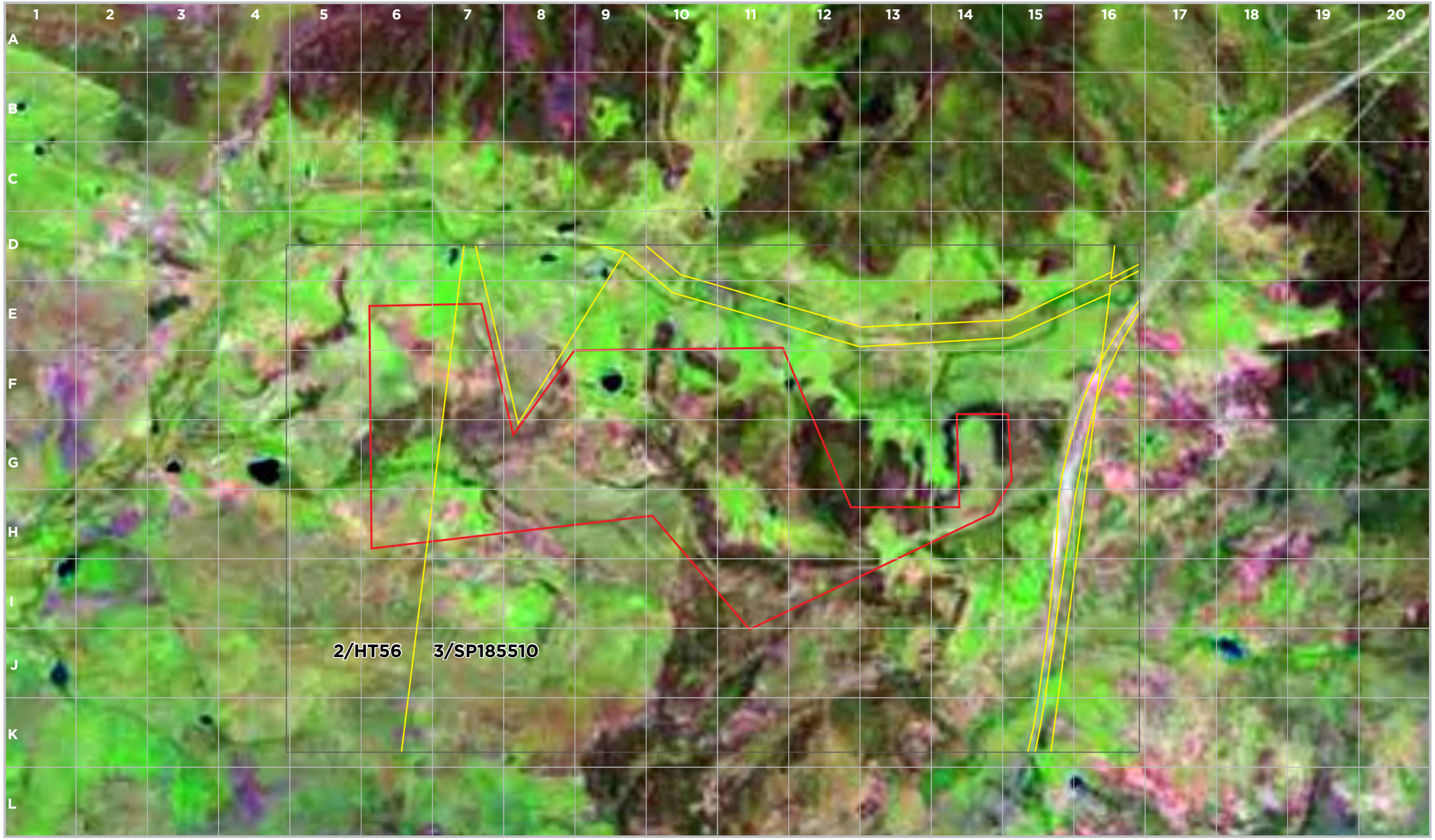


Figure 9: Historical Imagery Assessment (21/02/2008)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend
- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

Figure 10: Historical Imagery Assessment (03/11/2008)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

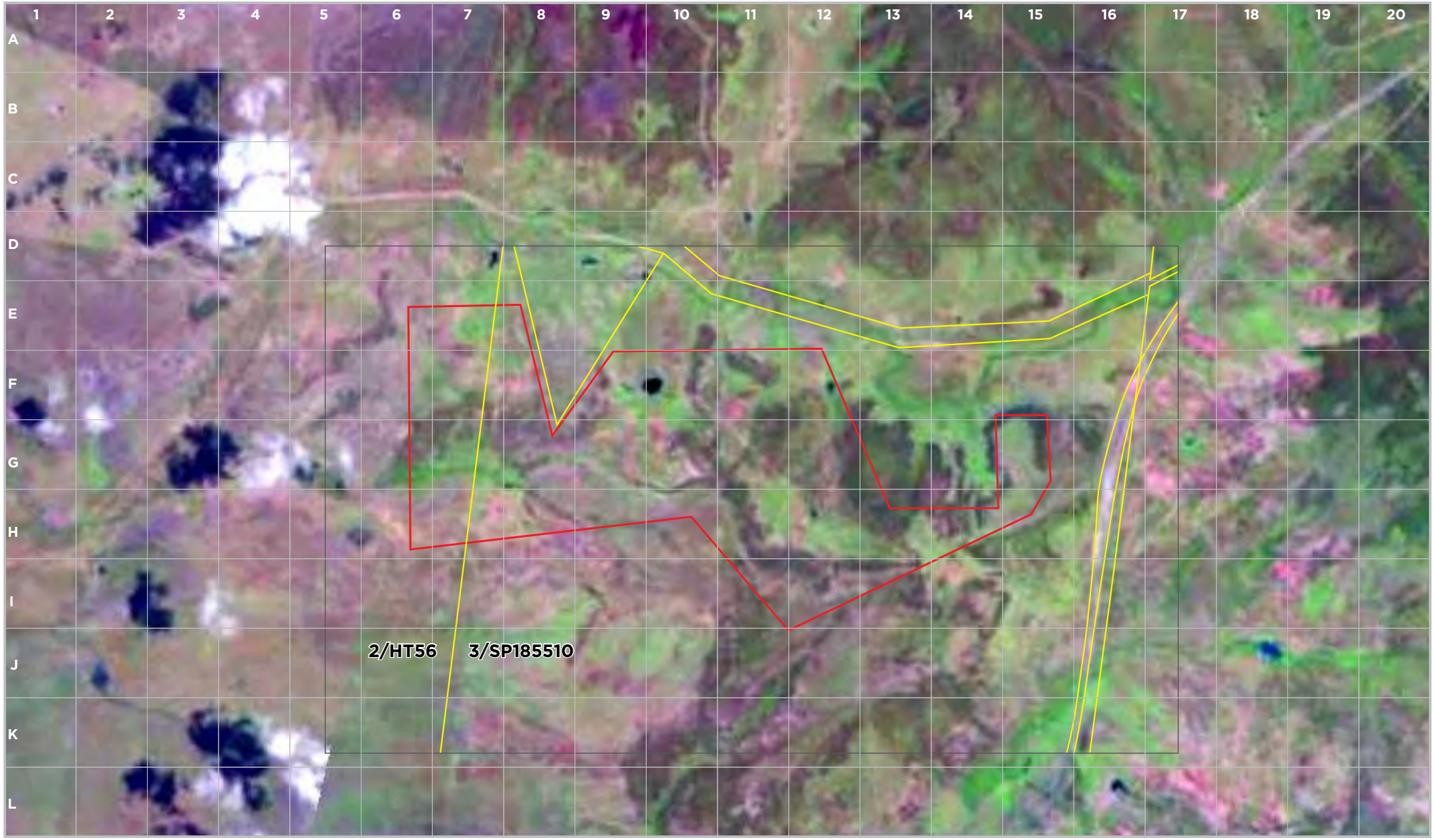


Figure 11: Historical Imagery Assessment (06/01/2009)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

Figure 12: Historical Imagery Assessment (11/08/2009)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE:
Not to scale
26/09/2014

Legend
- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

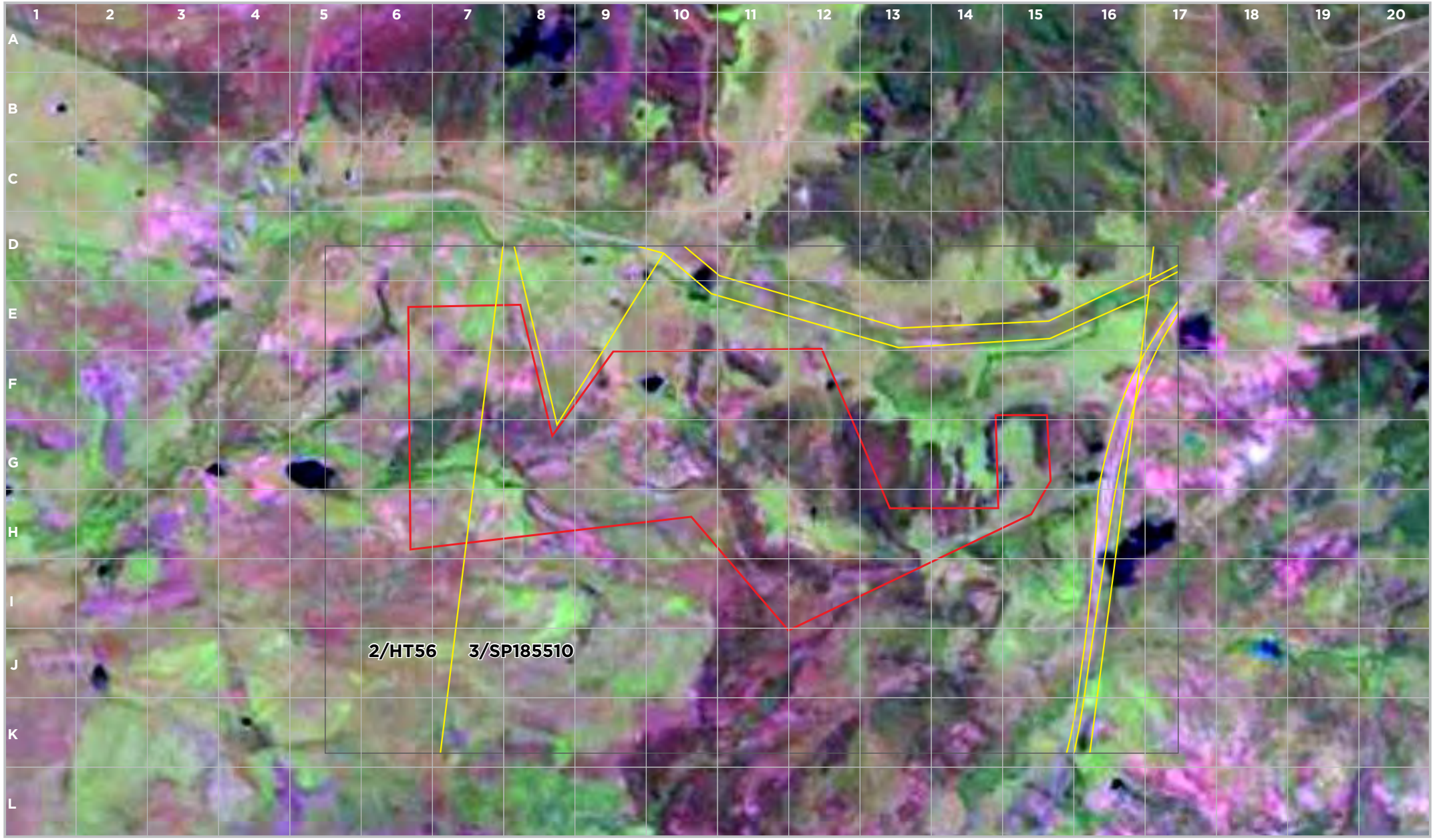


Figure 13: Historical Imagery Assessment (15/04/2010)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

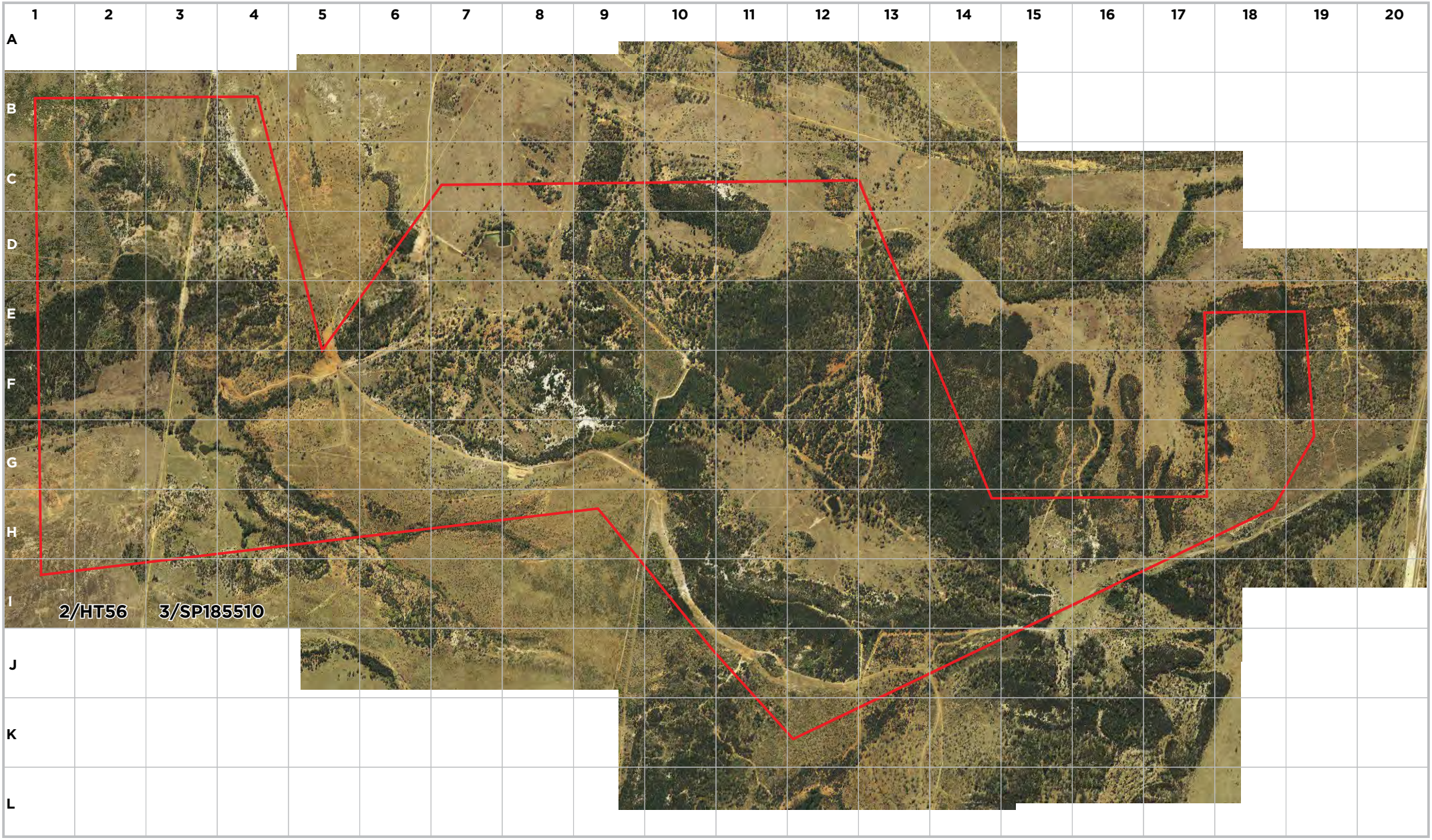


Figure 14: Historical Imagery Assessment (20/07/2010)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: DigitalGlobe (Queensland Globe)
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

Figure 15: Historical Imagery Assessment (04/05/2011)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

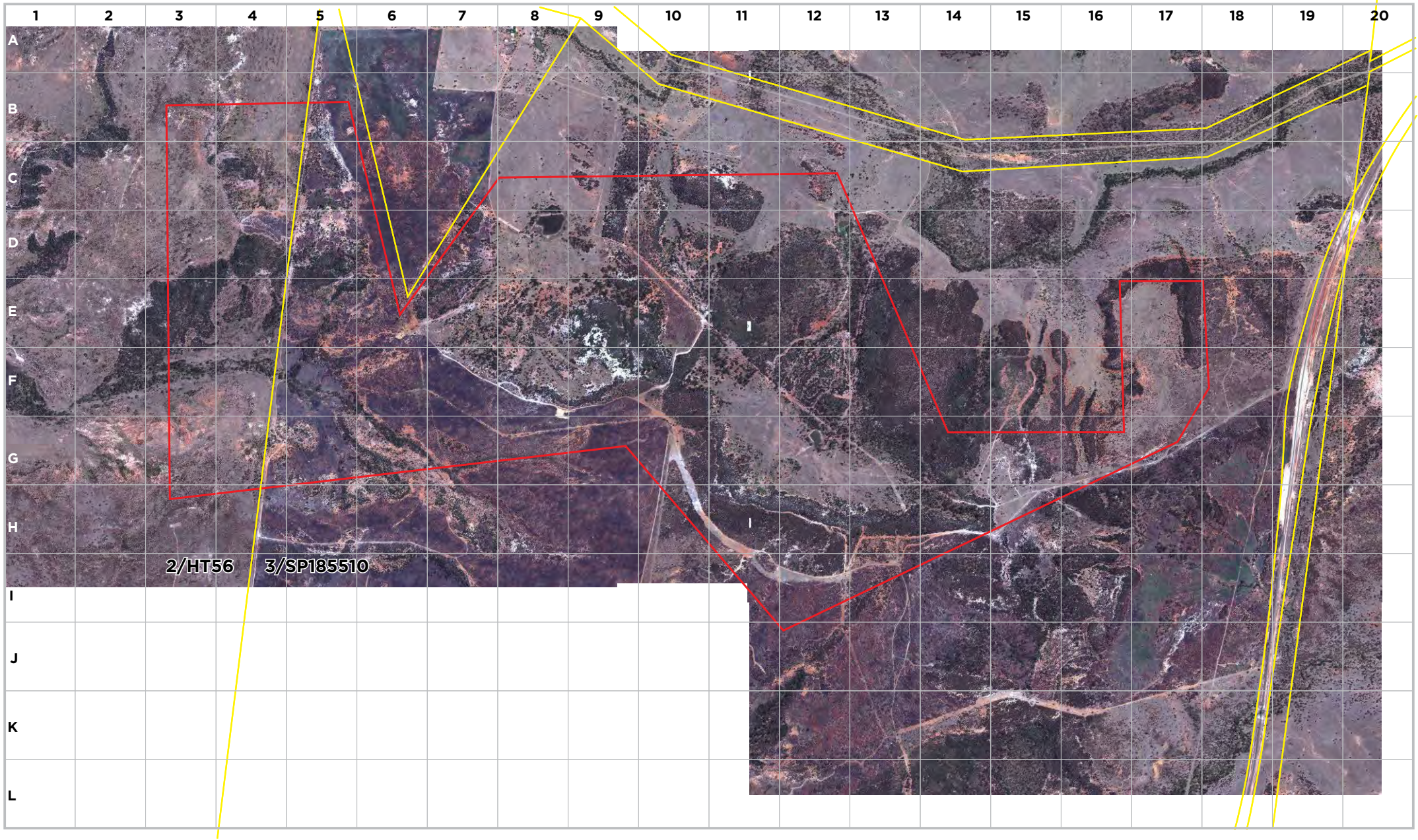


Figure 16: Historical Imagery Assessment (October 2011)

Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: Bing Maps, Microsoft
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

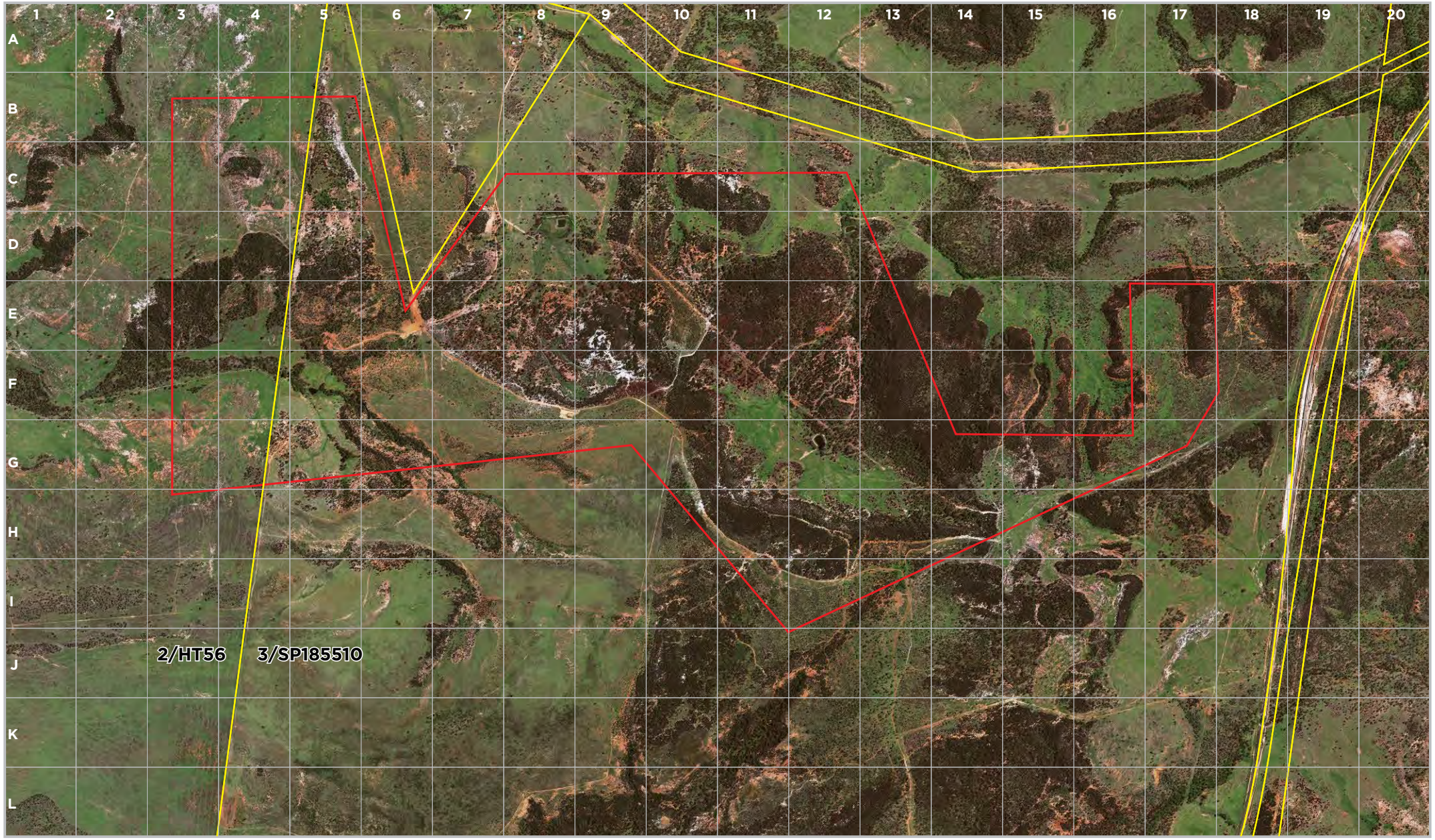


Figure 17: Historical Imagery Assessment (14/03/2013)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: Spot6
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

Figure 18: Historical Imagery Assessment (13/10/2013)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: GeoEye-1
Not to scale
26/09/2014

Legend
- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

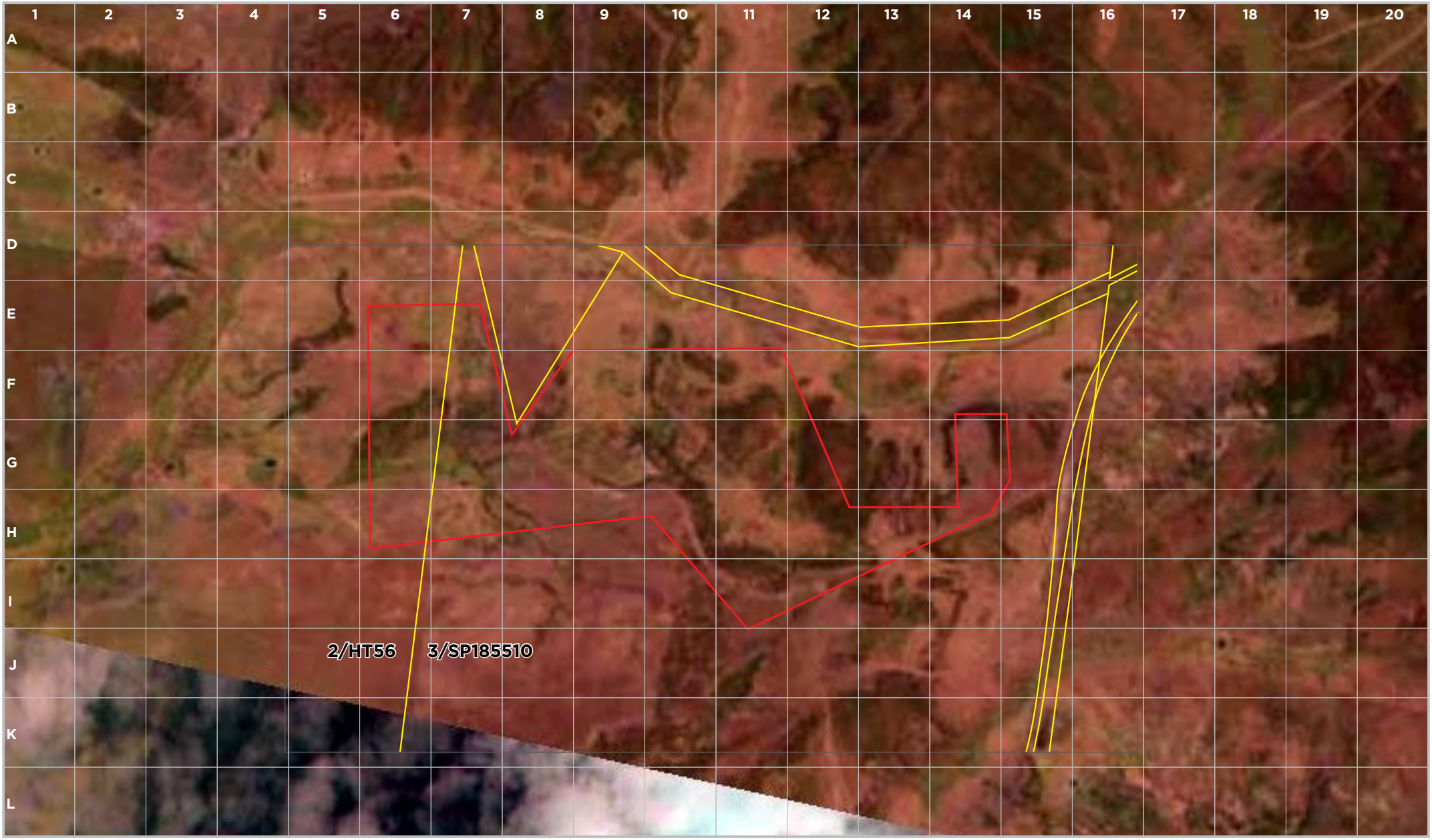


Figure 19: Historical Imagery Assessment (05/01/2014)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: USGS-LANDSAT
Not to scale
26/09/2014

Legend

- Mining Lease Application boundary
- Lot and plan boundary

GTenvironmental

Figure 20: Historical Imagery Assessment (27/05/2014 & 28/05/2014)
Revision 1
COMET RIDGE PROJECT
IMAGE SOURCE: GT Environmental Pty Ltd
Not to scale
26/09/2014

Legend
- Mining Lease Application boundary
- Lot and plan boundary
- GTE soil survey site

GTenvironmental

APPENDIX D

Crop Frequency Forage Reports

FORAGE REPORT: CROP FREQUENCY

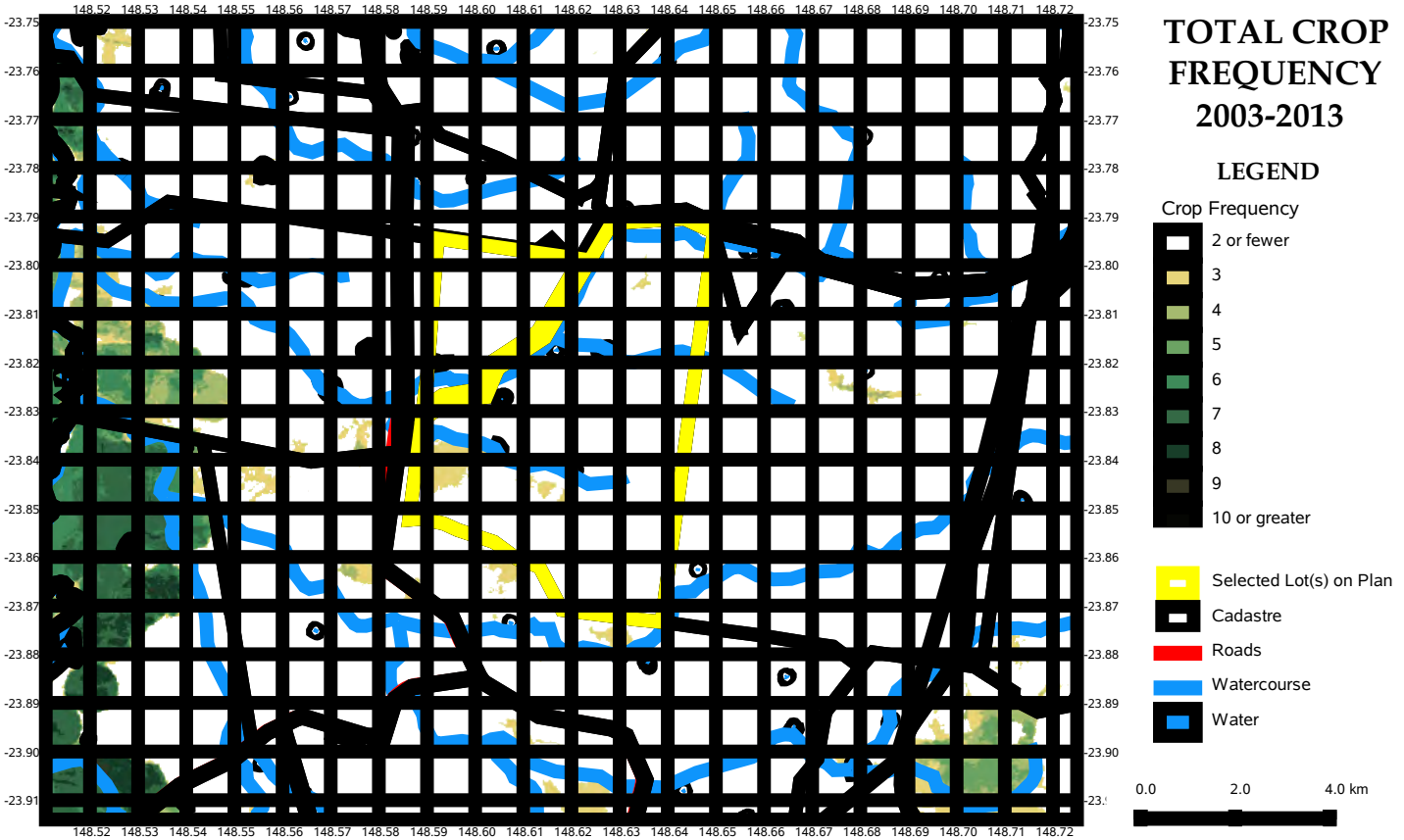
http://www.longpaddock.qld.gov.au/forage *September 23, 2014* *Lot on Plan: 2HT56* *Label: CometRidgeProject*

Queensland Government

Introduction

This report presents crop frequency information for your chosen area, for the time period selected. The report is for a minimum ten year period between 1988 and 2013. The report includes crop frequency mapping which is based on time series analysis of Landsat satellite imagery over the summer and winter growing seasons. The approach is based on detection of annual cycles of greenness, therefore some perennial crops may not be represented. Snapshots of composite Landsat imagery for February and September for each year are also provided. For further information, refer to the FORAGE User Guide (http://www.longpaddock.qld.gov.au/forage/forage_user_guide.pdf).

Annual crop frequency map for 2003 - 2013



How to interpret the information

Crop frequency mapping: Coloured areas on the map indicate locations where active crops have been detected three or more times in the summer and winter growing seasons, for a minimum ten year period. The map on this page shows 'Total Frequency' and is a count of number of years in which an active crop was detected. The two maps on the following page show the summer and winter crop frequency. These maps show a count of the number of times an active crop was detected in each of those growing seasons. The detection of active crops is based on time-series analysis of Landsat satellite imagery. Due to limitations of the automated method used to detect active cropping, you should also view the Landsat satellite imagery snapshots to confirm the presence or absence of cropping.

Landsat satellite imagery: The summer (February) and winter (September) Landsat imagery snapshots on the following pages help confirm the presence of an active crop. Each snapshot is designed to optimise the identification of winter and summer cropping and is generated from a number of images acquired within the growing season. The cropped areas will generally appear bright green in the imagery compared with the surrounding landscape. Even if the crop frequency mapping does not indicate cropping in an area, it is important to check each Landsat image to confirm that cropping has not been undertaken. Sometimes it will not be possible to clearly identify cropped areas in the imagery. For example, in some wetter seasons, much of the imagery can appear very green and cropping may be difficult to identify. Where this is the case, it is recommended to undertake further investigation using other information sources.

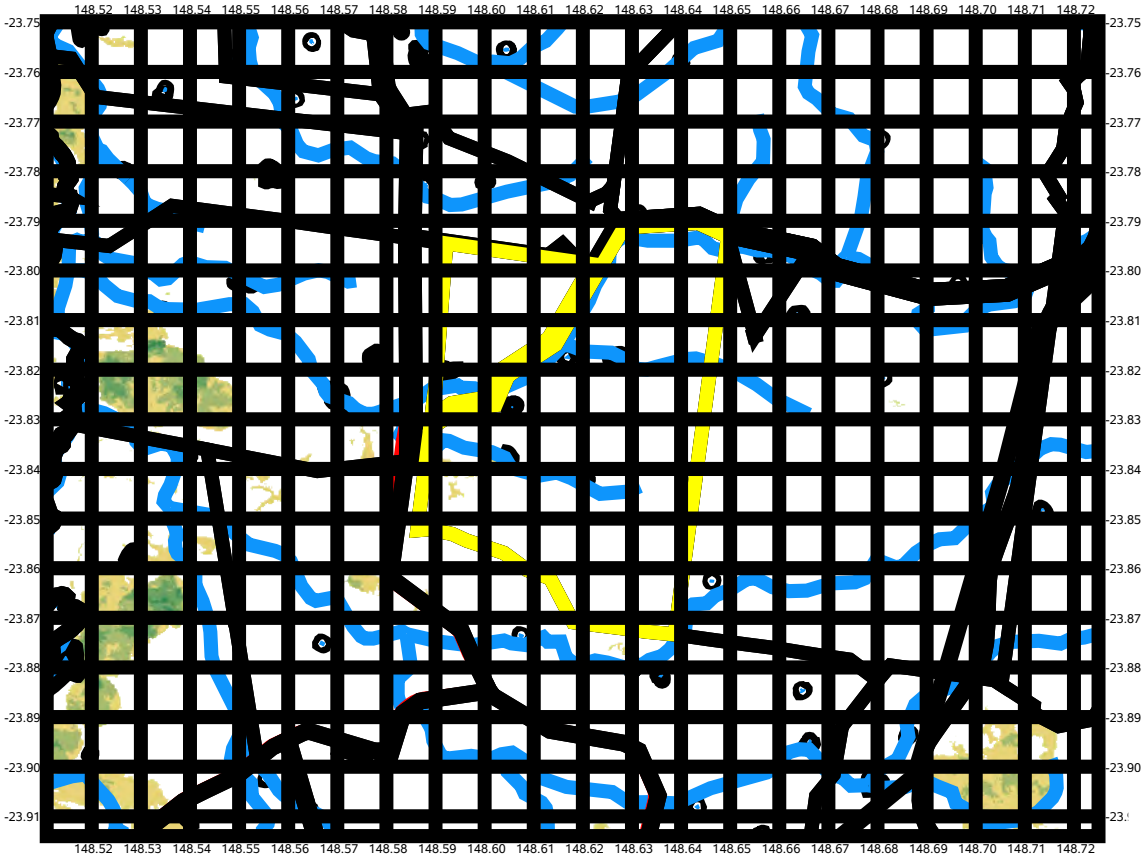
Disclaimer

FORAGE REPORT: CROP FREQUENCY

http://www.longpaddock.qld.gov.au/forage *September 23, 2014* *Lot on Plan: 2HT56* *Label: CometRidgeProject*

Queensland Government

Summer (February) crop frequency map for 2003 - 2013



SUMMER CROP FREQUENCY 2003-2013

LEGEND

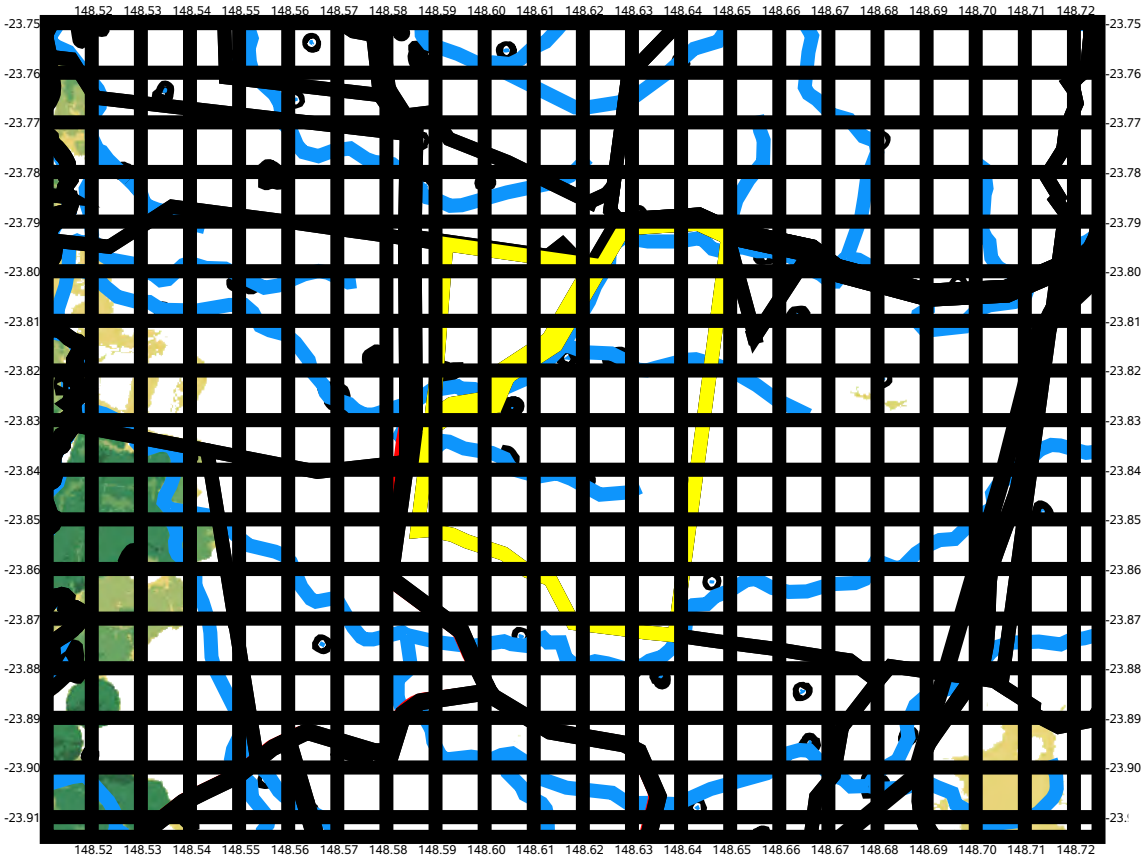
Crop Frequency

- 2 or fewer
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 or greater

- Selected Lot(s) on Plan
- Cadastre
- Roads
- Watercourse
- Water

0.0 2.0 4.0 km

Winter (September) crop frequency map for 2003 - 2013



WINTER CROP FREQUENCY 2003-2013

LEGEND

Crop Frequency

- 2 or fewer
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 or greater

- Selected Lot(s) on Plan
- Cadastre
- Roads
- Watercourse
- Water

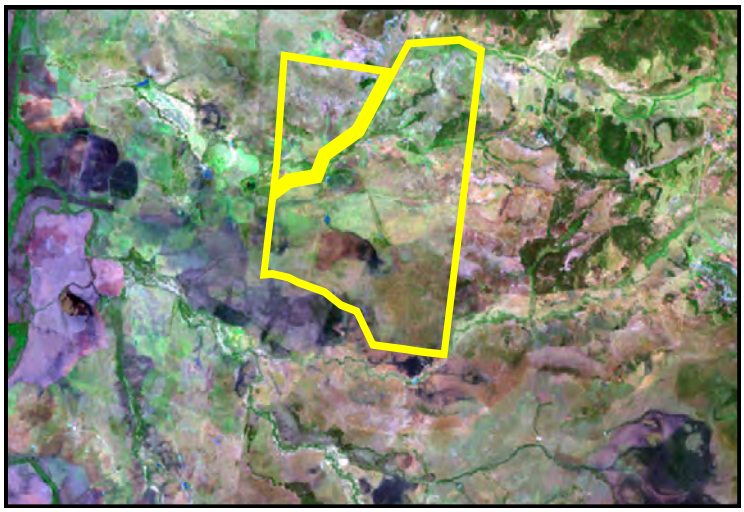
0.0 2.0 4.0 km

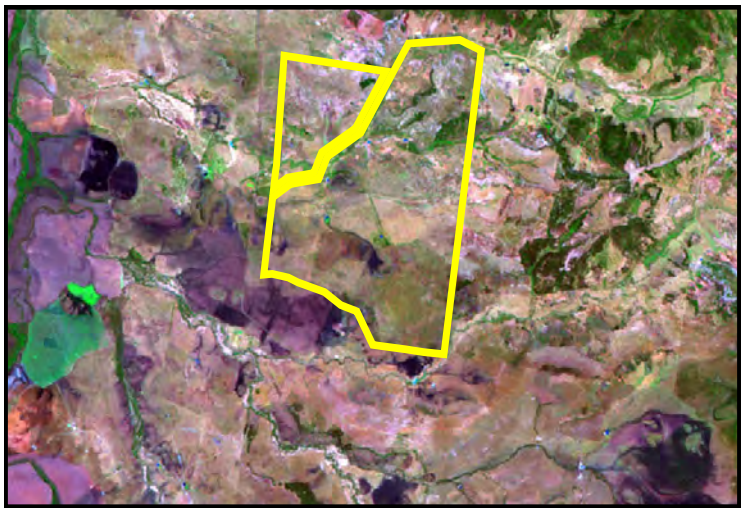
FORAGE REPORT: CROP FREQUENCY

http://www.longpaddock.qld.gov.au/forage *September 23, 2014* *Lot on Plan: 2HT56* *Label: CometRidgeProject*

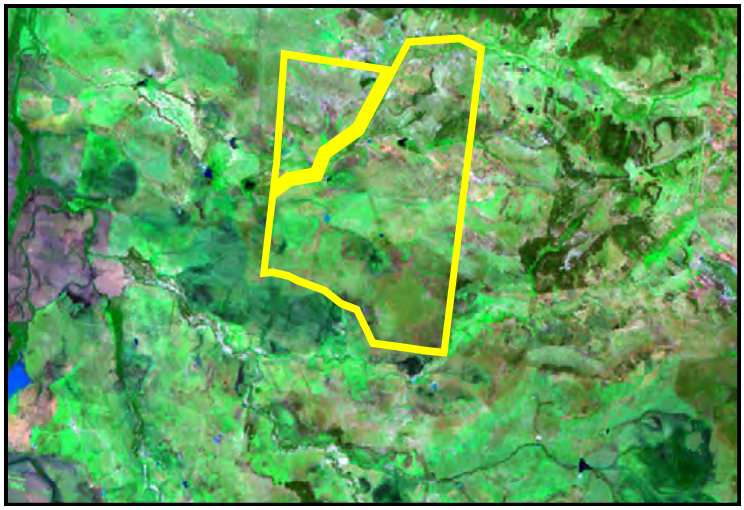
Queensland Government

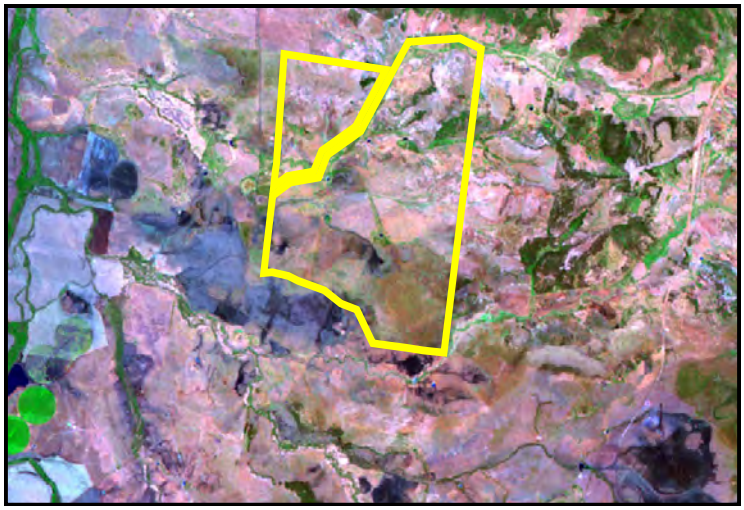
February (left) and September (right) images for 2003



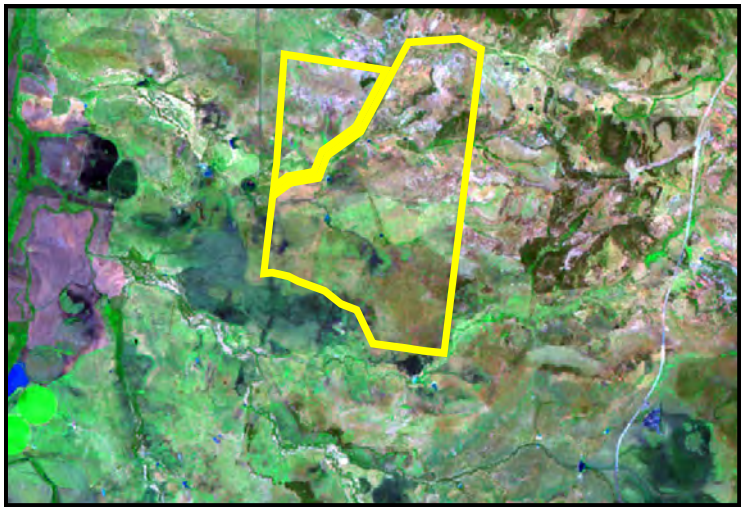


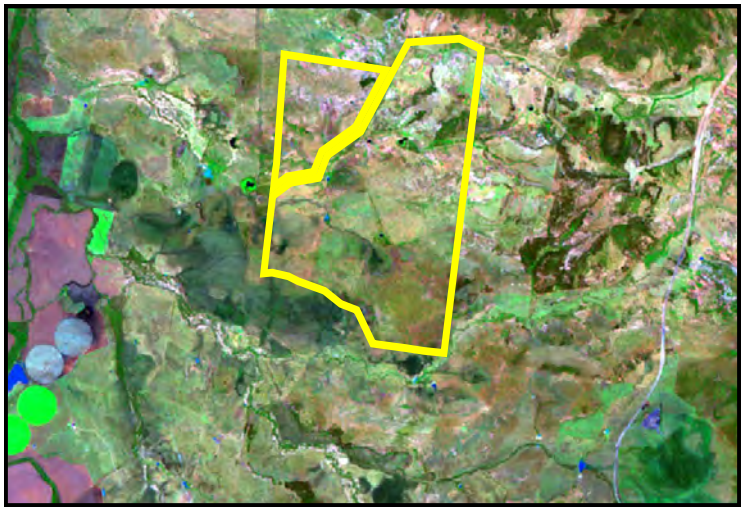
February (left) and September (right) images for 2004





February (left) and September (right) images for 2005



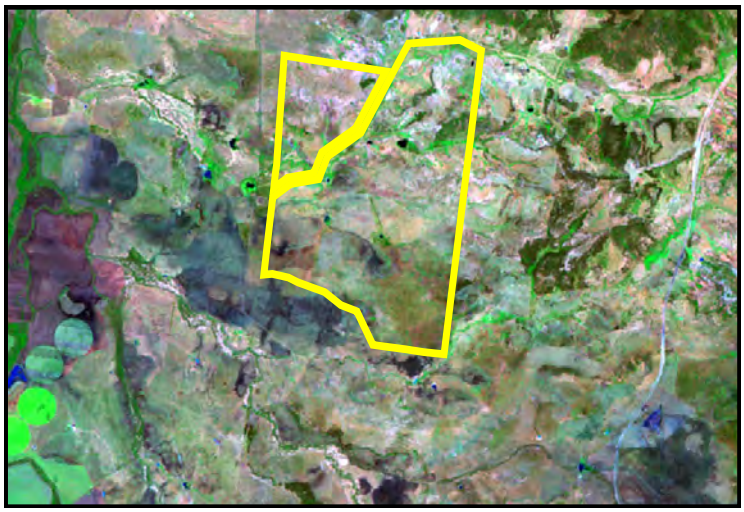


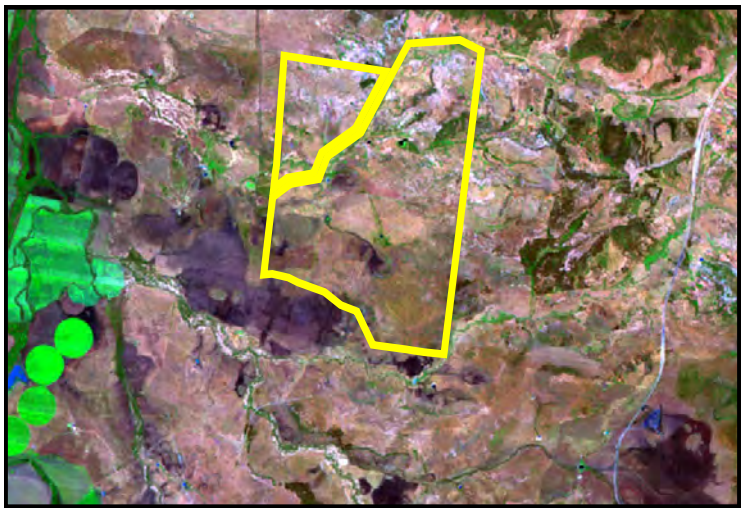
FORAGE REPORT: CROP FREQUENCY

http://www.longpaddock.qld.gov.au/forage *September 23, 2014* *Lot on Plan: 2HT56* *Label: CometRidgeProject*

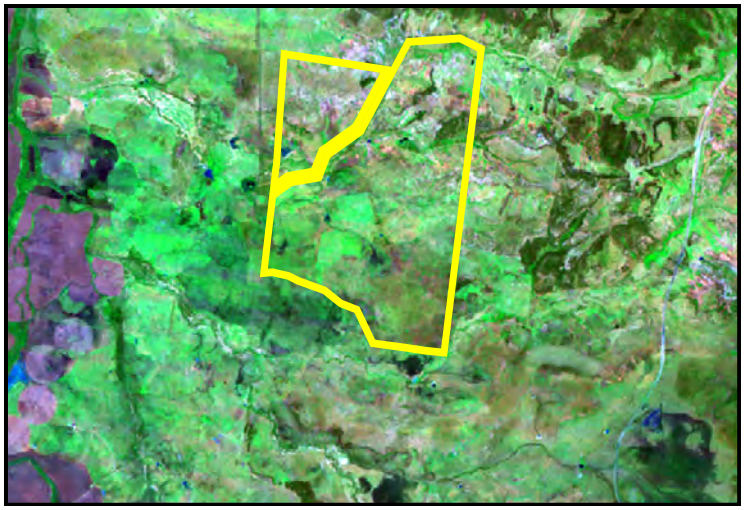
Queensland Government

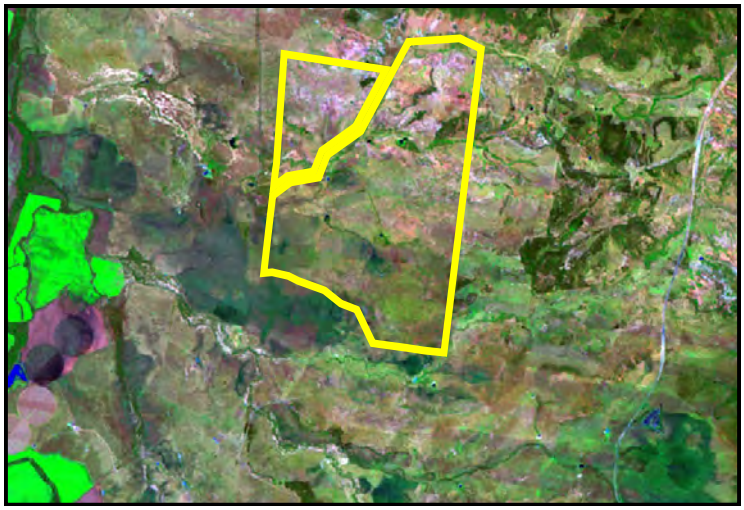
February (left) and September (right) images for 2006



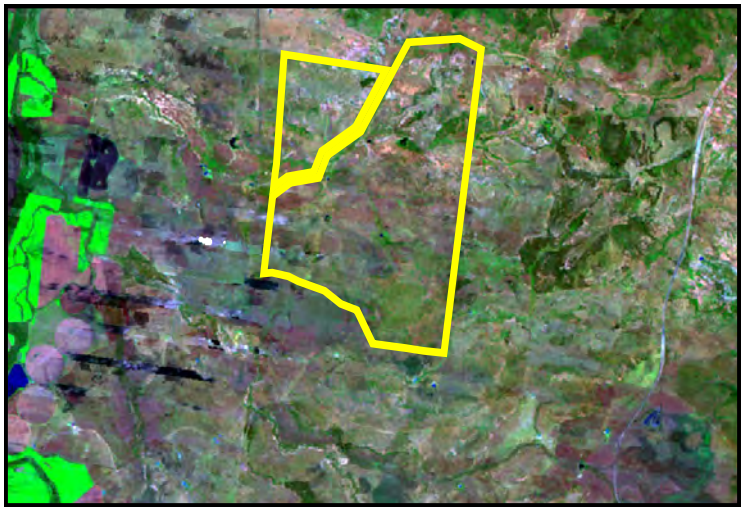


February (left) and September (right) images for 2007





February (left) and September (right) images for 2008

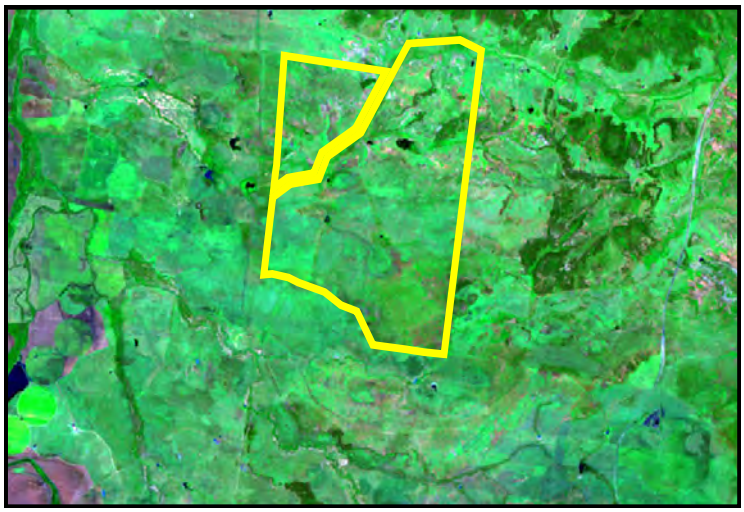
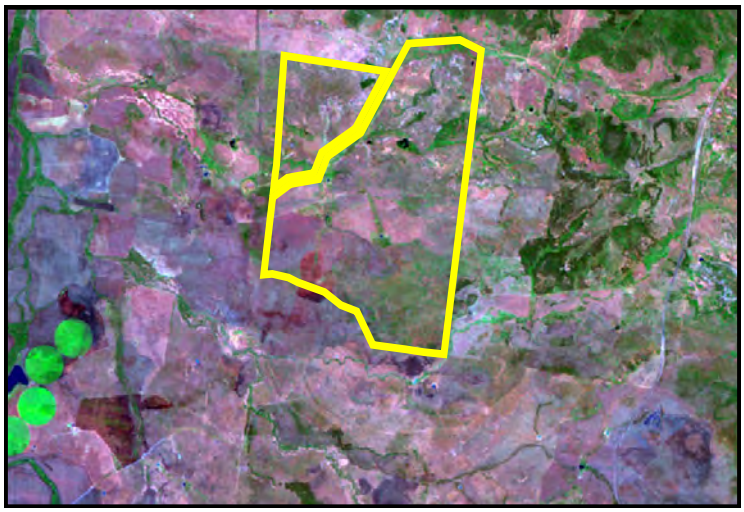


FORAGE REPORT: CROP FREQUENCY

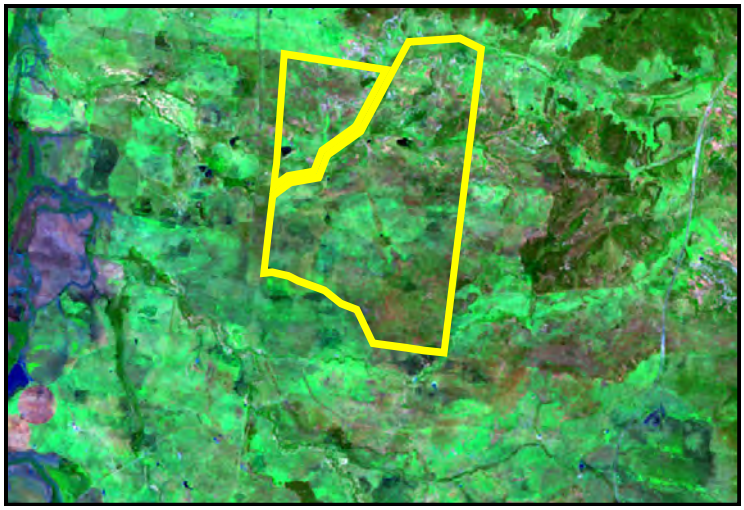
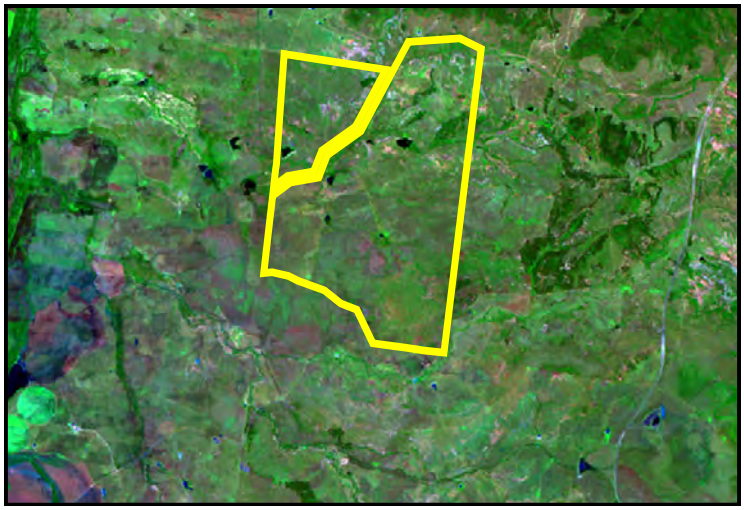
http://www.longpaddock.qld.gov.au/forage *September 23, 2014* *Lot on Plan: 2HT56* *Label: CometRidgeProject*

Queensland Government

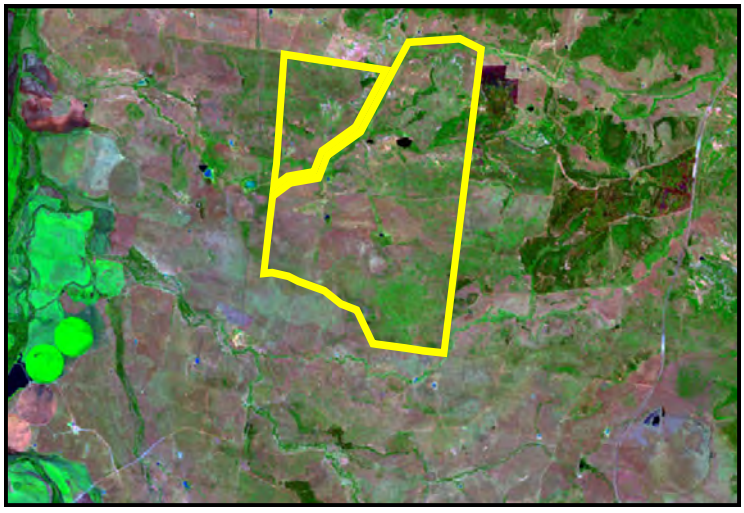
February (left) and September (right) images for 2009

February (left) and September (right) images for 2010

February (left) and September (right) images for 2011

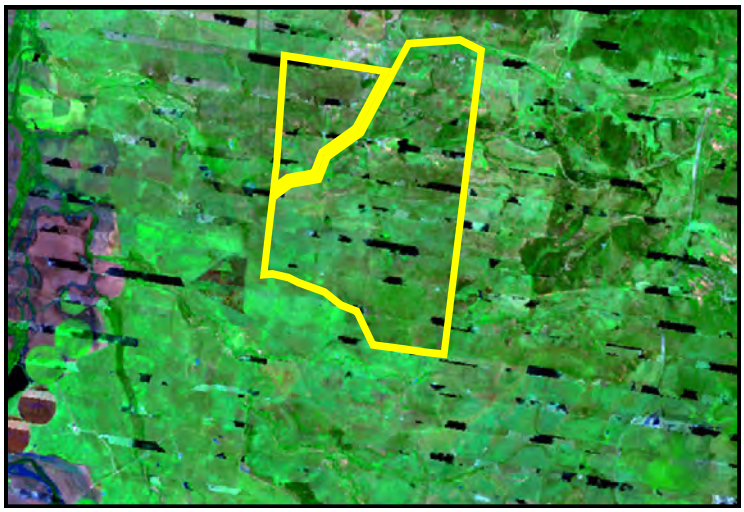



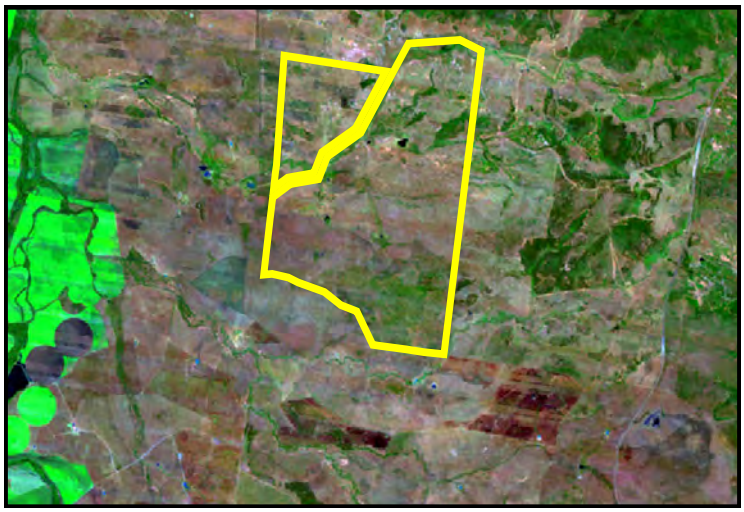
FORAGE REPORT: CROP FREQUENCY

http://www.longpaddock.qld.gov.au/forage *September 23, 2014* *Lot on Plan: 2HT56* *Label: CometRidgeProject*

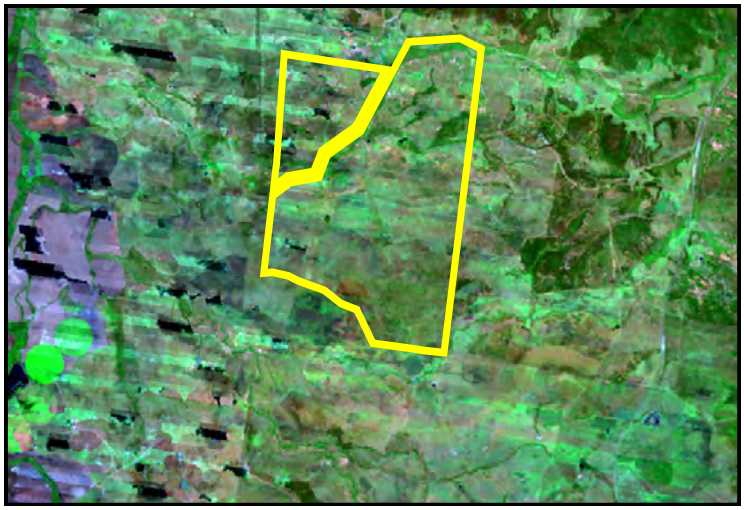
Queensland Government

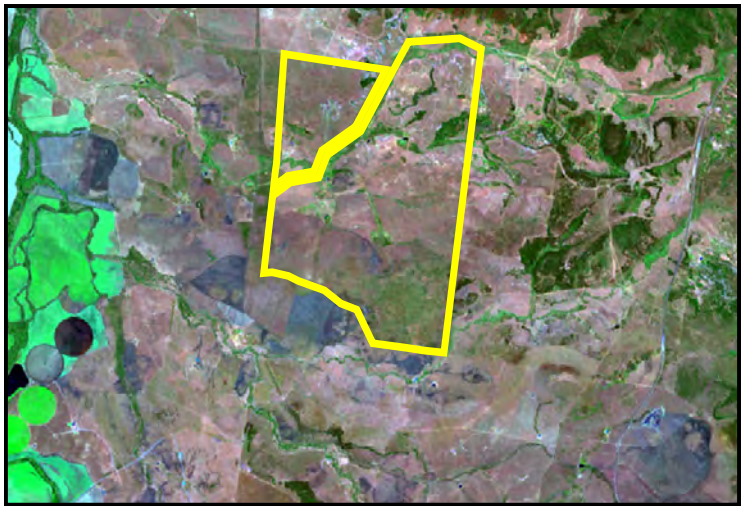
February (left) and September (right) images for 2012





February (left) and September (right) images for 2013





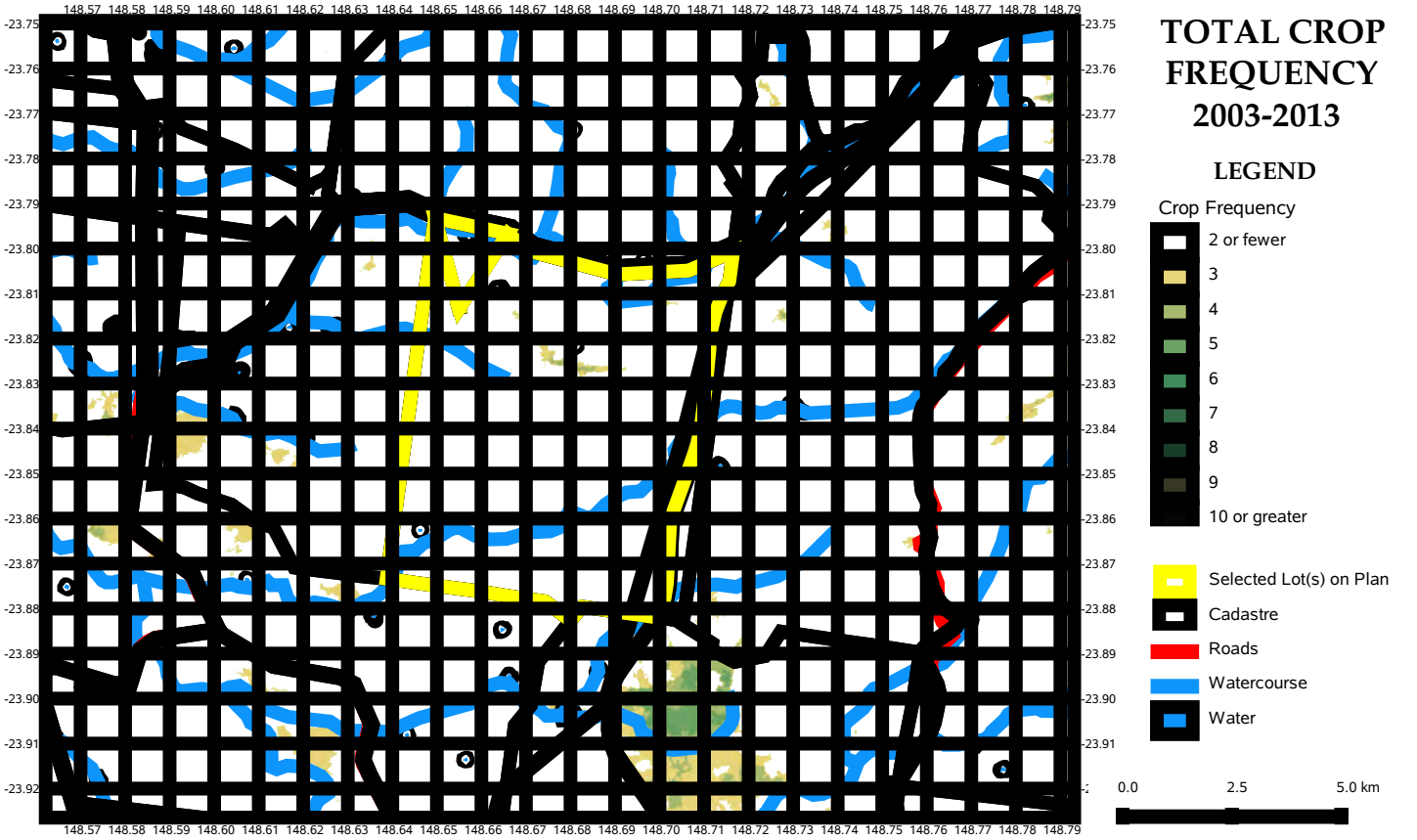
FORAGE REPORT: CROP FREQUENCY

Queensland Government

Introduction

This report presents crop frequency information for your chosen area, for the time period selected. The report is for a minimum ten year period between 1988 and 2013. The report includes crop frequency mapping which is based on time series analysis of Landsat satellite imagery over the summer and winter growing seasons. The approach is based on detection of annual cycles of greenness, therefore some perennial crops may not be represented. Snapshots of composite Landsat imagery for February and September for each year are also provided. For further information, refer to the FORAGE User Guide (http://www.longpaddock.qld.gov.au/forage/forage_user_guide.pdf).

Annual crop frequency map for 2003 - 2013



How to interpret the information

Crop frequency mapping: Coloured areas on the map indicate locations where active crops have been detected three or more times in the summer and winter growing seasons, for a minimum ten year period. The map on this page shows 'Total Frequency' and is a count of number of years in which an active crop was detected. The two maps on the following page show the summer and winter crop frequency. These maps show a count of the number of times an active crop was detected in each of those growing seasons. The detection of active crops is based on time-series analysis of Landsat satellite imagery. Due to limitations of the automated method used to detect active cropping, you should also view the Landsat satellite imagery snapshots to confirm the presence or absence of cropping.

Landsat satellite imagery: The summer (February) and winter (September) Landsat imagery snapshots on the following pages help confirm the presence of an active crop. Each snapshot is designed to optimise the identification of winter and summer cropping and is generated from a number of images acquired within the growing season. The cropped areas will generally appear bright green in the imagery compared with the surrounding landscape. Even if the crop frequency mapping does not indicate cropping in an area, it is important to check each Landsat image to confirm that cropping has not been undertaken. Sometimes it will not be possible to clearly identify cropped areas in the imagery. For example, in some wetter seasons, much of the imagery can appear very green and cropping may be difficult to identify. Where this is the case, it is recommended to undertake further investigation using other information sources.

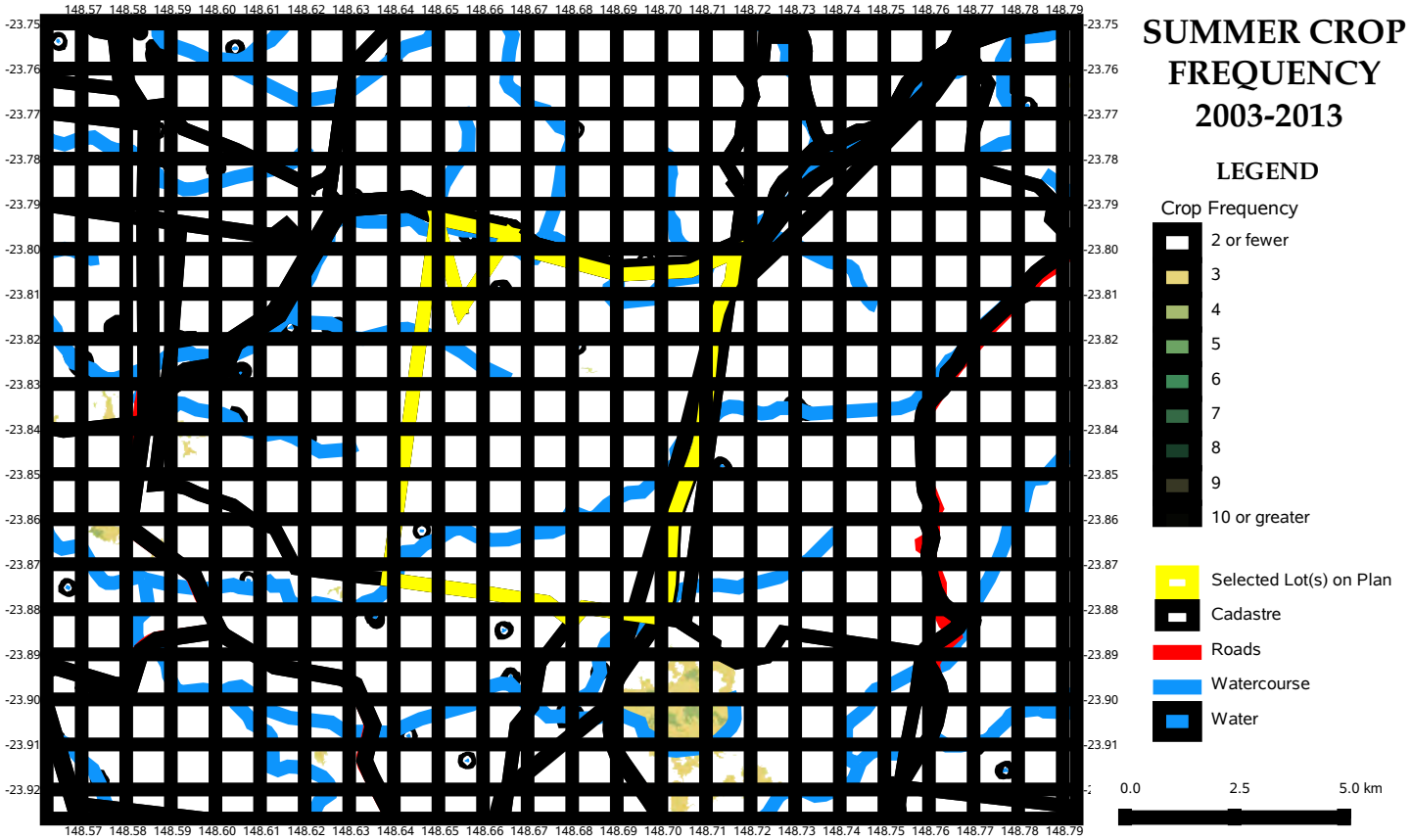
Disclaimer

FORAGE REPORT: CROP FREQUENCY

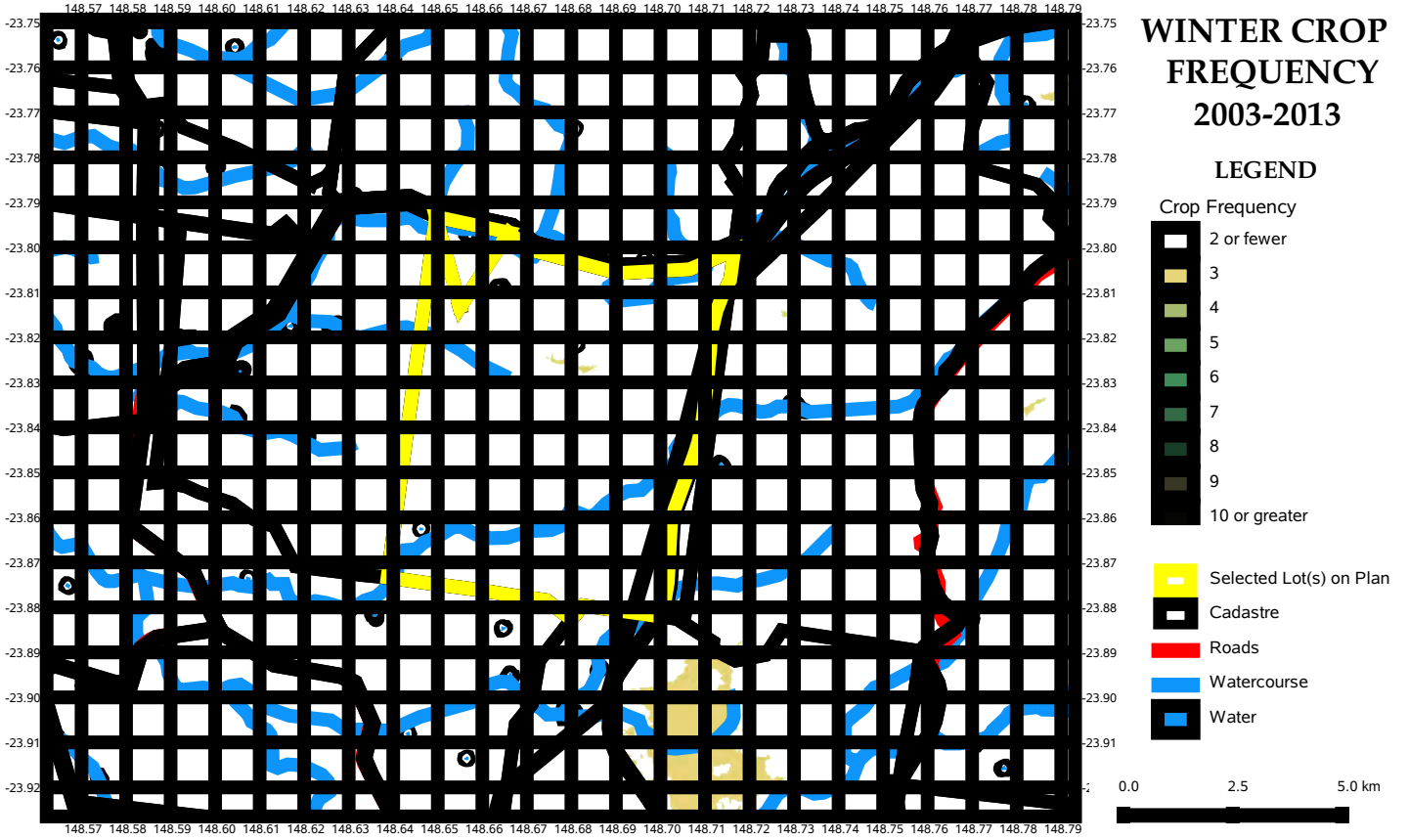
http://www.longpaddock.qld.gov.au/forage *September 5, 2014* *Lot on Plan: 3SP185510* *Label: CR14*

Queensland Government

Summer (February) crop frequency map for 2003 - 2013



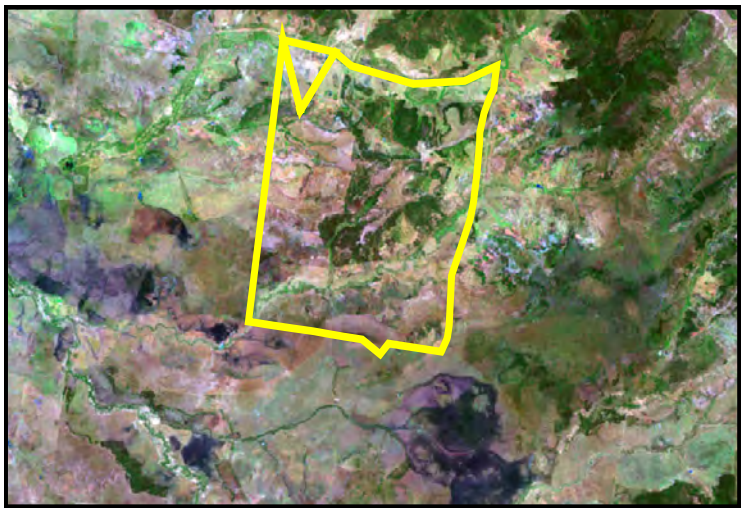
Winter (September) crop frequency map for 2003 - 2013

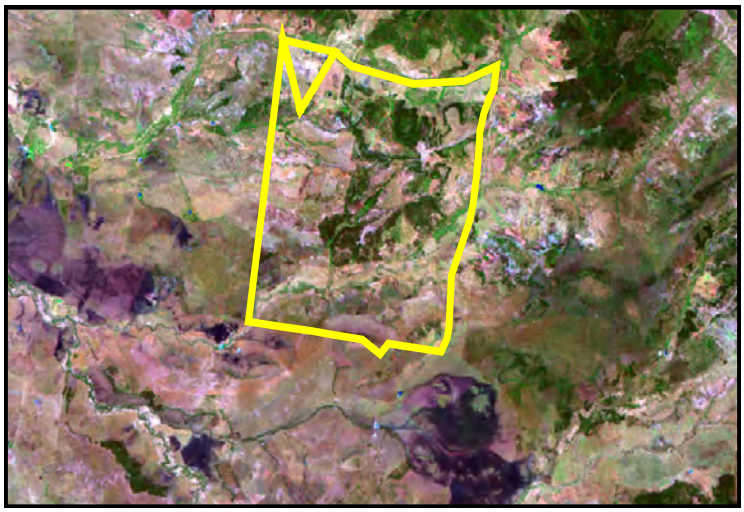


FORAGE REPORT: CROP FREQUENCY

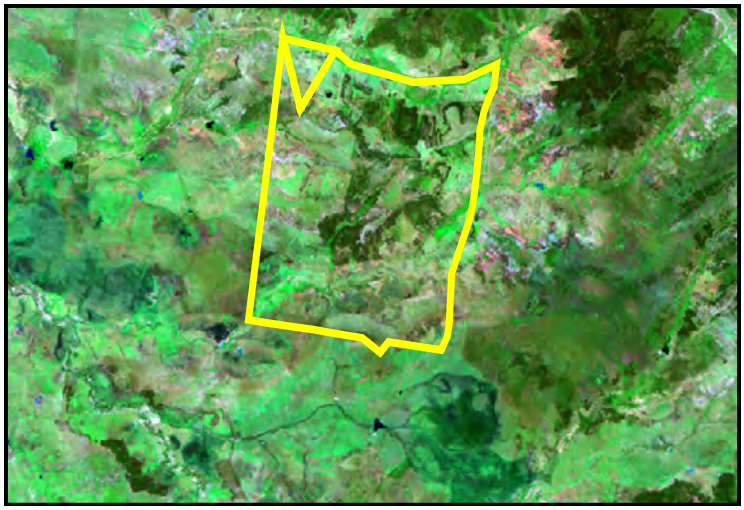
Queensland Government

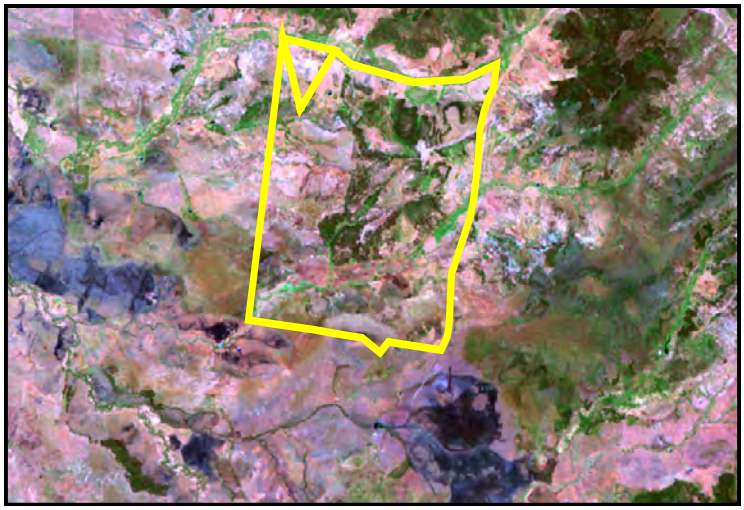
February (left) and September (right) images for 2003



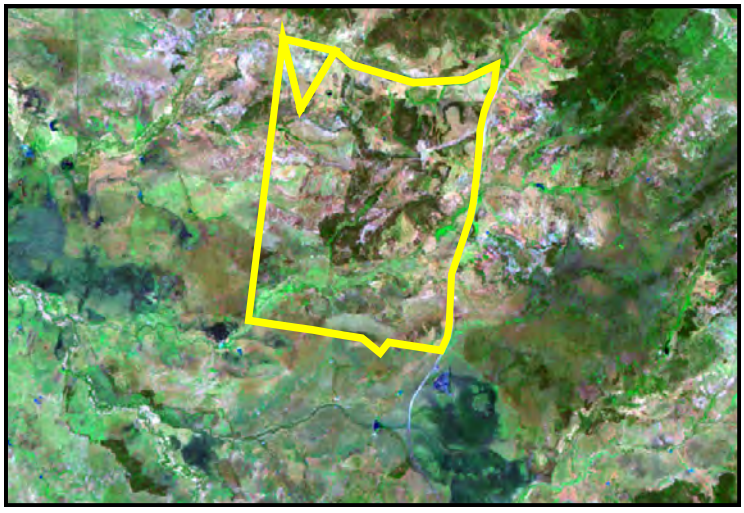


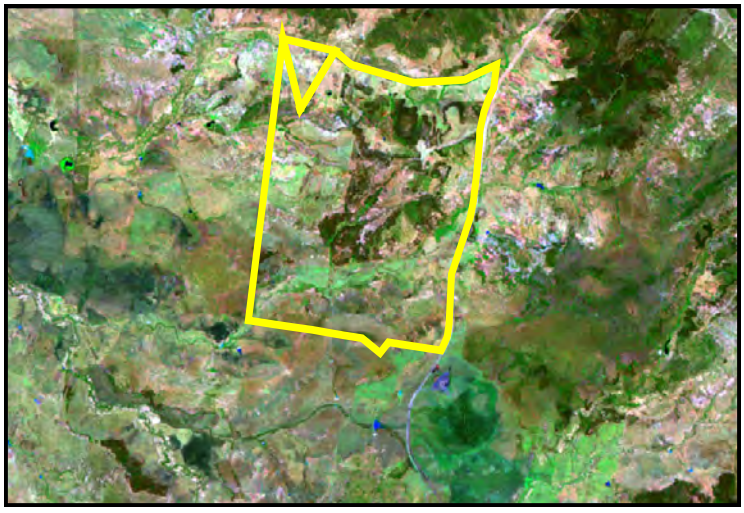
February (left) and September (right) images for 2004





February (left) and September (right) images for 2005

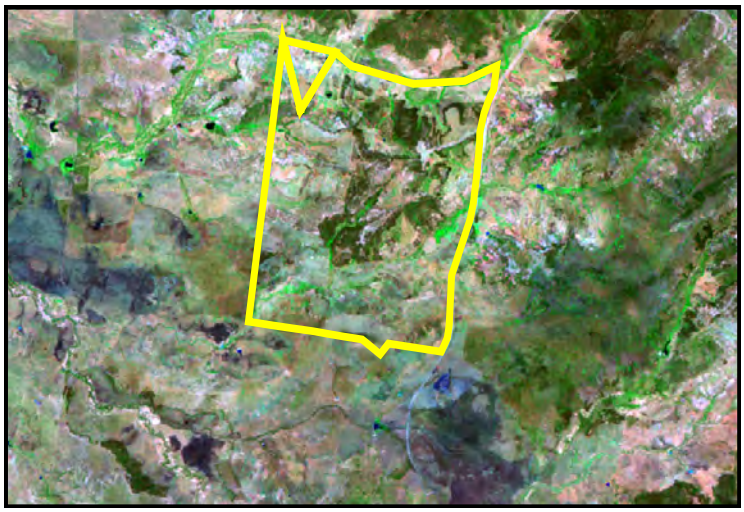
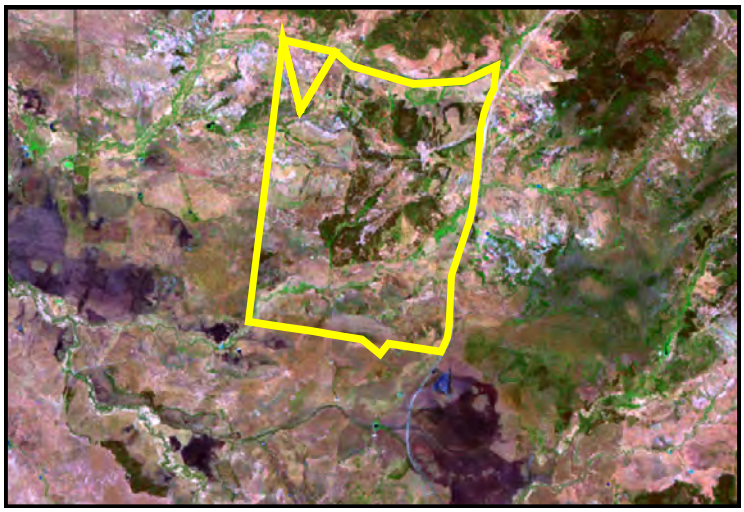




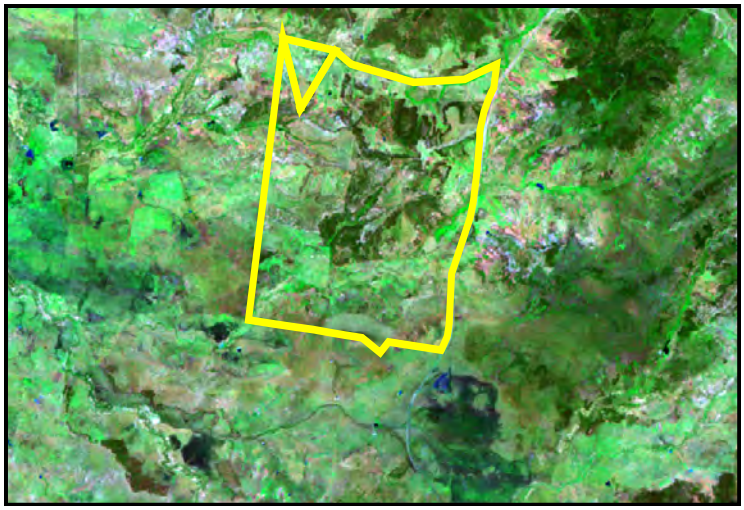
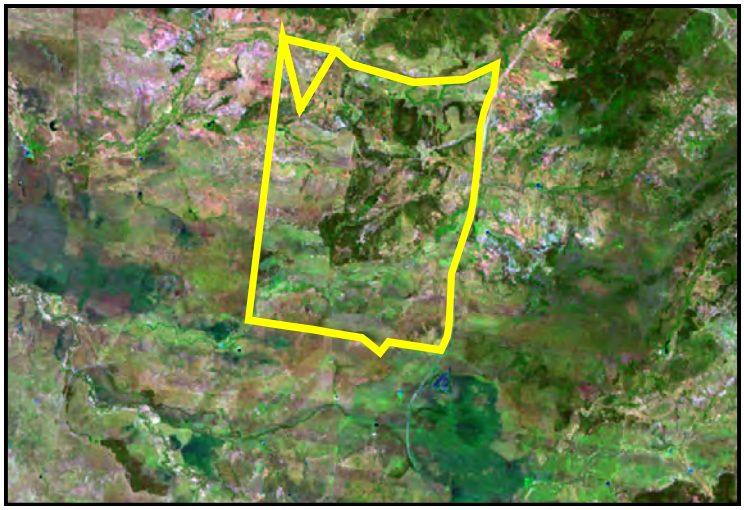
FORAGE REPORT: CROP FREQUENCY

Queensland Government

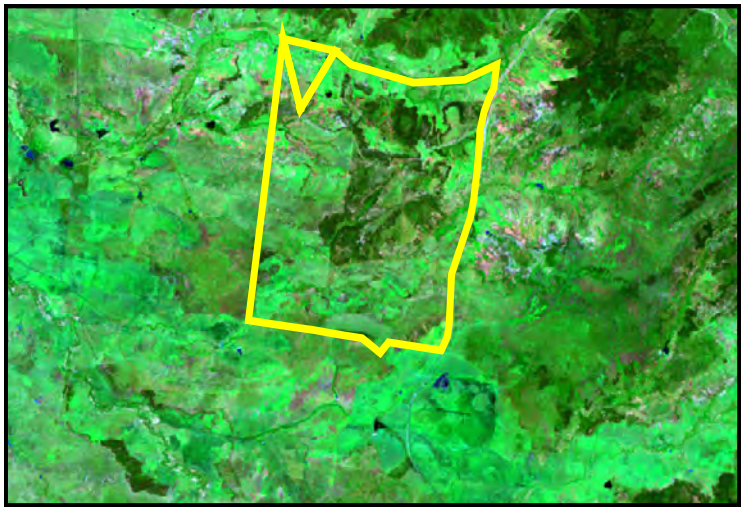
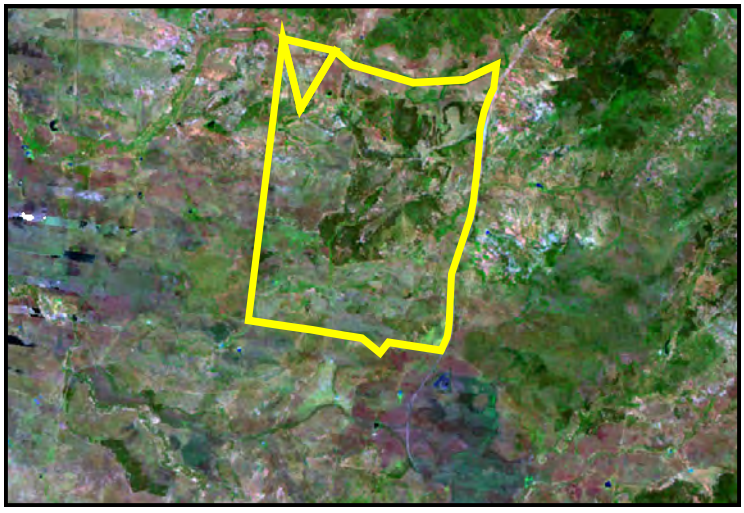
February (left) and September (right) images for 2006

February (left) and September (right) images for 2007

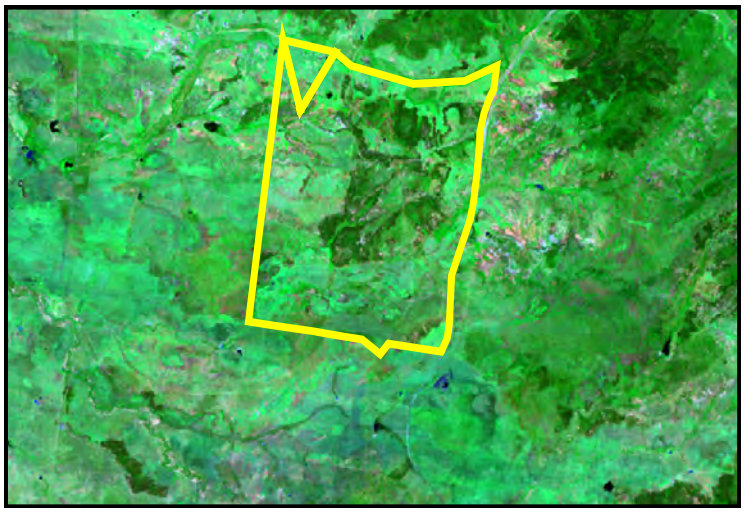
February (left) and September (right) images for 2008

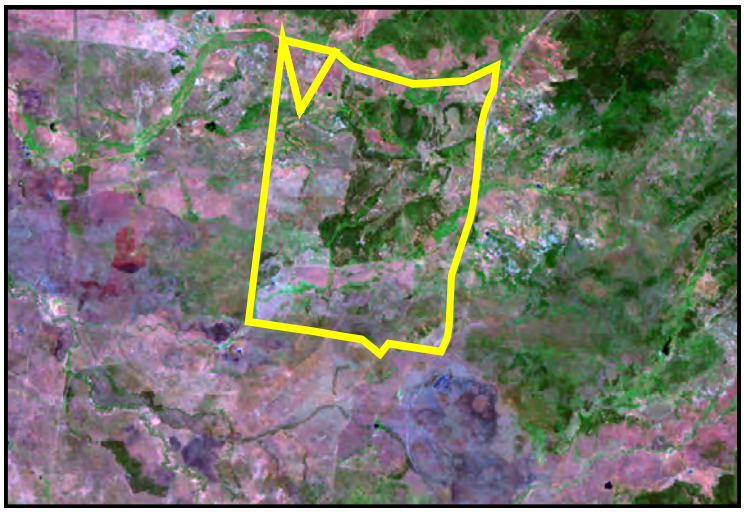



FORAGE REPORT: CROP FREQUENCY

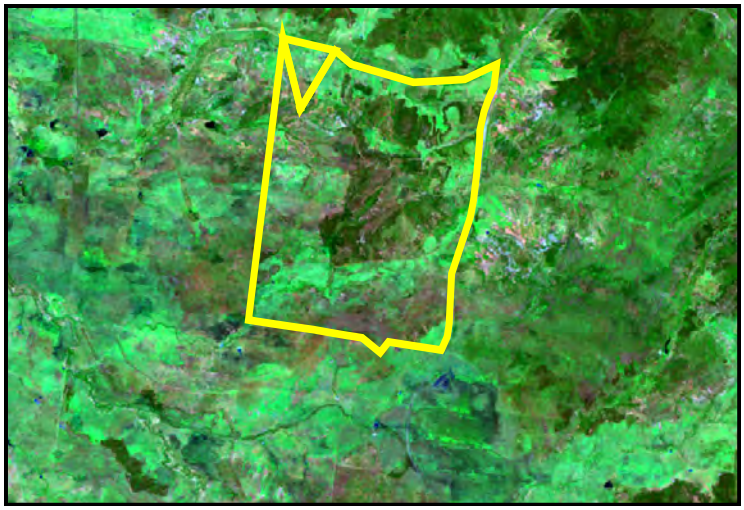
Queensland Government

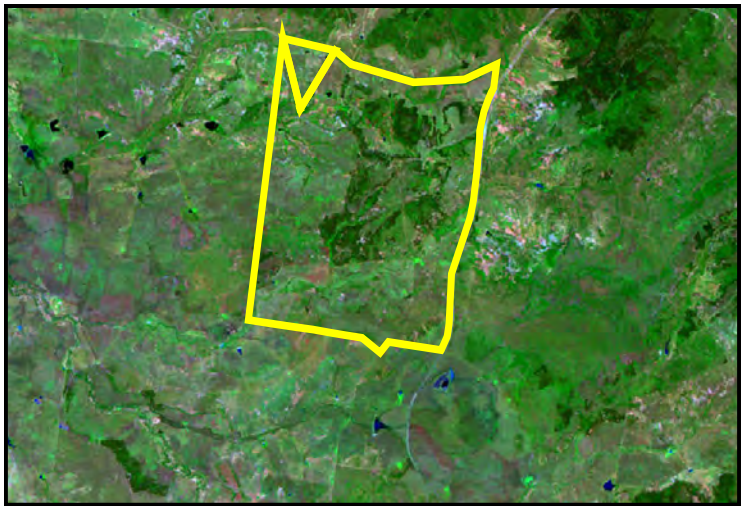
February (left) and September (right) images for 2009



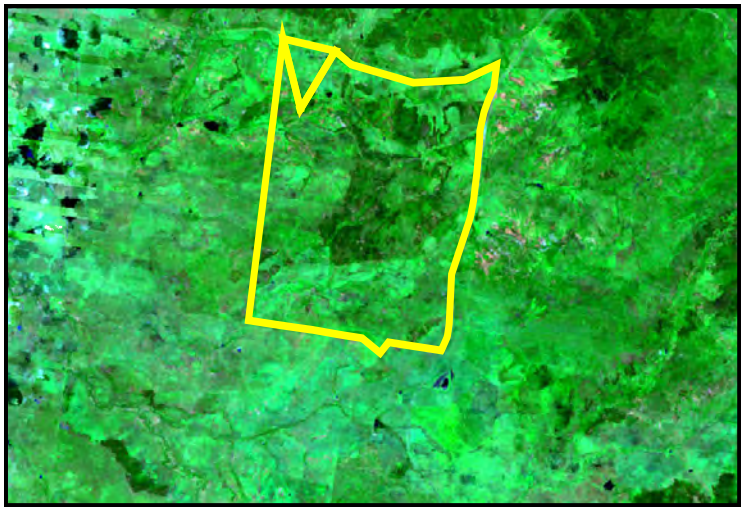


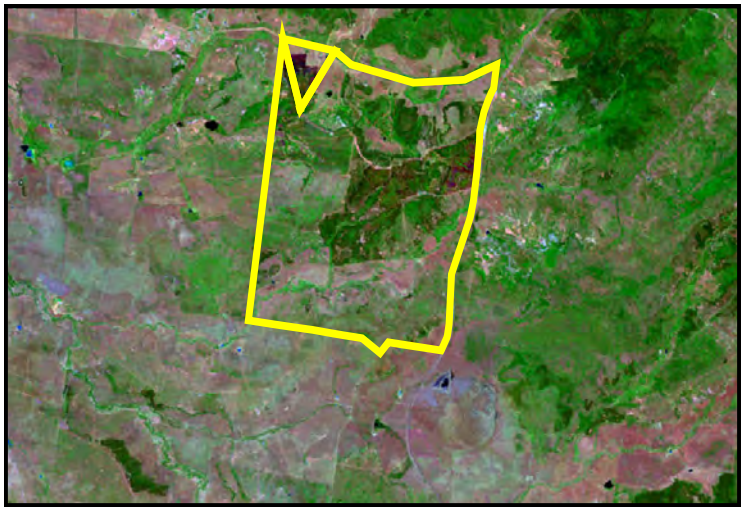
February (left) and September (right) images for 2010





February (left) and September (right) images for 2011

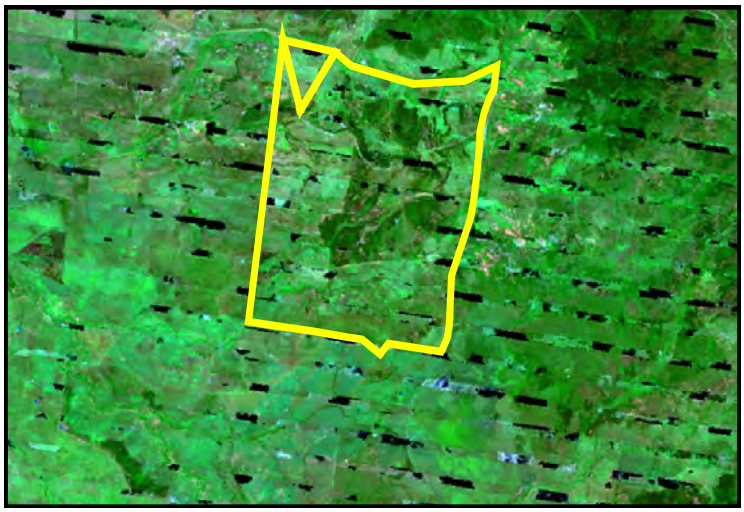


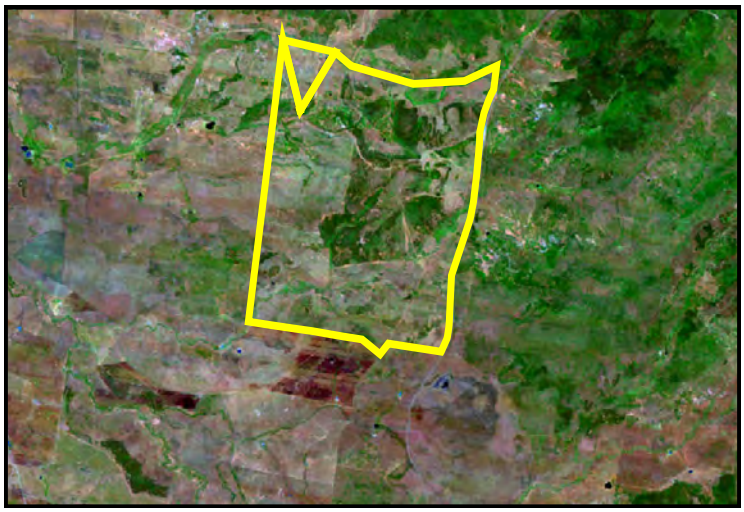


FORAGE REPORT: CROP FREQUENCY

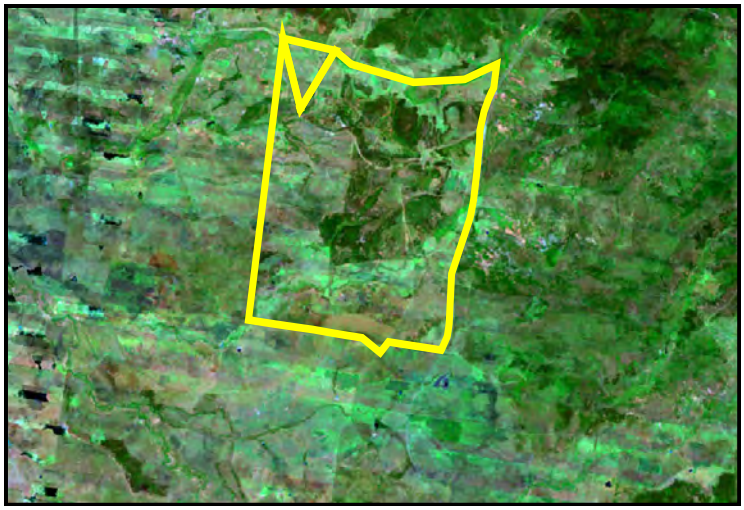
Queensland Government

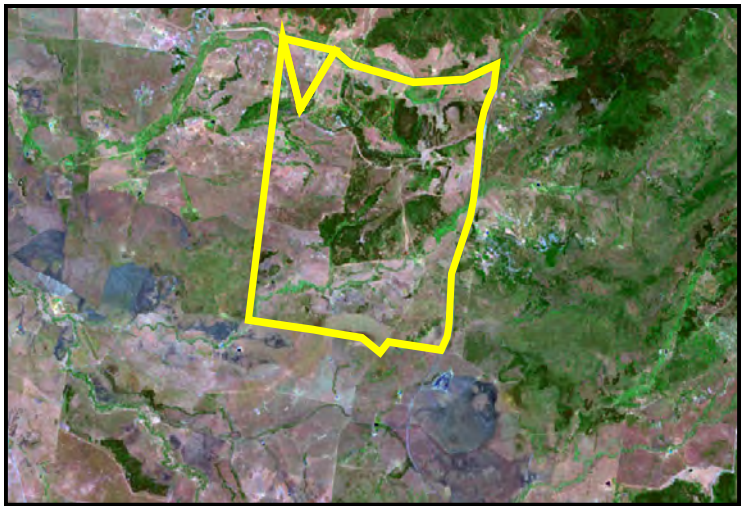
February (left) and September (right) images for 2012





February (left) and September (right) images for 2013





APPENDIX E

Landholder Verification Letter

1 October 2014

The Chief Executive
Department of State Development, Infrastructure & Planning
C/- the RPI Act Development Assessment Team
PO Box 15009
CITY EAST QLD 4002

Dear Sir/Madam

Re: Priority Agricultural Area Assessment (Lot Plan 2/HT56) for the Comet Ridge Project Area

We, William and Stuart Dixon are the registered holders of Lot 2 on HT56 (the "Lagoons").

We understand that Acacia Coal Limited is proposing to apply for one Mining Lease Application (MLA) (and associated Environmental Authority) which partly occurs on our property.

To assist with the determination of the validity of Priority Agricultural Area (PAA) classification within the proposed disturbance footprint of the MLA, we hereby confirm that the area of interest shown in the **attached** figure has not been used within the previous 10 years (2004 to 2014) for:

- cropping;
- perennial horticulture;
- seasonal horticulture;
- irrigated agriculture and plantations; and/or
- intensive horticulture.

Yours sincerely,

Stuart Thomas Dixon 3/10/14

Name Signature Date

William Richard Dixon 02-10-2014

Name Signature Date