IN THE ENVIRONMENT COURT

CHRISTCHURCH REGISTRY

I MUA I TE KOOTI TAIAO O AOTEAROA

ENV-2017-CHC-090

Under	**the Resource Management Act 1991**
In the matter	**of an appeal pursuant to section 120 of the Act**
Between	**THE ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND INCORPORATED** **Appellant**
And	**WEST COAST REGIONAL COUNCIL AND BULLER DISTRICT COUNCIL** **Respondents**
And	**STEVENSON MINING LIMITED** **Applicant**

STATEMENT OF EVIDENCE OF TRACEY ROCK FOR STEVENSON MINING

4 May 2018

NATURAL RESOURCES LAW LIMITED

Solicitor: M R Christensen
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QUALIFICATIONS AND EXPERIENCE

1 My full name is Tracey Lee Rock.

2 I hold a degree in Mining Engineering and a Graduate diploma in Economics

3 I have held the position of Principal Mine Planning Engineer and Senior Mining Analyst with Palaris Mining since 2011.

4 I have over 24 years' experience in the resource industry in advisory, management, technical and operational roles at coal mines in Australia, New Zealand, Canada, Mozambique, Indonesia, Mongolia and Turkey.

5 I have extensive experience in project management, mine development, mine design, planning and scheduling. I have also undertaken multiple studies on all of the operating mines in the Buller region that are now owned by BT Mining, and have undertaken extensive technical assessment on both mining and rehabilitation and economic evaluations on every opencast mine in New Zealand formerly owned by Solid Energy New Zealand.

6 I contributed to the 2014 concept mine plan prepared for Stevenson Mining by Avery Consulting and the final concept mine plan report, providing technical input into the mine design and scheduling process, including location of pits, sumps and overburden placement areas.

7 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

8 My evidence includes:

(a) proposed mining equipment;

(b) concept mine plan, excavation of overburden and coal;

(c) indicative mine schedule;

(d) use of overburden, soil and rehabilitation materials;

(e) Te Kuha Concept mine plan; and

(f) addressing geotechnical risks.

9 In summary, my evidence recommends a conceptual design of the mine that is based on conventional methods that are commonly employed in the mining industry.

10 The details of the proposed concept mine design were developed, first by establishing the physical and environmental constraints of the site then designing a mine plan that would limit the quantity of disturbed land over the life of mine and enabling ongoing rehabilitation of the overburden emplacement areas. A large quantity of re-handle (3.8 million cubic metres) is planned at the end of the mine life to re-establish the ridgeline and ensure only minor effects to the landscape. These rehabilitation goals are consistent with those set for other open cast coal mine sites that have been permitted within the Buller District.

11 As resource consenting will precede detailed mine design it is important that any consent that may be granted allows sufficient flexibility to allow optimisation and refinement of the mine design during detailed design.

PROPOSED MINING EQUIPMENT

12 **Table 1** sets out the types of equipment planned to be used in the mining process and the hours planned to operate this equipment. This is the number and type of equipment required to mine 1,400,000 bench cubic metres of overburden, 250,000 tonnes of coal and undertake rehabilitation works annually.

Table 1: Proposed mining equipment and work hours.

Type	Model	Model Type	No	Mining Rate	Operating Hours pa
Overburden					
Drill	Sandvik	DX800	1	680 bcm/hr	1,500
Drill	Sandvik	DP1100i	1	400 bcm/hr	1,000
Excavator	Liebherr	R9100	1	300 bcm/hr	2,000
Excavator	Liebherr	R964C	1	210 bcm/hr	1,000
Trucks	Cat	773G	7	125 bcm/hr	2,000
Coal					
Excavator	Liebherr	R944C	1	125 t/hr	2,000
Trucks	Volvo	8X4	4	31 t/hr	2,000
Ancillary Equipment					
Water Truck	Cat	770	1	-	2,000
Wheel Loader	Cat	980M	2	-	1,500
Grader	Cat	14M	1	-	2,000
Track Dozer	Cat	D9T	1	-	2,000
Track Dozer	Cat	D8T	1	-	2,000
Track Dozer	Cat	D5K2	1	-	2,000
Rehabilitation					
Reach Excavator	Cat	385C	1	-	As required
Truck	Cat	740B	2-4	-	As required

13 Stevenson own a selection of mining equipment of the same make or similar to those listed in **Table 1**. They operate them at both contract operations and owner operator quarries in New Zealand and achieve the mining rates shown in this table.

14 The mining rates shown in **Table 1** are less than industry best practice and are achieved at other mine sites in the Buller region. These rates have been estimated based on the mining conditions expected at Te Kuha. The actual mining rates will be dependent on the experience of the operators, the practicality of the short term planning and the operational supervision.

15 Work hours were calculated using an equipment availability of 90% and an average of one hour per day of operational delays. The operation is planned to operate 10 hours per day, five days a week excluding public holidays and wet weather. A maximum work hours of 2,000 hours per annum has been estimated taking these factors into account.

CONCEPT MINE PLAN / EXCAVATION OF OVERBURDEN AND COAL

16 The mine footprint is shown in **Appendix 1**. The mine design has been based on mining the overlapping Brunner and Paparoa pits individually. The mine has been designed to concept level, and will need further design after further geological and geotechnical drilling has been undertaken.

17 The mine design has been based on mining the individual pits from approximately south to north in strips, as shown in **Appendix 2**. The Brunner pit is based on five 140 m wide strips and the Paparoa pit is based on eight 100 m wide strips.

18 Both pits overlap to the north of the mine footprint; this impacts on the design of the Paparoa pit, as it has been designed to advance beneath the Brunner pit when it has been completed.

19 The overall wall slope for the pit was designed to be a maximum of between 45 and 50° for both the Brunner and Paparoa pit walls. This overall angle will be evident on the western wall of the Brunner and Paparoa pits as well as the south-eastern wall of the

Paparoa pit in the 150 m zone that the ridgeline is not mined. The overall pit design wall angles have been based on operational experience from nearby open cast mines.

20 As pre-strip in advance is undertaken before mining coal along dip, the overall angle of the wall in the advancing face is between 25 and 38°. This mine plan is at concept level and the advancing face angle may require to be reduced after further geological and geotechnical testing and assessment has occurred. This future assessment will be incorporated into the detailed mine design that will commence before mining can commence.

21 The mining quantities within the pit design for the overburden and major coal seams are shown in **Table 2**. All tonnages, volumes and qualities are based on air dried moisture content. When further geological testing has been completed, this may result in varying mining quantities or quality of the coal (including moisture content). Taking into the account the moisture content ROM coal tonnes may increase or decrease slightly (<10%).

Table 2: Indicative mining qualities and quantities.

Layer	Prime Volume Kbcm[1]	Total ROM Coal Kt[2]	Strip Ratio bcm/ROM t	CSN [3]	RD[4] t/bcm	Overall Ash %	Product Energy MJ/Kg[5]
Brunner Pit							
BMS	3,814	1,731	2.2	5	1.27	5.2	32
Paparoa Pit							
BMS	177	30	5.9	3	1.30	10.7	29
PMUS	10.750	11	977	3	1.25	20.3	33
PMS	278	1,709	0.2	9	1.25	4.8	35
PMLS	186	73	2.5	9	1.25	7.9	34
Paparoa Total /Average	11,391	1,823	6.3	9	1.25	5.1	35
Total/ Average	**15,206**	**3,554**	**4.3**	**7**	**1.26**	**5.2**	**33**

Notes: 1 Kbcm = 1,000 bank cubic meters, [2]Kt = 1000 tonne, [3]CSN = crucible swelling number, [4]RD = relative density, [5]MJ/Kg = megajoules per kilogram

22 This region has not previously been mined so no allowance is required for previously extracted coal.

23 When required, drilling and blasting will be used to remove overburden and coal, which is considered standard mining practice in certain geology. The blasted rock will be removed by excavator and loaded into haul trucks. All explosives to be used for blasting activity will be stored in a magazine off site.

24 The Brunner seam is planned to be mined as one working section and the Paparoa has been planned as one or two working sections based on interburden thickness.

25 Each of the pits commence mining in strip one and pre-stripping of the next strip is advanced before coal is mined along strike in

each advancing strip. Two cross sections in both the Brunner and Paparoa pits are shown in **Appendix 3 and 4**. The Brunner pit cross sections are shown for Year 4 and 7, with mining completed in this strip by Year 8. The Paparoa pit cross sections are shown in Year 4 and 12, when the mining is below the previous Brunner pits. A geotechnical assessment on the conceptual mine design may result in minor changes to the stages of mine planning.

26 The initial Paparoa boxcut pit will require additional stability measures (i.e. rockbolts or mesh) as designed by a geotechnical engineer prior to mining. This will ensure the stability of the eastern highwall (approximately 300 m in length (150 m of the boxcut and 150 m of the second strip southern wall.

27 At completion of coal mining (Year 16) a final void is evident in the last strips of the Paparoa Pit. This void is planned to be backfilled and was designed with the following criteria:

(a) return as much of the disturbed area to natural topography where possible;

(b) limit final slopes to a maximum slope of not greater than 2:1 (27 degrees);

(c) return the majority of Paparoa pit to original topography (excluding the ridge line which had to be slightly reduced to stay within maximum slope angles of 27 degrees); and

(d) the upper portion of the Brunner pit has been designed to a slightly lower level from the original topography in order to reduce the amount of rehandle required to fill the final void – a reduction of 1.1 million cubic meters has been achieved.

28 The redesigning of final topography landform requires a rehandle volume of 3.8 million cubic metres (loose) to fill the final void. The final void emplacement may take up to ten years to achieve.

INDICATIVE MINE SCHEDULE

29 The concept schedule for mining the Brunner and Paparoa pits consists of mining a portion of both pits every year. Mining in the

first year includes mining overburden for water management and infrastructure construction and mining commences with the Paparoa pit as this overburden will be used on the base of the engineered landform areas.

30 Each strip will be mined, with a portion of the overburden from the next strip pre-stripped for highwall stability. Coal will be mined along strike, mainly at the base of each strip.

31 The mine schedule is shown in **Table 3**. When further geological testing has been completed, the mining quantities and quality of each seam may vary (including moisture content) which may vary the annual prime volume mined per annum and strip ratio.

Table 3: Indicative proposed mine schedule.

Year	1	2	3	4	5	6	7	8
Prime Volume (Kbcm)	1168		1,189	1,192	1,177	1,199	1,195	1,191
ROM Coal (Kt)	-	223	250	250	250	250	250	250
Strip Ratio (bcm/t ROM)	-	5.2	4.7	4.8	4.7	4.8	4.8	4.8

Year	9	10	11	12	13	14	15	16
Prime Volume (Kbcm)	1,196	1,194	874	892	764	792	852	330
ROM Coal (Kt)	250	250	250	250	251	253	250	76
Strip Ratio (bcm/t ROM)	4.8	3.3	3.3	3.3	3.3	3.2	3.3	10.2

USE OF OVERBURDEN, SOIL AND REHABILITATION MATERIALS

32 The mine planning includes the excavation and salvage of soil and vegetation as it is an important part of the operation as these materials will be used in rehabilitation. These materials will either be immediately reused or stockpiled for future use.

33 Any overburden removed during pit development will be placed in ELFs, either as temporary storage (to be re-handled later in mine sequencing) or to form a final ELF.

34 The strategy for the construction of the ELFs considered the following factors:

(a) placement of overburden from the Paparoa pit at the base of all ELFs due to its non-acid forming properties;

(b) use of the original topography as a guide for the final landform, following the ridgeline profile;

(c) placement of overburden back into the Paparoa pit to reinstate the ridgeline as early as possible;

(d) ongoing establishment of final and temporary rehabilitation slopes for visual bunding and reduction in disturbance footprint;

(e) placement of material in order to minimise the impact on high value ecosystems;

(f) minimising the quantity of rehandle;

(g) ongoing rehabilitation to re-establish clean water features; and

(h) bulk factor of 20%.

35 Three ex-pit ELFs are required for the life of mine, including two areas adjacent to the initial mining area in both the Brunner and Paparoa pits (to the east), and one area adjacent to the final area of mining in the Brunner pit (to the north).

36 The progression of the ELF schedule follows the progression of mining in both of the pits. The ELF east and adjacent to the first mining area in the Brunner pit is the main ELF. A portion of this ELF is used as the ROM pad after the first two years of mining. This location was selected because there are minimal flat areas available and this multi-purposes the land for both an ELF and ROM pad.

37 The progression of the ELF schedule during the mining stage is shown in **Appendix 5**. All ELFs are planned to be built from the

bottom up following the development of the Brunner and Paparoa pits. The ELFs will start as ex-pit ELFs but will progress to in-pit ELFs when the elevation is the same as the base elevation of the pit floor.

38 Soil will be stockpiled in up to three different areas within the mine footprint, which will be used in final rehabilitation. Rehabilitation is designed to progressively occur each year and follow the progression of the mining. At the completion of coal extraction (Year 16) a final void will be present in the last strips of the Paparoa pit.

39 The recreating of final landform topography requires a re-handle volume of 3.8 million cubic metres (loose) to fill the final void. It is planned to take four years to reinstate the ridgeline but may take up to ten years to achieve fully rehabilitated surfaces. **Appendix 6** shows the development of the final ELF which includes reinstatement of the ridgeline.

ADDRESSING GEOTECHNICAL RISKS

40 Every mine site must manage geotechnical risk on an ongoing basis. Standard management tools used in the mining industry include the following:

(a) a geotechnical isolation/pit slope stability trigger action response plan (TARP) which defines the geotechnical triggers, actions to be taken and the persons responsible when triggers are identified.

(b) a principal hazard management plan (including a ground control management plan) and standard operating procedures that would encompass both long term planning, short term planning and implementation

41 Additional drilling is proposed at Te Kuha in order to gather more geotechnical data. This data will be used for more geotechnical analysis that can then be used for more detailed long and medium term planning. In order to manage the risk of geotechnical hazards at Te Kuha the following process outlined in **Table 4** should be followed.

Table 4: Design and implementation process.

Process Area	Process Step	Comment
Risk	Additional Drilling and geotechnical information	Understand risks and failure modes
	Geotechnical analysis	Use additional geotechnical data sourced from additional drilling
	Broadbrush risk register	Includes operations personnel as well as experienced operations management and technical personnel
System	Principal Hazard management plan	Legislation and risk management standards Develop Safe Operating Procedures
	Risk Assessment	
	Ground Control Management Plan	
Geotechnical Study	Geotechnical Design and operation manual	
	Geotechnical water drawdown and monitoring guidelines	
	Geotechnical truck dump design and operating guidelines	
Medium term plans	Medium term design checklist	
	Engineer Designs	Need to make sure design complies to geotechnical recommendations, taking into account the model, structures, pit condition, mining method, water, previous strip performance, possible failure mechanisms, monitoring, instrumentation, validation
Short term plans	Design checklist	Ensure design checklist is in place and that design is within geotechnical design and operation manual. A key trigger is if high or extreme risks are triggered or design is outside geotechnical recommendations
	Design	
	Design Review and Approval	Competent and trained engineer should sign off on designs and designs checked and approved
Communication of plans	Machine guidance plans	
	Survey layout	
Operations	Weekly Interaction plans	Weekly plan for supervisors should have hazards and required controls and carried in pit to check
	Prestarts with operators	

Process Area	Process Step	Comment
	Crest and low wall standoffs	Including primary and specified standoffs. Controls could be increased by risk assessment, supervisor, TARP or geotechnical advice. Use of signage or hard barriers (or both)
	Safe operating procedures	
	Supervisor/statutory inspections	
	Geotechnical inspections	
Trigger Response Action	Ground Control TARP	
	Basic Monitoring	Extensiometers
	Advance Monitoring	Real time slope stability radar with alarm system
Incident Management	Incident investigation	Remediation management
	Inspector notifications	
Emergency Management	Removal of personnel and equipment	
Audit and Review	Update primary management plan	

42 It is standard procedure to develop a geologic hazard inventory that describes all of the geologic hazards at a given mine site. These hazards are typically communicated to mine personnel using hazard identification plans, which illustrates areas of instability, rock fall hazards and other hazards. An inventory and hazard identification plans will be utilised at Te Kuha.

CONCLUSION

43 In summary, my evidence recommends a conceptual design of the mine that is based on conventional mining methods that are commonly employed in the mining industry.

44 The details of the proposed concept design were developed through accounting for physical site constraints and geology and then establishing a mine design and schedule that would achieve the required mining quantities per annum. The planned mining

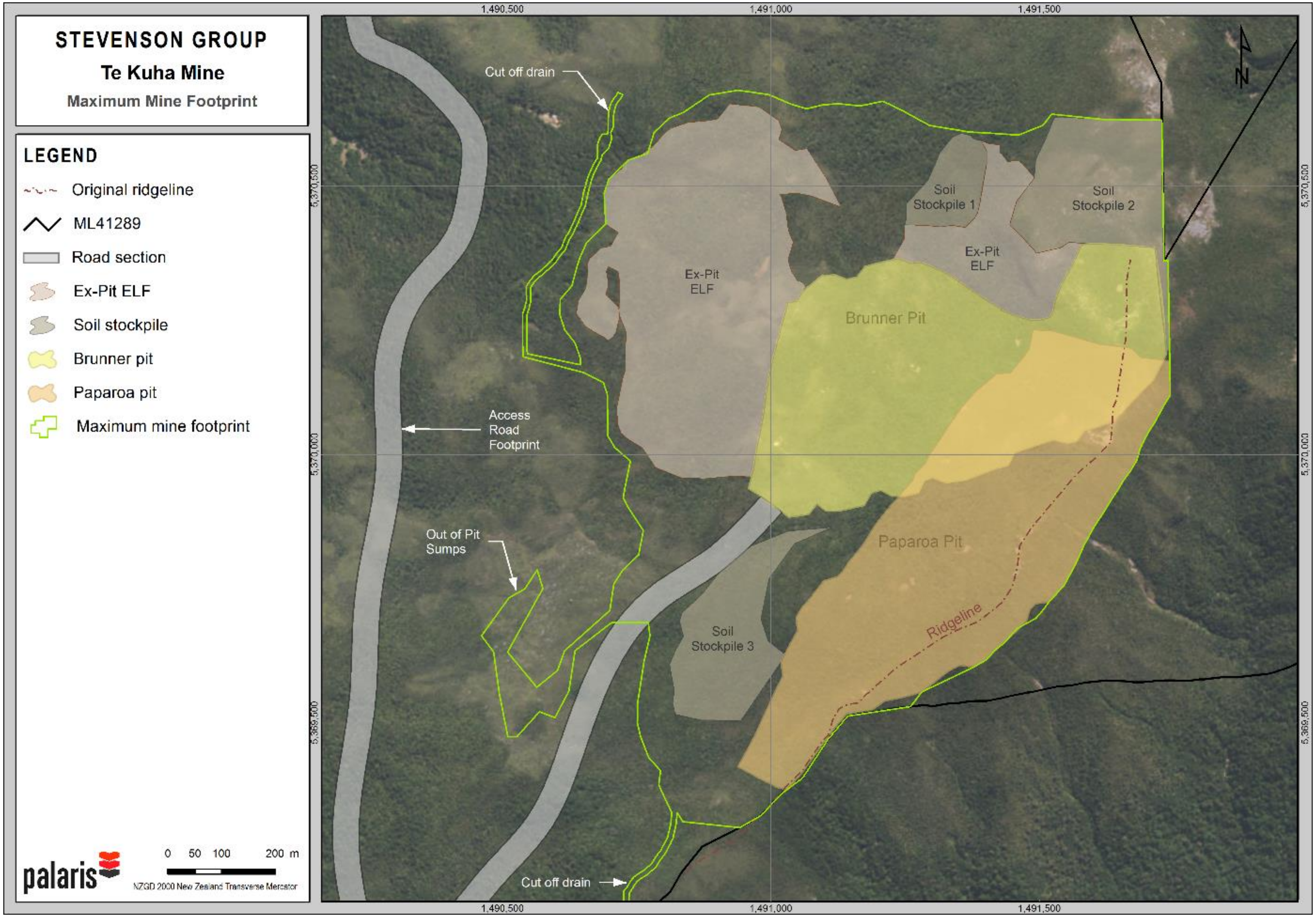
quantities are lower than other open cast coal mine sites that have been permitted within the same region of the Buller District.

45 As resource consenting will precede detailed design it is important that any consent that may be granted allows sufficient flexibility to allow optimisation and refinement of the ELFs and rehabilitation targets during detailed design.

Tracey Rock

4 May 2018

Appendix 1: Proposed Te Kuha Mine footprint area



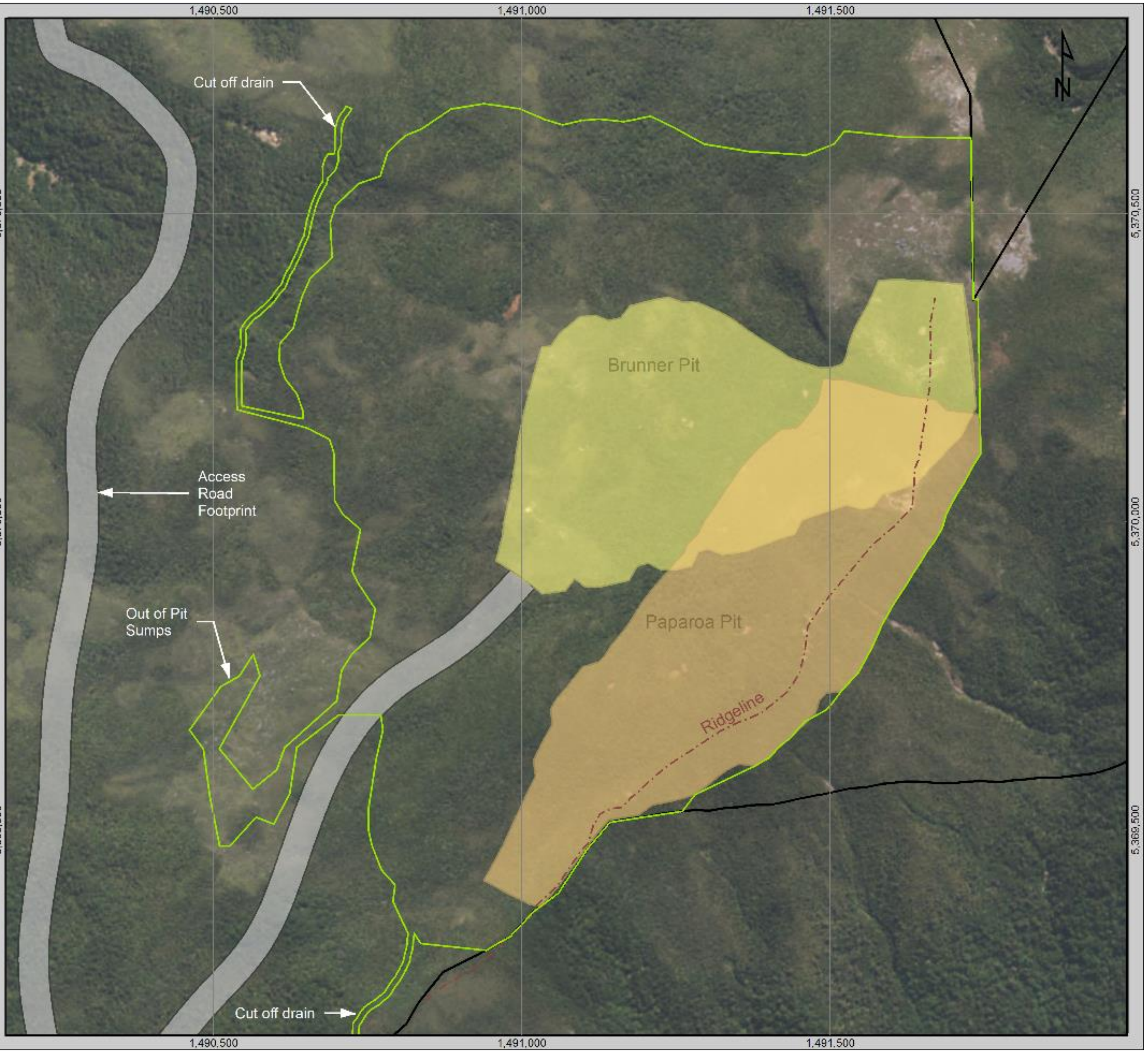
STEVENSON GROUP

Te Kuha Mine

Maximum Mine Footprint

LEGEND

- Original ridgeline
- ML41289
- Road section
- Brunner pit
- Paparoa pit
- Maximum mine footprint

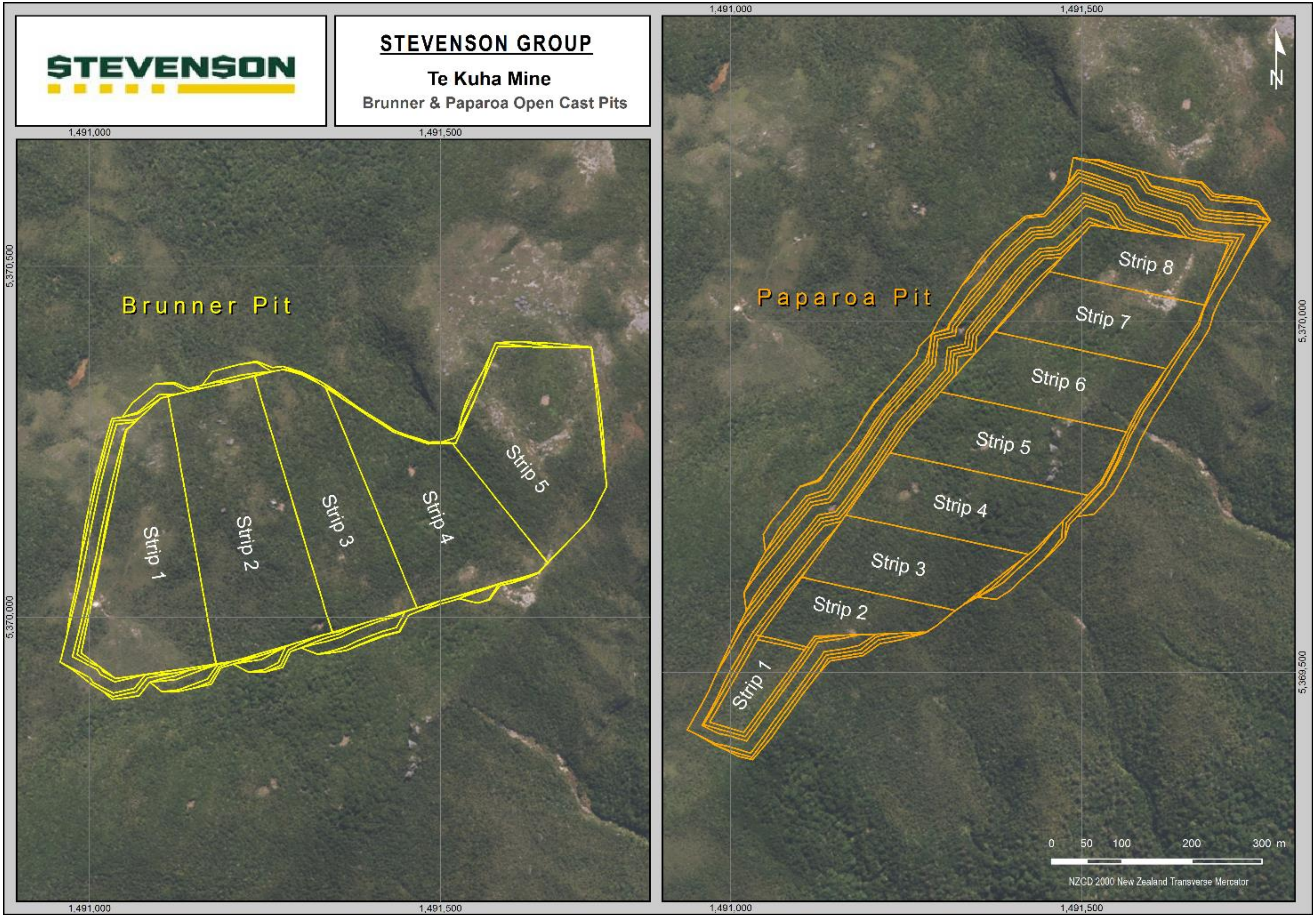


0 50 100 200 m

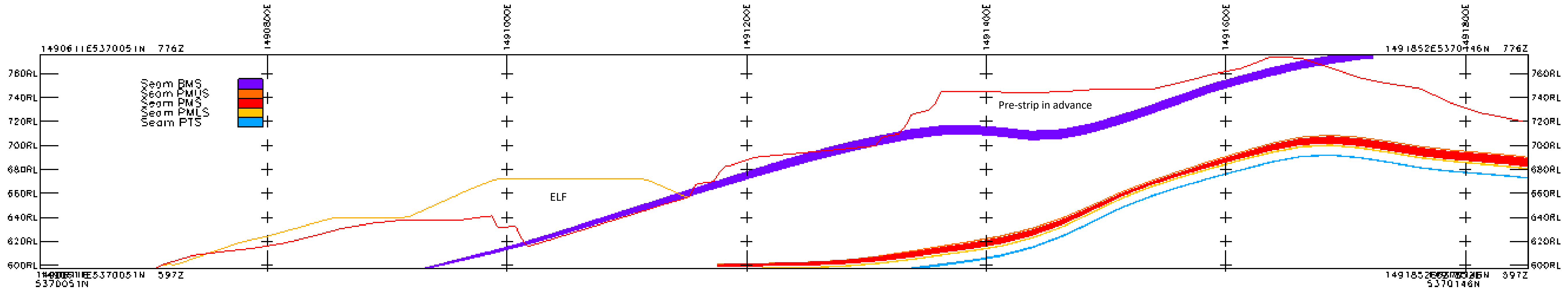
NZGD 2000 New Zealand Transverse Mercator

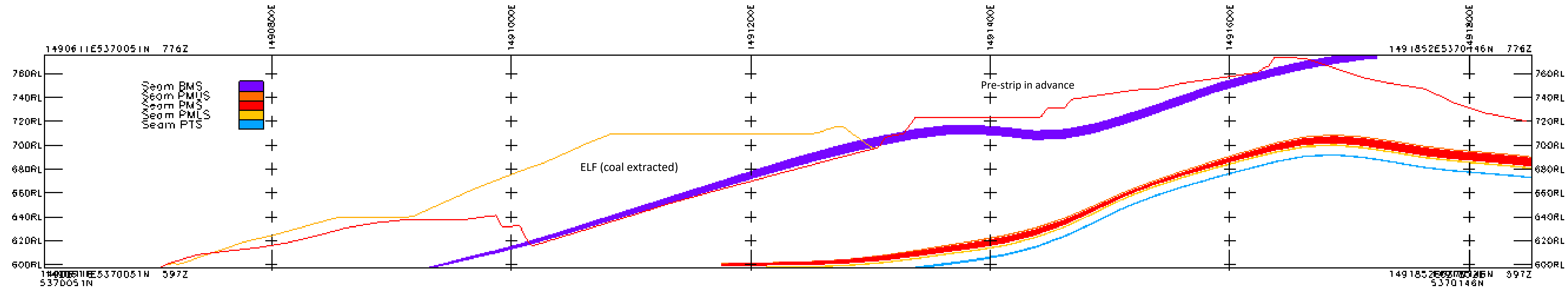
palaris

Appendix 1: Brunner and Paparoa open cast pits at the proposed Te Kuha Mine



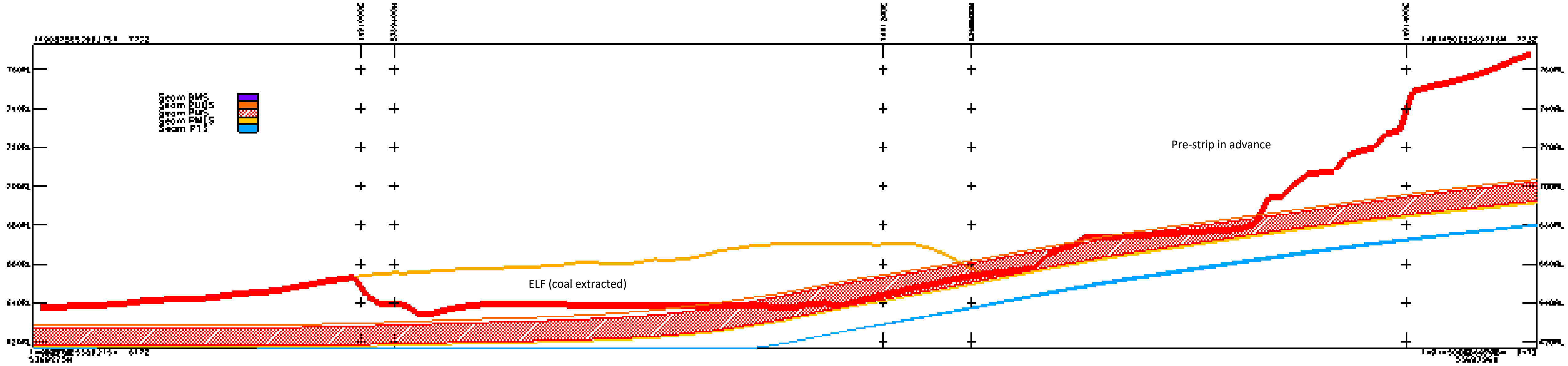
Appendix 2: Brunner Cross Sections Year 4 and 7

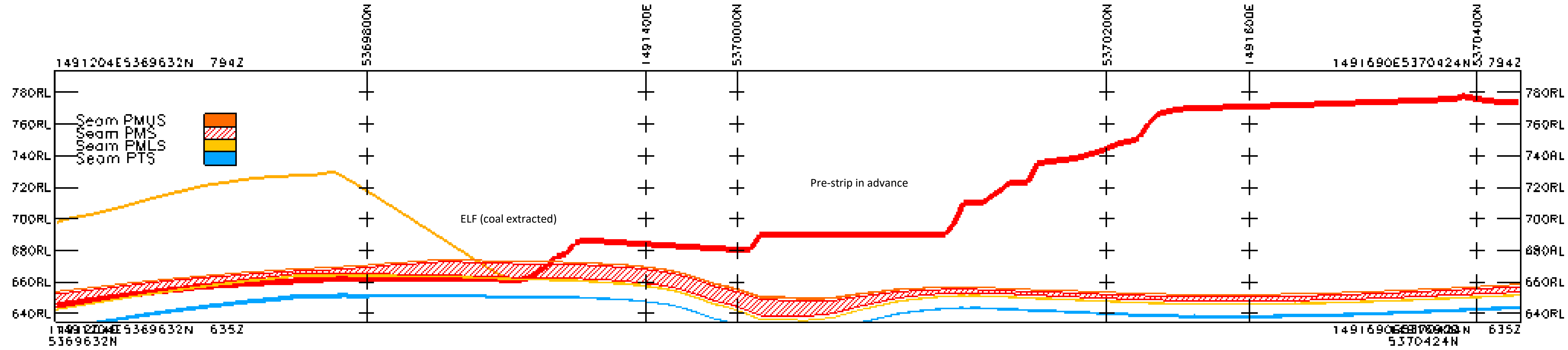




Where Purple is the Brunner seam and red/yellow and blue are the Paparoa seams

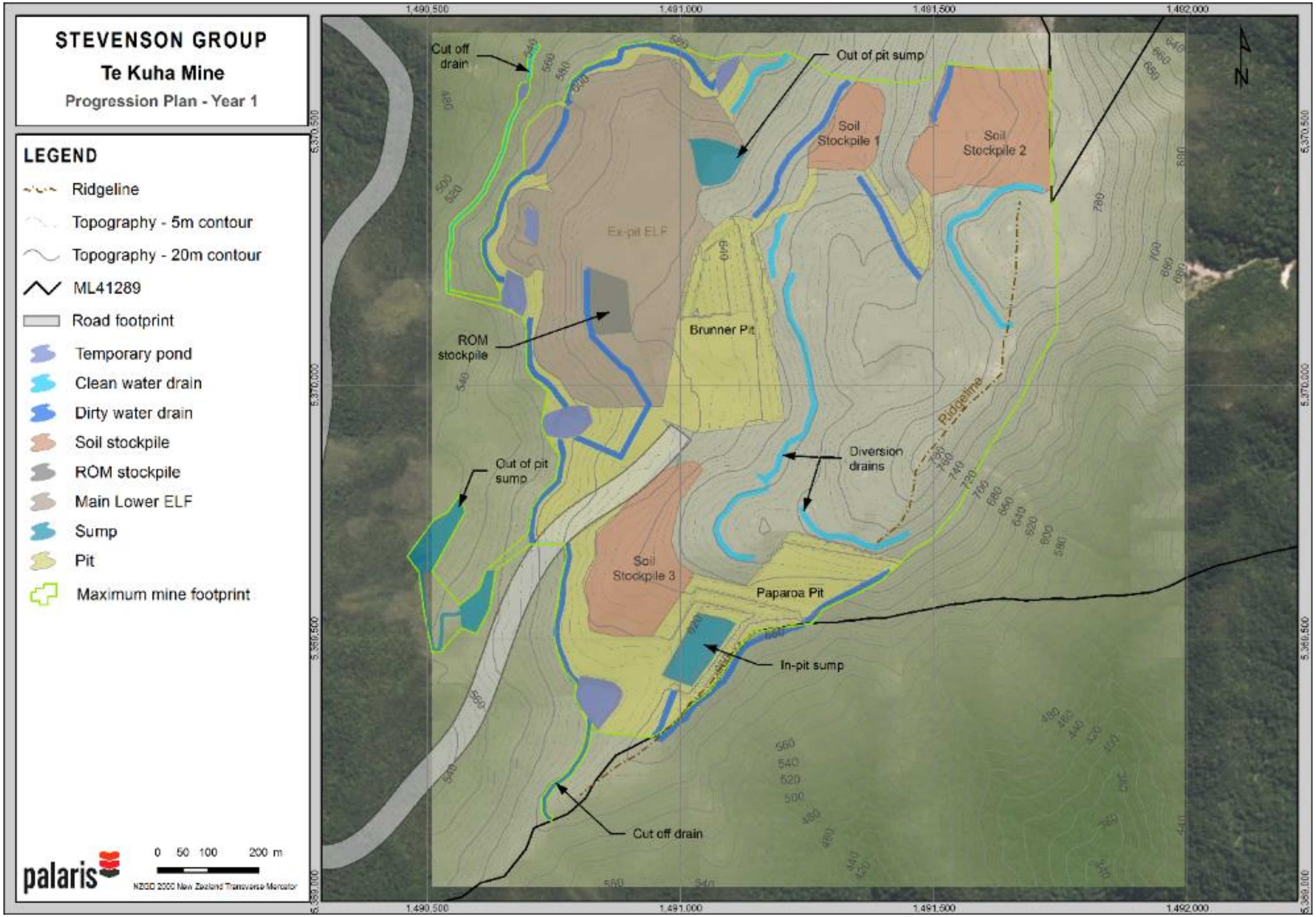
Appendix 4: Paparoa Cross Sections Year 4 and 7

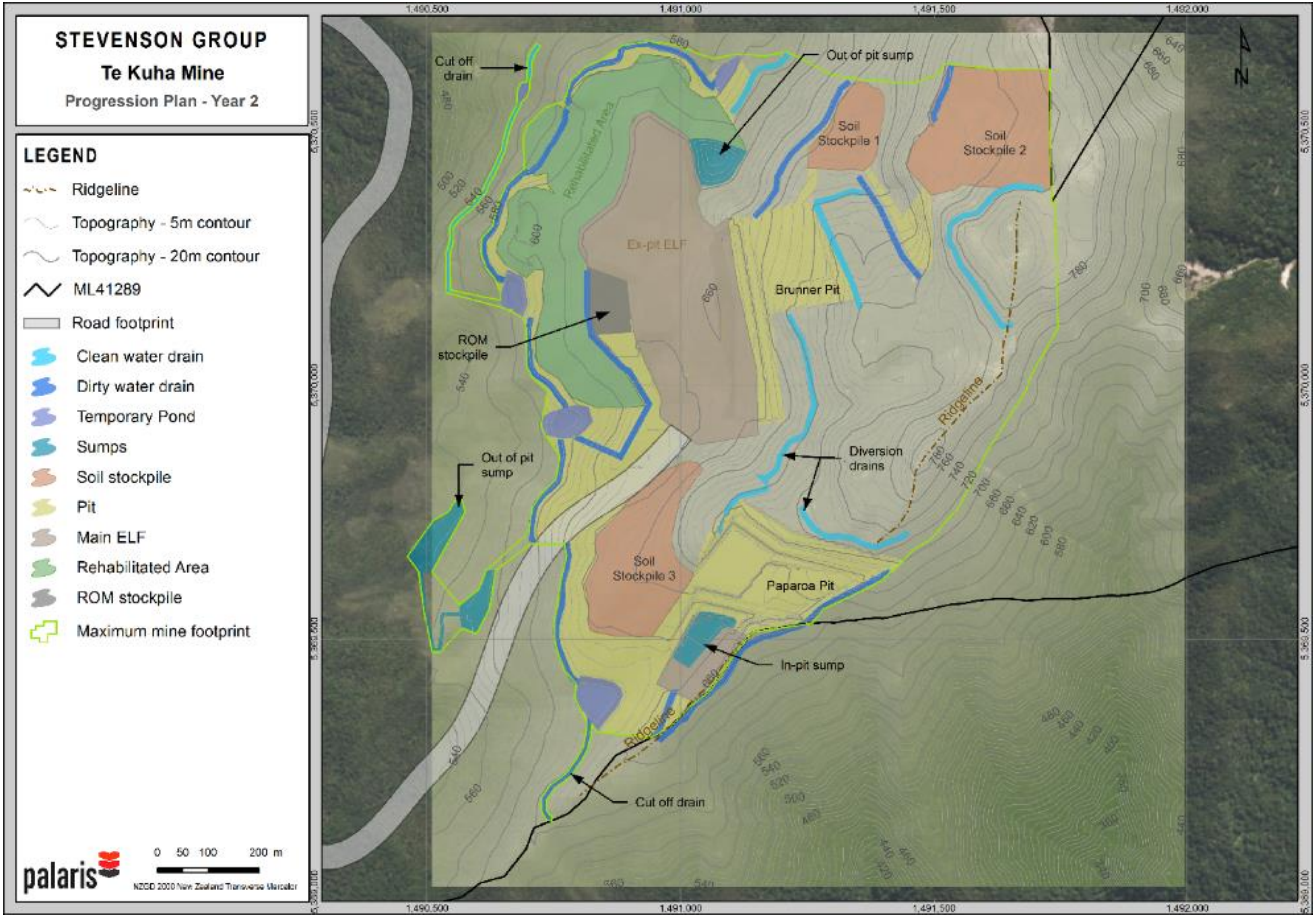


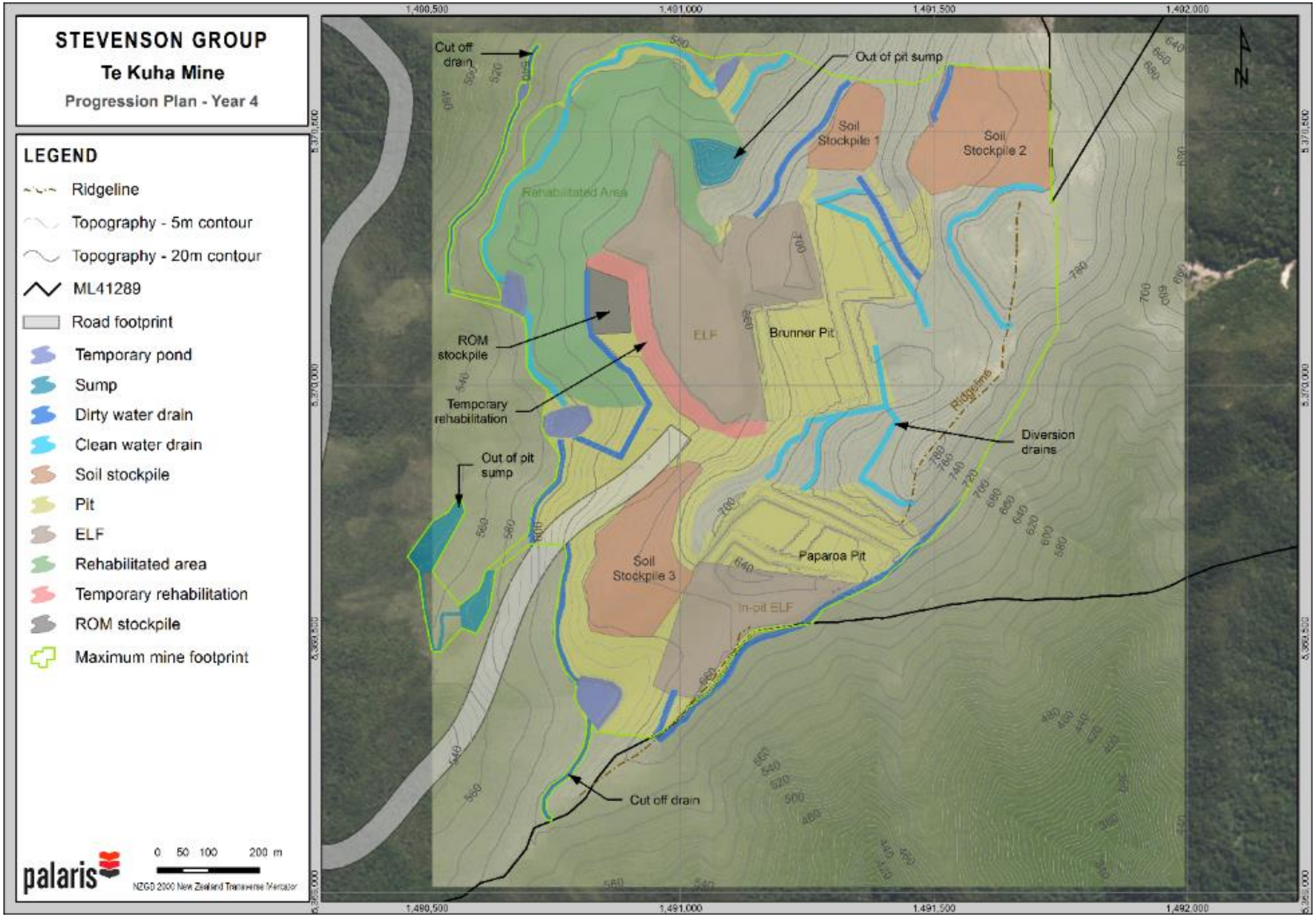


Where red/yellow and blue are the Paparoa seams

Appendix 5: Stage Plans




STEVENSON GROUP
Te Kuha Mine
Progression Plan - Year 2
LEGEND
Ridgeline
Topography - 5m contour
Topography - 20m contour
ML41289
Road footprint
Clean water drain
Dirty water drain
Temporary Pond
Sumps
Soil stockpile
Pit
Main ELF
Rehabilitated Area
ROM stockpile
Maximum mine footprint
palaris
0 50 100 200 m
NZGD 2000 New Zealand Transverse Mercator
1,490,500
1,491,000
1,491,500
1,492,000
5,370,500
5,370,000
5,369,500
5,369,000
N
Cut off drain
Out of pit sump
Soil Stockpile 1
Soil Stockpile 2
Rehabilitated Area
Ex-pit ELF
Brunner Pit
ROM stockpile
Ridgeline
Diversion drains
Out of pit sump
Soil Stockpile 3
Paparoa Pit
In-pit sump
Ridgeline
Cut off drain


STEVENSON GROUP
Te Kuha Mine
Progression Plan - Year 4
LEGEND
Ridgeline
Topography - 5m contour
Topography - 20m contour
ML41289
Road footprint
Temporary pond
Sump
Dirty water drain
Clean water drain
Soil stockpile
Pit
ELF
Rehabilitated area
Temporary rehabilitation
ROM stockpile
Maximum mine footprint
palaris
0 50 100 200 m
NZGD 2000 New Zealand Transverse Mercator
1,490,500
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5,369,500
5,369,000
Cut off drain
Out of pit sump
Soil Stockpile 1
Soil Stockpile 2
Rehabilitated Area
ROM stockpile
Temporary rehabilitation
ELF
Brunner Pit
Ridgeline
Diversion drains
Out of pit sump
Soil Stockpile 3
Paparoa Pit
In-pit ELF
Cut off drain

STEVENSON GROUP

Te Kuha Mine

Progression Plan - Year 5

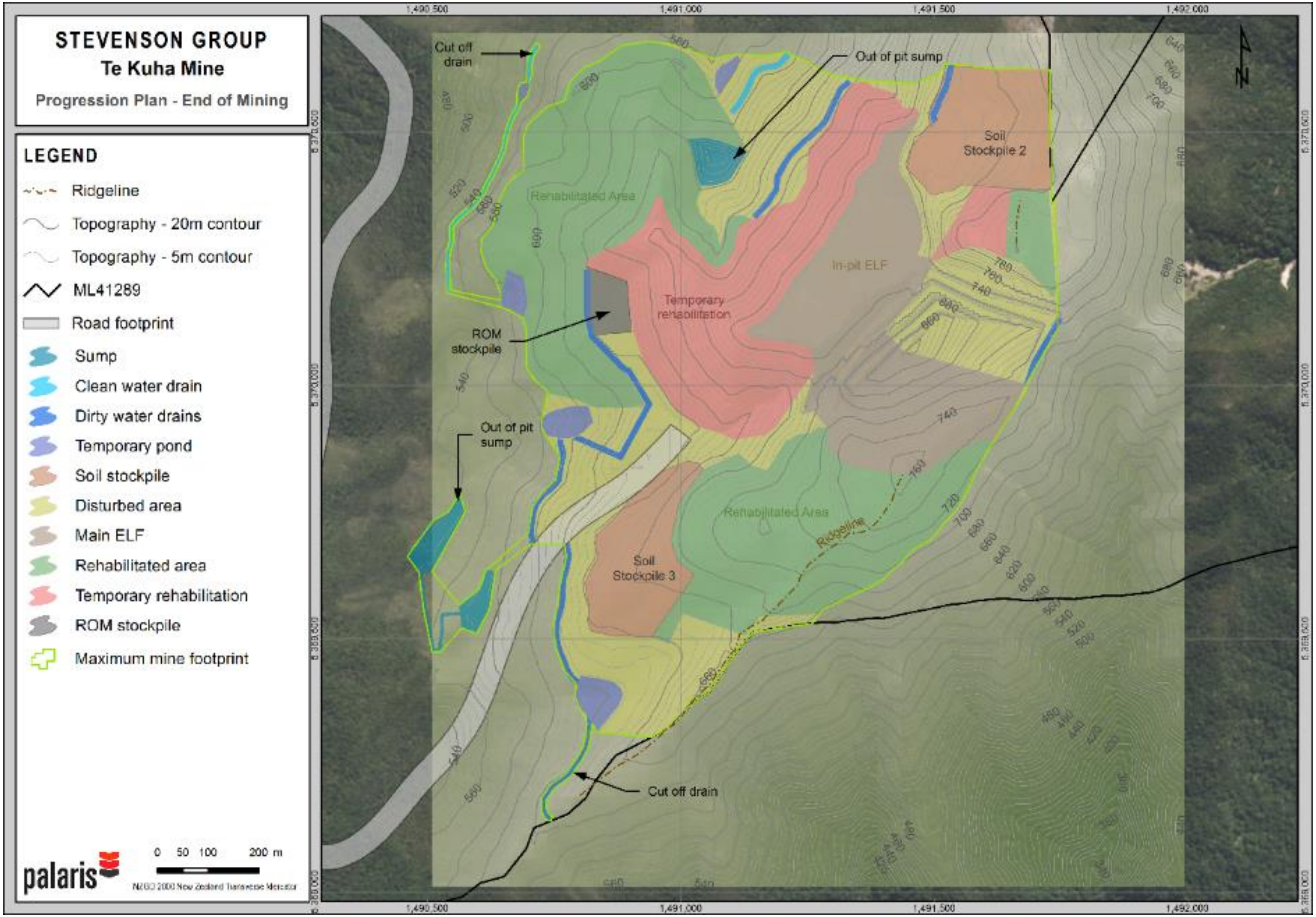
LEGEND

- Ridgeline
- Topography - 20m contour
- Topography - 5m contour
- ML41289
- Road footprint
- Clean water drain
- Dirty water drain
- Temporary pond
- Sump
- Soil stockpile
- Pit
- ELF
- Rehabilitated area
- Temporary rehabilitation
- ROM stockpile
- Maximum mine footprint

palaris

0 50 100 200 m

NZGD 2000 New Zealand Transverse Mercator



STEVENSON GROUP
Te Kuha Mine
Progression Plan - End of Mining
LEGEND
Ridgeline
Topography - 20m contour
Topography - 5m contour
ML41289
Road footprint
Sump
Clean water drain
Dirty water drains
Temporary pond
Soil stockpile
Disturbed area
Main ELF
Rehabilitated area
Temporary rehabilitation
ROM stockpile
Maximum mine footprint
palaris
0 50 100 200 m
NZGD 2000 New Zealand Transverse Mercator
Cut off drain
Out of pit sump
Soil Stockpile 2
Rehabilitated Area
In-pit ELF
Temporary rehabilitation
ROM stockpile
Out of pit sump
Rehabilitated Area
Ridgeline
Soil Stockpile 3
Cut off drain
1,490,500
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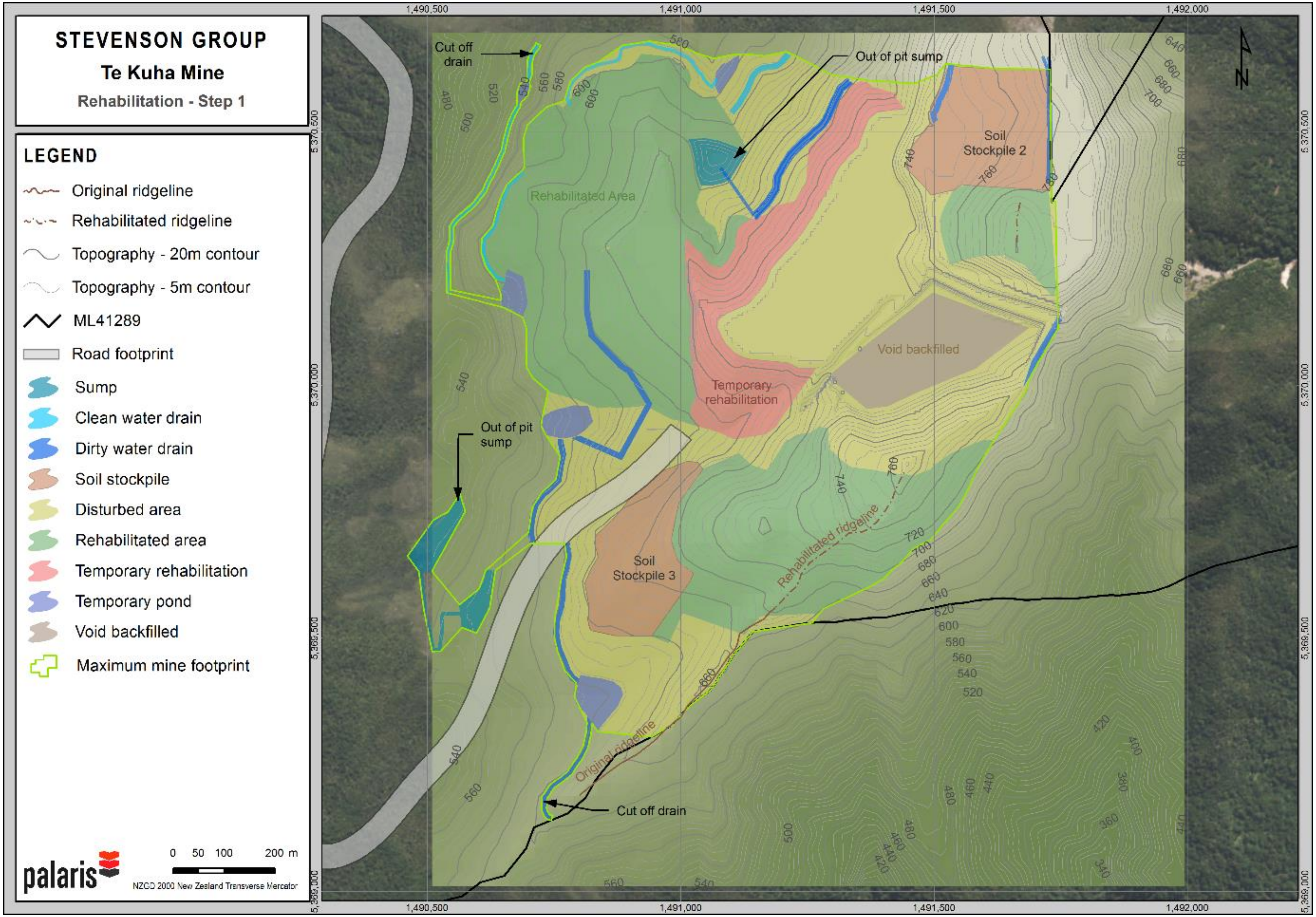
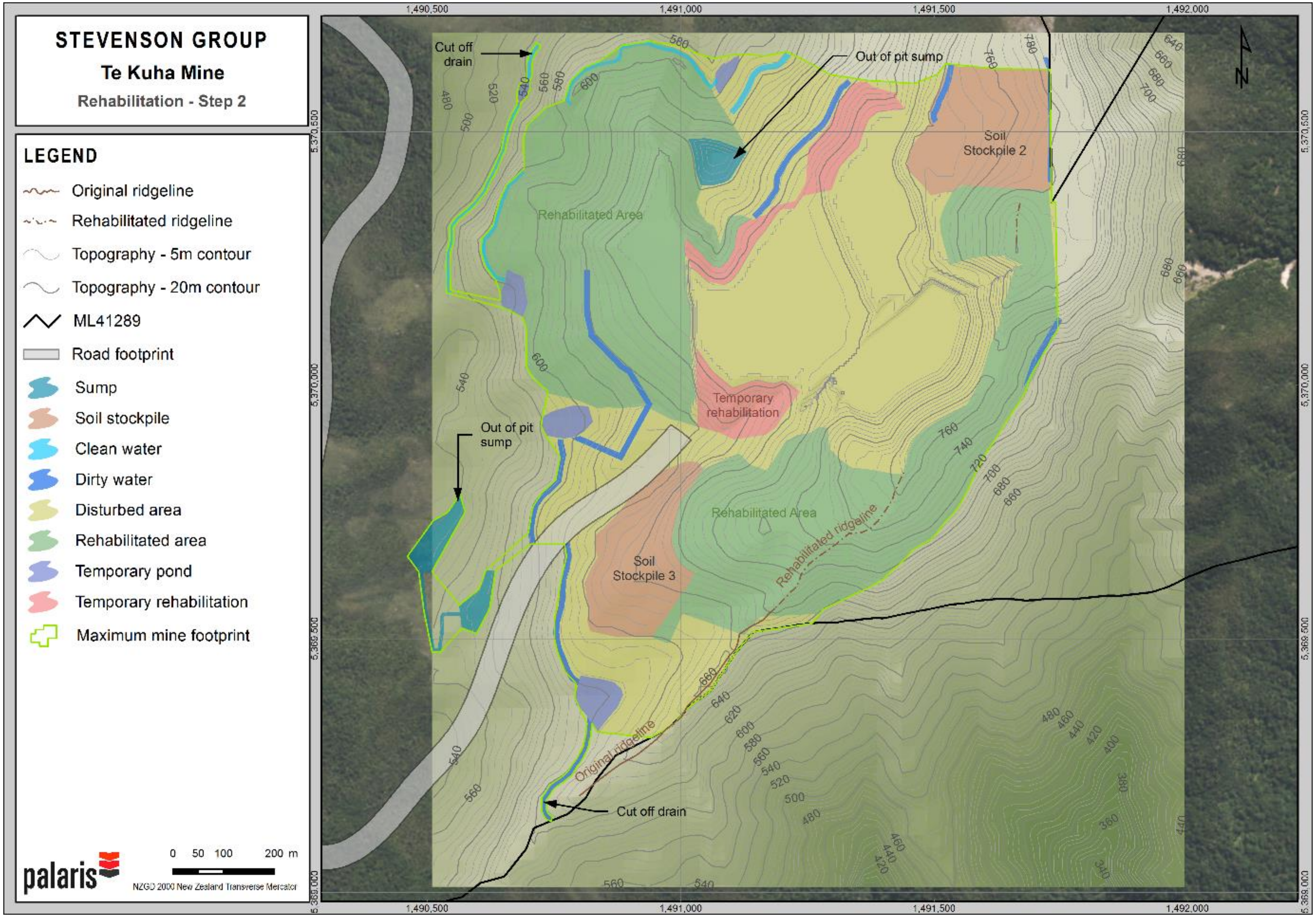
1,491,500
1,492,000

Appendix 6: Rehabilitation process




STEVENSON GROUP
Te Kuha Mine
Rehabilitation - Step 2
LEGEND
Original ridgeline
Rehabilitated ridgeline
Topography - 5m contour
Topography - 20m contour
ML41289
Road footprint
Sump
Soil stockpile
Clean water
Dirty water
Disturbed area
Rehabilitated area
Temporary pond
Temporary rehabilitation
Maximum mine footprint
palaris
0 50 100 200 m
NZGD 2000 New Zealand Transverse Mercator
1,490,500
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1,492,000
5,370,500
5,370,000
5,369,500
5,369,000
Cut off drain
Out of pit sump
Soil Stockpile 2
Rehabilitated Area
Temporary rehabilitation
Out of pit sump
Soil Stockpile 3
Rehabilitated ridgeline
Original ridgeline
Cut off drain

STEVENSON GROUP

Te Kuha Mine

Rehabilitation - Step 3

LEGEND

- Ridgeline
- Topography - 5m contour
- Topography - 20m contour
- ML41289
- Road footprint
- Sump
- Dirty water
- Clean water
- Soil stockpile
- Disturbed area
- Rehabilitated area
- Temporary pond
- Maximum mine footprint

0 50 100 200 m

NZGD 2000 New Zealand Transverse Mercator

STEVENSON GROUP

Te Kuha Mine

Final Rehabilitation

LEGEND

- Ridgeline
- Topography - 5m contour
- Topography - 20m contour
- Rehabilitated area
- Maximum mine footprint

palaris

0 50 100 200 m

NZGD 2000 New Zealand Transverse Mercator