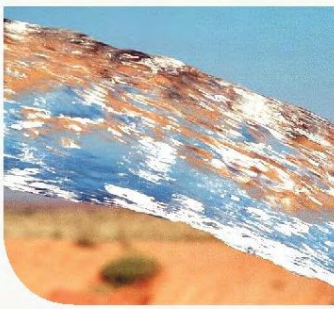
APPENDIX 8: WETLAND VEGETATION MONITORING PROGRAM



KEYSBROOK PROJECT

WETLAND VEGETATION MONITORING

(SPRING 2021)

REPORT FOR
DORAL PTY LTD

MARCH 2022

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Rockwater
HYDROGEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

76 Jersey Street Jolimont 6014 Western Australia Postal: PO Box 201 Wembley 6913 Western Australia
Ph: 61 8 9284 0222 Fax: 61 8 9284 1785 Email: consult@rockwater.com.au www.rockwater.com.au ABN: 43 008 804 653

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REVISION	AUTHOR	REVIEW	AUTHORISED	ISSUED
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1 INTRODUCTION

The Keysbrook Leucoxene Project (the Project) was acquired by Doral Mineral Sands Pty Ltd (Doral) from MZI Resources (MZI) in July 2019. The Project is located approximately 55 km south of Perth near the small townships of Keysbrook and North Dandalup (Figure 1). A condition of the mining development is to monitor the effects of mining (e.g. groundwater extraction) on the environment, including potentially groundwater dependent ecosystems (GDEs) in nearby Conservation Category wetlands. Following an initial survey of wetland vegetation in autumn 2015 (Rockwater 2015), Rockwater has been commissioned to undertake annual vegetation condition surveys of certain wetlands of the project area, in accordance with Doral's environmental commitments.

This report presents the results of the spring 2021 monitoring at three Conservation Category wetland sites and data from photographic monitoring points (PMPs) established to monitor vegetation condition around the Project. Following four years of baseline data collection, the scope of the monitoring was amended in 2018 to annual monitoring for the assessment of changes to the health and condition of GDEs. The work is undertaken as part of Doral's monitoring obligations and commitments to maintain compliance with legislative requirements for the Project. Doral's community monitoring programme has also continued in spring 2021 with two regional wetlands sites surveyed.

2 PROJECT MONITORING COMMITMENTS AND OBJECTIVES

Groundwater and vegetation monitoring commitments for the Keysbrook Mineral Sands Project (the Project) are outlined in a Water Management Plan (WMP) (MBS 2013) and Groundwater Licence Operating Strategy (GLOS) (Rockwater 2013). Additional groundwater monitoring conditions are contained in the Works Approval (L8918/2015/1) for the Project.

The focus of the wetland vegetation health monitoring programme is on Conservation Category wetlands in the vicinity of the project area. The locations of Conservation Category wetlands are shown in Figure 2.

Two water management objectives in the WMP are directly relevant to Conservation Category wetlands in the area. Those objectives and the respective monitoring targets are outlined in Table 1.

Table 1: Water Management Objectives and Targets

Objective	Target
Abstraction of water does not cause adverse, long-term impacts to the water quality or levels of Conservation Category wetlands	Monitoring indicates water quality and levels are within trigger levels
Abstraction of groundwater does not adversely impact on the health and condition of native vegetation associated with Conservation Category wetlands	Monitoring indicates no adverse, long-term impact on native vegetation or groundwater dependant ecosystems

Vegetation health assessments in spring 2021 are required for three of the vegetation monitoring quadrat sites at Keysbrook. The remaining sites only require re-assessment by trigger of either a decline in water level beyond an acceptable value at adjacent groundwater monitoring bores, or a decline in the health (vigour) of remnant vegetation at wetlands immediately to the north.

Specific commitments within the WMP and GLOS relevant to the 2021 spring survey are detailed below and relate to wetland locations shown in Figure 2.

- Pre-operational baseline survey and six-monthly (spring and autumn) vegetation health assessments in Conservation Category Wetlands (UFI nos.) 14472, 14473 and 14465.
- Annual photographic monitoring in spring (previously spring and autumn) for (5 of 12) sites listed in the WMP.
- Vegetation health assessments are to be conducted in spring (previously spring and autumn).

This report presents Doral's wetland vegetation monitoring activities for spring 2021.

3 REGIONAL CONTEXT OF THE STUDY AREA

A baseline survey report by Rockwater (2015) outlined aspects of the Keysbrook Project setting, including climate, geology, hydrogeology, geomorphology and soils, vegetation and conservation-significant wetlands. Background information from that report is provided in the following section for context.

3.1 CLIMATE

Keysbrook has a Mediterranean-type climate with hot dry summers and mild, moderately wet winters. Monthly rainfall observations for the November 2020 to October 2021 period and long-term average climate data for nearby BoM stations are presented in Table 2. The long-term rainfall averages for nearby BoM stations at Hopelands and Medina (both now closed) are 604.5 mm and 746.0 mm respectively. Rainfall averages for BOM stations further afield at Cloon and Karnet are 853.1 and 1157.3 mm respectively. Roughly three quarters of annual rainfall within the area falls in the winter-spring period (Table 2).

Table 2: Average Monthly Rainfall and Dam Evaporation for Jandakot Airport, Karnet Compared with Rainfall Data from Hopelands and Pinjarra, November 2020 – October 2021

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Total[1]
	2020		2021											
Annual Rainfall (mm)														
Keysbrook[2]	70	0.2	0	39	40	-	90.4[2]	78.2	241.8	76.4	79.6	115	3.2	-
Cloon[3]	97.4	2.2	3.2	43.8	36.0	55.4	*131*	*102.6*	*333*	*122*	*90.8*	*117*	*4.6*	1,134
Karnet[4]	121	4.8	2.0	64.6	*71.5*	*71.8*	*147*	*118*	*410*	*160*	*120*	*129*	*3.8*	*1,420*
Average Rainfall (mm)														
Cloon[2]	30.1	13.4	18.6	12.0	21.3	41.0	106.1	145.0	177.7	141.7	98.4	47.8	30.1	853.1
Karnet[4]	45.2	18.4	18.7	21.9	25.4	64.7	140.5	208	220.4	183.7	132	75.7	45.2	1157.3
Evaporation (mm)														
Karnet (1973-2016)	159	207.7	232.5	193.9	158.1	90	65.1	51	55.8	65.1	78	114.7	159	1,460
Medina[5]	195	244.9	260.4	224.8	195.3	114	71.3	54	52.7	71.3	96	145.7	195	1,715

[1]Total for Nov 2020 – Oct 2021; [2]Doral Keysbrook Minesite Weather station. Data incomplete for April and May 2021;
[3]Cloon (Station 9242, 1994 to 2021); [4]Karnet (Station 9111, 1963 to 2021); [5]Medina (Station 9194, 1983 to 2018);
N.B. Data shaded are above average values (Keysbrook site data for the review period is compared with Cloon averages); Data in italics represent observations which have not been fully quality controlled by Bureau of Meteorology.

Averages for nearby stations presented in Table 2 are higher than average. The weather station at the Keysbrook mine was replaced in May 2021 and there was a brief period (14 April-3 May 2021) when no observations were made. As a result, site rainfall data for 2021 is incomplete. Available data suggests that at least 834 mm rainfall was recorded at Keysbrook between November 2020 and October 2021. This is about 25% higher than the rainfall recorded for the previous period (2019/2020) period.

The nearest BoM station to record evaporation is Medina Research Centre (station 009194, now closed). Average monthly evaporation data are presented for comparative purposes. The average monthly evaporation at Medina exceeds average rainfall rates from spring (September) to mid-autumn (April), with an average annual total evaporation of about 1,715 mm. Evaporation at Karnet, in the hills about 9 km to the east of Keysbrook is about 15% lower (Table 2).

3.2 GEOLOGY

The Project is located in the Perth (sedimentary) Basin and is underlain by about 10 to 15 m of superficial formations (Quaternary age), comprising the Bassendean Sand and the underlying Guildford Formation. These formations unconformably overlie about 50 to 130 m of the Leederville Formation – Wanneroo and Mariginiup Members – of Cretaceous age. The Mariginiup Member underlies most of the project area whereas the Wanneroo Member, up to 25 m in thickness, is present only in the very western part. The Leederville Formation unconformably overlies the Cattamarra Coal Measures in the east and conformably overlies the South Perth Shale in the west.

3.3 HYDROGEOLOGICAL SETTING

A description of the aquifers of the project area is given by Rockwater (2006, 2007). Two aquifers of the Perth Basin are relevant to the project. The first is the shallow Superficial aquifer, comprising the Bassendean Sand and Guildford Formation. The upper four to eight metres of Bassendean Sand are moderately permeable and contain the water table at depths that range from zero to 10 m below ground surface. The underlying Guildford Formation generally has low permeability. The saturated thickness above the base of the Bassendean Sand ranges from zero to about two metres depending on the season and the local aquifer geometry. This Bassendean Sand section of the Superficial aquifer contains the mineral sand deposit and is influenced by mining operations at Keysbrook.

The second relevant aquifer is the Leederville aquifer, which extends to at least 130 m below ground surface. The Leederville aquifer is utilised as a water source for the mining operation.

Water salinities in the Superficial aquifer range from 200 to 1,000 milligrams per litre total dissolved solids (mg/L TDS), while in the Leederville aquifer they are generally less than 1,000 mg/L TDS.

Mining operations during the winter will result in the groundwater levels in the Bassendean Sand being temporarily lowered to the base of the unit, in and around individual mining cells. Water levels will start recovering as mining moves to new cells, excavated cells are backfilled, and rainfall recharges the reconstituted aquifer.

It is noteworthy that Superficial aquifer water levels in the vicinity of wetland UF 14472 in the southern mining block are below the base of the ore (as indicated by nearby monitoring bores KWT1A to KWT1E). Consequently, several Conservation Category wetlands in this vicinity (Fig. 2) are unlikely to be subjected to dewatering effects.

3.4 GEOMORPHOLOGY AND SOILS

The Project is situated on the Swan Coastal Plain, about three kilometres west of the Darling Scarp. The mineral sands deposit occurs in Superficial deposits (Bassendean Sand) of the Bassendean Dune System, which is the oldest of three generations of dunes on the Swan Coastal Plain. Sands from recent dune and shoreline deposits form a gently undulating aeolian sand plain that has been leached of carbonate leaving mostly quartz sand.

The Bassendean Sand overlies the finer-textured soils of the Guildford Formation (Pinjarra Plain), which typically consist of clayey sand or sandy clay in the Keysbrook area. The upper surface of the Guildford Formation is partially ferruginised at some locations (Rockwater 2006).

Several wetlands occur in the low undulating topography of the Bassendean Dune System and in poorly defined drainages of the coastal plain in the vicinity of the Project.

Soil mapping of the Bassendean Dune System indicates that the project area corresponds to an area of Bassendean Dune Phase soils (B1, 1a, 2 and 5) and minor Pinjarra Phase soils (P1b, 2 and 7) (MBS 2011). The area is characterised by well- to moderately-bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan.

3.5 VEGETATION

The Project area is located within the SWA02 sub-region of the Swan Coastal Plain IBRA (Interim Bioregionalisation of Australia region). The IBRA recognises 89 large geographically distinct bioregions within Australia, based on climate, geology, landform, native vegetation and species information (DoE 2014). These bioregions are further divided into 419 geomorphological units as sub-regions.

The Swan Coastal Plain is situated in the South West Botanical Province of Western Australia which is recognised as one of the world's biodiversity hotspots (DPaW 2014). The South West Botanical Province supports forests, woodlands, shrublands and heath which are characterised by high species endemism.

Vegetation associated with the project area was mapped by Bennett Environmental Consulting (2004), although access to all listed wetlands on some areas of private land was not possible at the time. In the vicinity of the wetlands, vegetation was primarily described as Tall Open Scrub dominated by *Kunzea glabrescens* with scattered trees of *Banksia ilicifolia* over scattered low shrubs and sedges. This description relates to vegetation in parts of dampland 7604 (Fig. 2). No declared rare flora (DRF) or Priority-listed flora were recorded in vegetation of the Project area by the 2005 survey.

The vegetation of Bushland Forever Site No. 77 within the West Kingia property was surveyed by Trudgen and Archer (2001). Twenty-two vegetation units were described during the survey and these were grouped on the basis of the dominant upper stratum species, which included *Eucalyptus marginata* (Jarrah), *Allocasuarina fraseriana* (Sheoak) and Banksia species. Vegetation units with Banksia overstoreys were most common at the site and were further divided into groups according to the composition of shrub layers. Two previous surveys of vegetation in the vicinity of wetland 14807 have been reported by Hart Simpson and Associates (1990) and Masters and Associates (1992). These are referenced in the Bush Forever Directory, but have not been reviewed for the current survey.

GHD (2010) surveyed wetlands within Bushland Forever Site No. 77, referred to as the Elliot Rd wetlands, as part of the Murray Drainage and Water Management Plan. The survey report included related studies of ecological water requirements for wetlands in the Murray Drainage and Water Management Plan area.

3.6 CONSERVATION CATEGORY WETLANDS

The geomorphic classification system (Semeniuk 1987; Semeniuk and Semeniuk 1995), which allocates wetlands into types based on the fundamental characteristics of the shape of the host landform and the wetland's hydrological regime, has been adopted as the primary classification system for mapping wetlands in Western Australia (DPaW 2013). Table 3 outlines the geomorphic classification system.

Table 3: Geomorphic Classification System for Mapping Wetlands

	Basin	Flat	Channel	Slope	Highland
Permanently inundated	Lake	-	River	-	-
Seasonally inundated	Sumpland	Floodplain	Creek	-	-
Intermittent inundation	Playa	Barlkarra	Wadi	-	-
Seasonally waterlogged	Dampland	Palusplain	Trough	Paluslope	Palusmont

Semeniuk and Semeniuk (2001) suggest that wetlands of the Swan Coastal Plain are unique in a global context. On the Swan Coastal Plain, the geomorphic wetland types of the Bassendean Dunes are typically round to irregular basin-type wetlands (sumplands and damplands) and on the Pinjarra Plain they are flats and channel wetlands (palusplains and creeks) (DPaW 2014).

Semeniuk (1988) developed the concept of consanguineous suites of wetlands for the Swan Coastal Plain. The concept of consanguineous suites refers to grouping wetlands based on similarities in classification, geometry, stratigraphy, inferred origin and hydrology. In the vicinity of the Keysbrook Mineral Sands Project, the wetlands belong to the Keysbrook Consanguineous Suite.

Wetlands of the Swan Coastal Plain have been evaluated to determine their environmental values, and each wetland has been assigned to one of three wetland management categories (DPaW 2013):

1. Conservation – Wetlands which support a high level of attributes and functions.
2. Rehabilitation Potential – Wetlands which may have been modified or degraded, but still support substantial attributes and functions.
3. Multiple Use – Wetlands with few remaining important attributes and functions.

Only about 5.7% of the original extent of dampland in the Keysbrook consanguineous suite still supports a high level of values, attributes and functions; indicated by a "Conservation" management category (DPaW 2014).

There are no conservation category wetlands within the approved mining boundary or within the project footprint. However, several Conservation category wetlands occur immediately south of the project area and these are the focus of the wetland vegetation health monitoring programme. The locations of Conservation category wetlands are shown in Figure 2. Whilst these wetlands do not occur in the mining footprint (i.e. these wetlands will not be directly disturbed by mining), there are processes associated with mining activities that may affect the health of these ecosystems.

4 FIELD SURVEY METHODOLOGY

The vegetation monitoring methodology follows that of Rockwater (2015); however, the six-monthly monitoring programme shifted to annual assessment in 2018 following collection of adequate baseline data. In addition, the Photographic monitoring is also undertaken annually, to align with timing of the Wetland Vegetation Health Monitoring Programme.

Assessment of vegetation health was required at Conservation Category Wetlands 14472, 14473 and 14465 (Figure 2) on a six-monthly basis for the first three years of operation, followed by annual assessments for as long as groundwater is extracted from production bores KLP2 and KLP3.

The spring 2021 vegetation monitoring was undertaken on 22nd October (PMP 9, 10 and 11) and 19th November 2021 (all remaining sites). Tree canopy assessments within three of seven previously established vegetation monitoring quadrats to the south of the proposed mining area were undertaken at Conservation Category wetlands 14465, 14472 and 14473, and assessment of vegetation health at five photographic monitoring points (PMPs) was undertaken. PMP sites were assessed using the data sheet provided in the project Water Management Plan (WMP) (MBS 2011). The PMP and monitoring quadrats are combined at some sites. Two of three additional vegetation monitoring sites established to the northwest of the Project, within Bush Forever site 77 (Yangedi Swamp), were also re-surveyed in November 2021. Details of the wetlands and vegetation monitoring sites surveyed in spring 2021 at Keysbrook are listed in Table 4. Site locations are shown in Figures 3 and 4.

Table 4: Details for Vegetation Monitoring Sites Surveyed in the Keysbrook Project Area (Spring 2021)

Wetland Number	Classification	Management Category	Area (ha)	PMP	Quadrat
14465	Dampland	Conservation	1.03	PMP09	KVMQ4
14473	Dampland	Conservation	1.33	PMP08	KVMQ5
14472	Dampland	Conservation	0.52	-	KVMQ6
14807	Sumpland	Conservation	9.06	PMP13	KVMQ9
-	Remnant vegetation	N/A	-	PMP10	-
-	Remnant vegetation	N/A	-	PMP11	-

At each quadrat site, vegetation was assessed as follows:

- Vegetation condition was assessed using the condition scale of Keighery (1994) (Appendix I);
- Projected foliar cover (%) of tree species was estimated for tagged individual trees;
- Diameter at breast height (DBH) was measured for all trees. In the case of individual trees with multiple stems, all stems were measured at breast height;
- Crown condition and general health of each tree was assessed; and
- Other relevant observations (such as evidence of drought or dieback, disturbance from human activities, feral animal impacts and insect damage) were recorded.

Assessment of individual tree crowns at quadrat sites was undertaken using the subjective three-part scales of Wilson and Froend (2010); whereby scores are recorded for crown density and dead branches (9, 7, 5, 3 or 1), and epicormic growth (5, 4, 3, 2 or 1). A tree health assessment score was calculated by adding the scores for each component of the tree crown assessment. Tree health was classified as poor (1−5),

moderate (6−11), good (12−17) or very good (18−23). Individual scores for each tree were combined and mean values for each species within each transect were calculated. Comparisons of annual changes in condition (health) between spring 2020 and spring 2021 were made.

5 RESULTS

5.1 BOUNDARYVEGETATION

The 2021 spring survey covered four vegetation-monitoring quadrat sites and five photographic monitoring points (PMPs), in accordance with the current monitoring programme. The four quadrat sites provide data for three wetlands listed in the Water Management Plan (MBS 2015) and one reference wetland site (KVMQ9/14807) to the northwest of the Project that is monitored as part of Doral's community monitoring programme. A summary of 2021 quadrat monitoring data for the upper stratum (measurements of DBH, health and density) is provided in Table 5, together with the spring 2020 data for comparison.

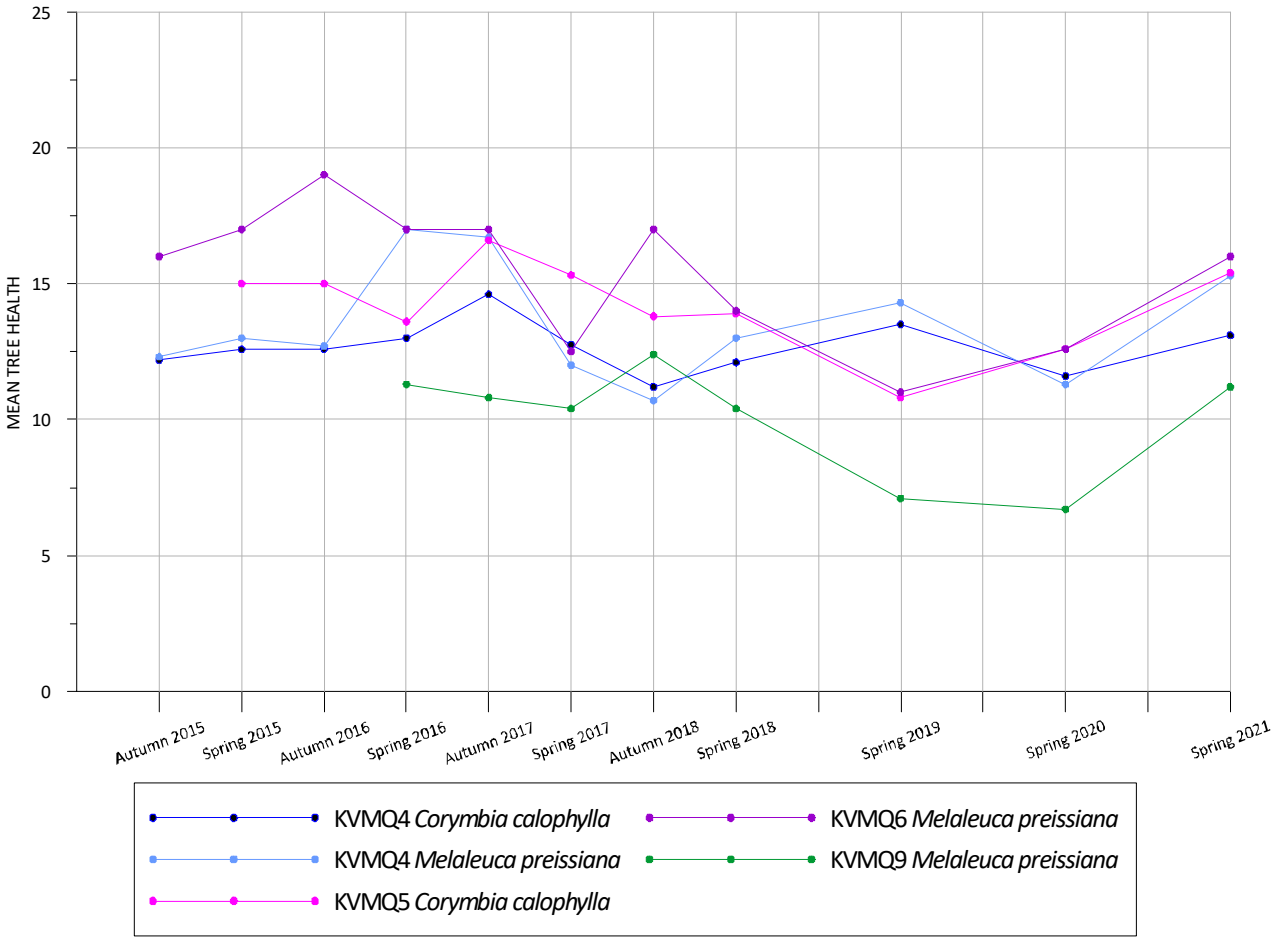
Table 5: Spring 2020–2021 Vegetation Monitoring Quadrat Data for Upper Stratum (Tree) Species

	Species[1]	KVMQ4 (Wetland 14465)		KVMQ5B (Wetland 14473)		KVMQ6 (Wetland 14472)		KVMQ9 (Wetland 14807)	
		2020	2021	2020	2021	2020	2021	2020	2021
DBH Range[2]	C.c.	4.3-51.3	4.4-51.8	2.3-38.3	3-38.7	-	-	-	-
	M.p.	7.2-30.8	7.2-31	-	-	2.7-32.5	2.2-35.5	5.7-35.9	5.6-35.9
Health Mean[3]	C.c.	11.6	13.1	12.6	15.4	-	-	-	-
	M.p.	11.3	15.3	-	-	12.6	16	6.7	11.2
Health Range	C.c.	4-18	5-21	5-19	9-20	-	-	-	-
	M.p.	10-14	12-19	-	-	14-16	16	3-11	6-16
Density[4]	C.c.	11 (2)	11 (2)	16	16	-	-	-	-
	M.p.	3	3	-	-	2	2	7 (3)	6 (4)

[1]Overstorey species - C.c. = *Corymbia calophylla*; M.p. = *Melaleuca preissiana*
[2]Diameter Range is the range in individual stem diameters (cm) at breast height (1.3m)
[3]Mean health rating for overstorey species. Tree health scale: poor (1−5), moderate (6−11), good (12−17) or very good (18−23).
[4]Density is number of trees in each plot + saplings/seedlings, figures in parenthesis represent the number of dead trees in the plot

Vegetation health improved for all species and in each quadrat surveyed in spring 2021, compared with the previous period. Mean health for tree species at each site is plotted in Text-Figure 1 below, together with survey results from previous assessments. The 2021 health means for *Melaleuca preissiana* and *Corymbia calophylla* at all wetland sites listed within the WMP were within historical ranges.

Health ratings for individual trees within the four quadrats surveyed are discussed in section 5.2 and the spring 2021 tree data are presented in Appendix II. Monitoring data sheets for each of the four sites are presented in Appendix III.



Text-Figure 1 - Mean tree health for wetland vegetation quadrats at Keysbrook, 2015-2021

Vegetation condition was assessed using the scale of Keighery (1994) at each quadrat site, with consideration of vegetation structure, disturbance at each structural layer and the ability of the vegetation unit to regenerate. The condition of vegetation in spring 2021 ranged from good to completely degraded (Table 6) and only minor change in condition was noted for one quadrat in spring 2021. Further comments on vegetation condition at individual monitoring sites are provided under section 5.2.

Table 6: Spring 2021 Vegetation Condition Assessment for Wetland Quadrats

Wetland Number	Quadrat	Rating[1]	Description
14465	KVMQ4	5	Degraded
14473	KVMQ5A/B	5	Degraded
14472	KVMQ6	6	Completely Degraded
14807	KVMQ9	3	Good

[1]Vegetation condition based on Keighery (1994)

5.2 QUADRATS IN CONSERVATION CATEGORY WETLANDS

5.2.1 KVMQ4

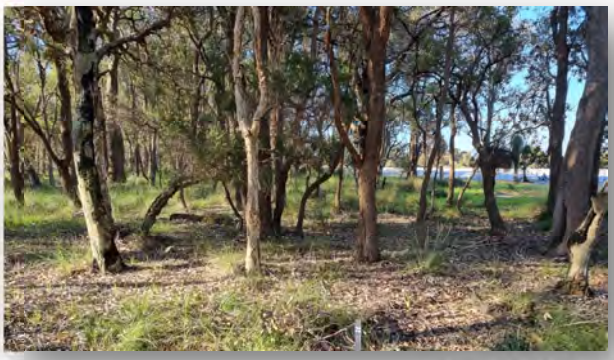
This site is located in parkland-cleared farmland on Lot 59 North Dandalup, to the south of the approved mining boundary at Keysbrook. The site has been mapped as a Conservation Category wetland (no. 14465); however, vegetation of the site is not representative of a typical wetland vegetation community for the area. Vegetation consists of a disturbed Low Forest of *Corymbia calophylla* and *Melaleuca preissiana* over Open Low Sedges (*Tetraria capillaris* and *Mesomelaena tetragona*). There are limited understorey species present and *Melaleuca preissiana and Juncus pallidus* are the only two recorded species that are indicative of a wetland vegetation community.

The structure of vegetation has been significantly altered by historical grazing. During 2021 the site was fenced to exclude Kangaroos and cattle. In addition, a range of understorey species were planted as a conservation initiative.

The general health of *Melaleuca preissiana* at the site improved over the review period, from 11.3 in 2020 to 15.3 in 2021. Similarly, the mean health of *Corymbia calophylla* improved, from 11.6 in 2020 to 13.1 in 2021 (Table 5). The mean health classification of tree canopies for *Melaleuca preissiana* and *Corymbia calophylla* improved from “moderate” to “good” in 2021 using the scale of Wilson and Froend (2010). The health range of these two species was also higher between 2020 and 2021, with a general improved crown condition recorded in 2021 for both species. *Corymbia calophylla* improved over the period of review, from a range of 4–18 in 2020 to 5–21 in 2021, and *M. preissiana* improved from a range of 10–14 to 12–19 (Table 5). Health rating data for individual tree crowns indicates that all trees in the quadrat either improved in condition (79%) or were unchanged (21%, Appendix II).

General vegetation condition in 2020 was unchanged and ranked as degraded using the scale of Keighery (1994). Comparative photographs for spring 2020 and spring 2021 at KVMQ4 are shown in Plate 1 and vegetation health assessment data for the site are presented in Appendix III.

SPRING 2020



SPRING 2021

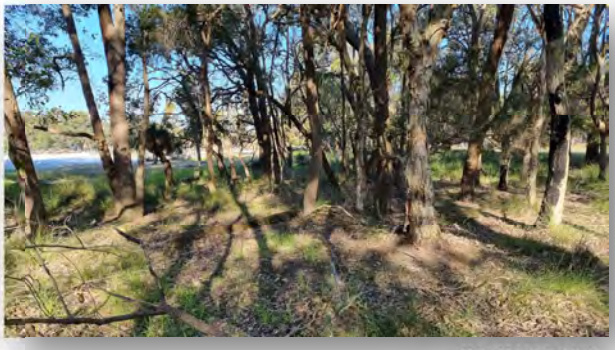
SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020



SPRING 2021

Plate 1: Spring 2021 vegetation monitoring photographs between spring 2020 and spring 2021 for wetland 14465, KVMQ4

5.2.2 KVMQ5

This site is located on Lot 506 North Dandalup, on private property to the south of the Keysbrook approved mining boundary. The 20 x 10 m quadrat at the site is positioned in a disturbed remnant of native vegetation within wetland 14473. The quadrat is divided into a 10 m x 10m quadrat centred on a degraded ephemeral creekline (KVMQ5A) and two 5 x 10 m extensions on KVMQ5B (one to the north and one to the south).

5.2.3 KVMQ5A

Vegetation at KVMQ5A was initially described as Open Low Scrub of *Astartea scoparia* over Very Open Tall Sedges of *Lepidosperma longitudinale* and *Juncus pallidus* over Open Low Grasses dominated by exotic species (*Cynodon dactylon*, *Paspalum dilatatum* and indeterminate grasses) and Very Open Herbs (*Lotus subbiflorus* and *Rumex crispus*) (Rockwater 2015).

In subsequent assessments, the understorey condition has deteriorated due to ongoing grazing, which has resulted in the proliferation of exotic species. Signs of active grazing by horses and/or sheep throughout the wetland have been recorded during most monitoring events and understorey vegetation has been significantly altered as a result.

Increased erosion was evident in the central channel of the drainage line that runs through the middle of quadrat KVMQ5A and deposition of transported vegetative material was still present up to around 0.5 m above ground level. This is likely a result of heavy surface flows after nearly double the average July monthly rainfall. Soil in the central portion of the drainage line was still wet

General vegetative cover of the understorey appeared to be similar to the 2020 assessment based on site inspection and representative photos presented in Plate 2. Annual and perennial exotic grasses and herbs dominate the understorey along the southern bank of the creekline through the site, with emergent native shrubs of *Astartea scoparia* and native sedges including *Lepidosperma longitudinale and Desmocladus fasciculatus.* General vegetation condition at the site was unchanged from 2020 to 2021 and remained as degraded (Table 6).

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

Plate 2: Spring 2021 vegetation monitoring photographs for wetland 14473, KVMQ5A

5.2.4 KVMQ5B

The original (2015) vegetation description at KVMQ5B was a dense Low Forest A of *Corymbia calophylla* over Open Low Scrub A of *Astartea scoparia* over Open Tall Sedges of *Lepidosperma longitudinale* and *Juncus pallidus* over Very Open Herbs (*Tetraria octandra* and *Lotus subbiflorus*) over Open Low Grasses dominated by exotic species (*Cynodon dactylon*, and indeterminate grasses) and Very Open Herbs (*Lotus subbiflorus* and *Rumex crispus*) (Rockwater 2015).

The cover of native species is significantly higher on the northern bank of the creekline and this has restricted the establishment of exotic species within a narrow strip between the creek and the property firebreak. Annual grasses dominate the understorey in the southern portion of the quadrat and this area has >95% cover of exotic species, as shown in the second and third paired images in Plate 3. This area has preferentially been grazed by foraging livestock in the past due to the abundance of palatable pasture grasses and there continues to be evidence of livestock tracks/trampling.

Corymbia calophylla is the dominant tree species at the site and the health of *C calophylla* trees in the quadrat improved (based on mean health scores) from 12.6 to 15.4 over the review period (Table 5). The health range of trees also improved slightly, from 5-19 in 2020 to 9-20 in 2021. Individual tree data presented in Appendix II shows that 75% of trees in the quadrat showed an improvement in canopy condition for 2020; remaining trees either remained unchanged (19%) or declined in condition (6%) over the period of review (Appendix II).

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

Plate 3: Spring 2021 vegetation monitoring photographs for wetland 14473, KVMQ5B

5.2.5 KVMQ6

Quadrat KVMQ6 is also located on Lot 506 North Dandalup, within a drainage line at wetland 14472. The site is at the northern end of Lot 506, slightly to the east of KVMQ5 (Figure 3). Vegetation of the site is parkland-cleared and was initially described as Low Forest A of *Melaleuca preissiana* with occasional emergent *Corymbia calophylla* over Very Open Tall Sedges of Juncus pallidus over Very Open Low Grasses (indeterminate exotic species) and herbaceous weeds (Rockwater 2015). Very few native species remain in the understorey at the site due to historical disturbance through grazing. The vegetation is completely degraded using the condition scale of Keighery (1994) and there was no change in vegetation condition between 2020 and 2021 (Table 6).

The two mature *Melaleuca preissiana* trees within the quadrat showed an improvement in health in 2021, with mean health shifting from 12.6 to 16 over the review period (Table 6, Appendix II). Visual inspection of trees at the site confirmed that canopy condition of *M.preissiana* trees had improved significantly, with new growth resulting in increased foliar cover compared with 2020. Trees in adjacent areas appear to be in good health. Site photographs presented in **Error! Reference source not found.** show the higher abundance of exotic grasses and herbs in the understorey in 2021, with a significantly higher cover of *Juncus pallidus*. Soil in the central channel of the creek was moist during the spring assessment and there was evidence of substantial surface water flow earlier in the season (transported leaves, branches and other vegetative debris washed up on tree trunks and banks). Trampling of the understorey by livestock was also evident.

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

Plate 4: Spring 2021 *vegetation monitoring* photographs for KVMQ6, within wetland 14472

5.2.6 KVMQ9

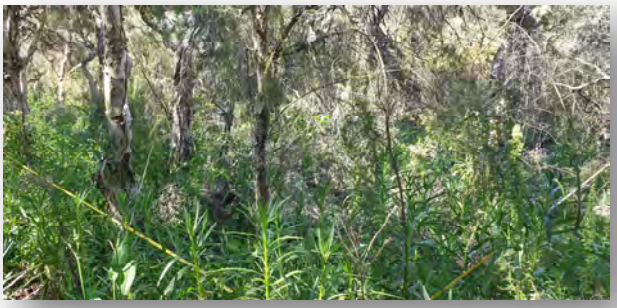
Site KVMQ9 is located at Lot 501 Elliot Rd Keysbrook on the western margin of wetland 14807 (Figure 4). Remnant vegetation within the property is part of Bushland Forever Site No. 77. Access to the site was undertaken through the neighbouring property (Lot 1) of Alan Elliott. The wetland is categorised as a sumpland in the Geomorphic Wetlands, Swan Coastal Plain database and is part of a broader chain of sumpland wetlands in the Keysbrook area.

Vegetation of the site was initially described as *Melaleuca preissiana* low woodland to low open forest over *Astartea scoparia* low scrub over *Alternanthera nodiflora* and exotic open herbs (Rockwater 2015). The site was completely inundated during the 2021 spring survey following above-average winter rainfall. Representative photographs taken during 2021 monitoring are presented as Plate 5 and show a thin sheet of aquatic herbs and algae covering surface water within the site. Wetland vegetation showed evidence of a high water mark (suspended dried algae and vegetative debris) approximately 0.75 m above the November 2022 water level of 0.1-0.25 m above ground level across the site. General vegetation condition fluctuates at the site in response to the presence of aggressive weed species in drier years and at different stage in the wetland hydroperiod (inundation suppresses germination of many exotic terrestrial herbs). In 2021, the condition of vegetation at the site was rated as 'good' using the scale of Keighery (1994).

The health mean for *M. preissiana* was significantly higher in 2021 (Table 5), with all *M. preissiana* trees at the site improving in condition over the period of review. Mean health increased from 6.7 to 11.2, although the overall health of *M. preissiana* remained as moderate using the rating framework of Wilson and Froend (2010). The range in health values also increased; from 3-11 to 6-16 (Table 5).

SPRING 2020

SPRING 2021



SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

SPRING 2020

SPRING 2021

Plate 5: Spring 2021 vegetation monitoring photographs for quadrat KVMQ9 within wetland 14807

5.3 COMPARISON OF ANNUAL SPRING VEGETATION AT PHOTO-MONITORING POINTS

The health of wetland vegetation was recorded at selected photo-monitoring points (PMP) in spring 2021, in accordance with the WMP. PMP sites are listed in Table 4 and site locations are shown in Figures 3 and 4. Site photographs for spring 2020 and 2021 are presented for each site in Plates 6-10. Vegetation health assessment data sheets for each of the photo-monitoring point (PMP) sites are presented in Appendix IV.

5.3.1 PMP08

PMP08 is located at the northwestern corner of Lot 506 North Dandalup within Conservation Category Wetland 14473 (Fig. 3). The site is paired with vegetation monitoring quadrat KVMQ5, which was established within the channel of a surface drainage feature running through the northern end of the property (see s5.2). Native vegetation was initially described as heath of *Astartea scoparia* over *Lepidosperma longitudinale* and *Juncus pallidus* open tall sedges over low grasses dominated by exotic species. Vegetation surrounding the site is largely parkland-cleared; however the photopoint at this site is centred on a remnant with high cover and abundance of native understorey species (Plate 6).

There is a clear improvement in canopy condition of *Corymbia calophylla* trees from 2020 to 2021, as outlined in s5.2.4 for quadrat KVMQ5B. There were no tree deaths observed for *C. calophylla* trees in the vicinity of the monitoring point.

Plate 6: **Spring 2021 vegetation monitoring photographs for PMP08**

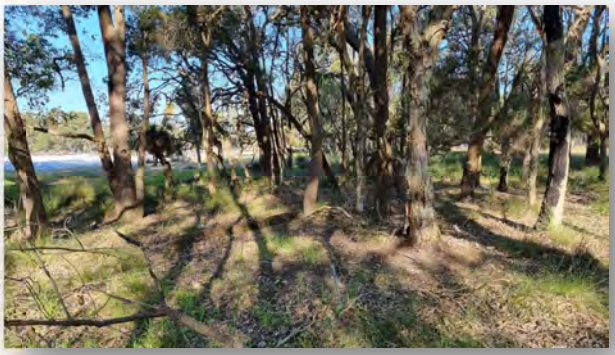
5.3.2 PMP09

PMP09 is located at Lot 59 North Dandalup within an isolated remnant of parkland-cleared *Corymbia calophylla* and *Melaleuca preissiana* low forest. During the review period this remnant was fenced for conservation purposes. The site is mapped as Conservation Category Wetland 14465 (Fig. 3); however, the wetland mapping dataset used in mapping is thought to be inaccurate given the largely dryland characteristics and terrestrial vegetation of the site. The cover of exotic and native understorey species increased over the period of review, which is likely due to a number of factors, including:

- exclusion of livestock and kangaroos from the site via a 2 m tall mesh wire fence;
- higher than average winter rainfall; and
- planting of native tubestock throughout the understorey of the area.

All *Melaleuca preissiana* trees and most *C. calophylla* trees showed improved canopy condition in 2021 compared with the previous period.

SPRING 2020



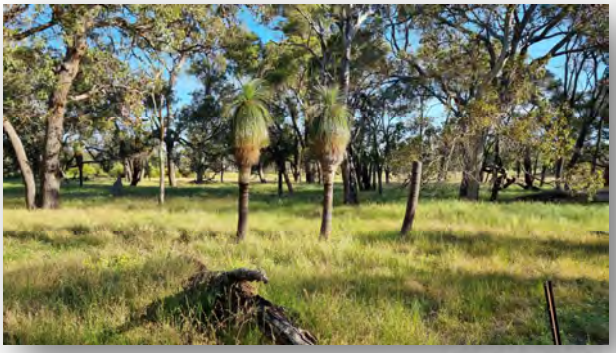
SPRING 2021

Plate 7: Spring 2021 vegetation monitoring photographs for PMP09

5.3.3 PMP10

PMP10 is located at Lot 34 Hopelands Road within a Conservation Covenant Area adjacent to the approved mining boundary. Vegetation at this site is parkland-cleared *Corymbia calophylla, Eucalyptus marginata* and *Persoonia elliptica* low woodland vegetation over *Kingia australis* open low scrub. Native grasses and herbs are absent within the lower strata and the understorey is dominated by exotic grasses and herbs. Vegetation of the site is representative of terrestrial rather than wetland vegetation. Site photographs comparing Spring 2020 and spring 2021 are presented in Plate 8. There were no signs of stress in mature trees at the site in spring 2021.

SPRING 2020



SPRING 2021

Plate 8: Spring 2021 vegetation monitoring photograph for PMP10

5.3.4 PMP11

PMP11 is situated on fallow land outside the licensed premises on the edge of resource enhancement category wetland 14457 (Fig. 3). Vegetation of the site is a completely degraded remnant of *Melaleuca preissiana* low forest over pasture grasses and other exotics (Plate 9). The understorey at this site contains no apparent native species. *M*. *preissiana* trees were in good health at the time of the spring 2021 survey and the understorey contained nearly 100% cover of exotic grasses.

Plate 9: Spring 2021 vegetation monitoring photographs for PMP11

5.3.5 PMP13

PMP13 is located at Lot 501 Elliot Rd Keysbrook, within Bushland Forever Site No. 77 (Yangedi Swamp). The site is situated in the southern portion of conservation category wetland 14807 (formerly 7028) (Fig. 3). Vegetation of the site is historically grazed and parkland-cleared *Corymbia calophylla* low woodland upslope to the west, and *Melaleuca preissiana* and *Eucalyptus rudis* forest over *Kunzea ericifolia* and *Astartea scoparia* low scrub on lower-lying ground to the east.

The site was under water in spring 2021 and a thin sheet of aquatic herbs and algae covered areas of open water throughout the wetland. This was in contrast to the 2020 survey, when the site was dry. Representative photos for spring 2020 and 2021 are presented in Plate 10 and show the different stage in the wetland hydroperiod between years. Site monitoring data are presented in Appendix IV.

There continues to be very low cover (<1%) of native and exotic species in the understorey at the site, and mature Flooded Gum (*E.rudis*) trees appeared to be in good condition.

Plate 10: Spring 2021 vegetation monitoring photographs for PMP13

5.4 GROUNDWATER DATA

Routine water level monitoring and water quality measurements form part of Doral's licensing requirements under a variety of legislative instruments. Groundwater levels for the majority of the monitoring bores across the Keysbrook site were within their respective trigger levels during the reporting period, as specified in the GLOS. However, there were three breaches in groundwater level trigger values during the review period, as follows:

- KS11 was 0.1m below the trigger level in January 2021;
- KS13 was 0.52m below the trigger level in June 2021; and
- KL8 was 2.11m below the trigger level in February 2021.

All three of the exceedances were considered to be erroneous data points as a result of recording or data entry errors (GRM 2022). None of the remaining monitoring data for 2021 indicate breaches of the groundwater level trigger values that would require a management response in accordance with the Water Management Plan.

The water level at KWT1D was very close to the trigger level limit of 28.75 m AHD in autumn 2020, and represents a historical low point since monitoring at the site commenced in 2015. This site is located immediately adjacent to the southern portion of the approved mining area, and close to several wetlands on private property to the south (Figure 2). The water level at KWT1D had risen slightly during 2021; however, it would be prudent to maintain a close eye on the site during the next summer/autumn period, as a breach of the water level trigger has implications for additional wetland monitoring commitments outlined in the WMP.

6 DISCUSSION

Monitoring of wetland vegetation at Doral's Keysbrook mineral sands project is a requirement of the Project's Water Management Plan (WMP, MBS 2015) and Groundwater Licence Operating Strategy (GLOS, Rockwater 2013). Wetland monitoring at the site was undertaken in October and November 2021 in accordance with the amended Wetland Vegetation Health Monitoring Programme. Wetland vegetation monitoring sites include quadrats and photographic monitoring points within bushland remnants on farmland and privately owned rural residential land.

Monitoring of three quadrat sites was required in 2021 to assess vegetation health in accordance with monitoring commitments in the WMP (s5.2.2). One additional (reference) wetland site on private land to the northwest of the Project was also monitored in 2021. Assessment of other vegetation monitoring sites set up in 2015 to record baseline conditions is only required by either a decline in water level or by changes in water quality beyond trigger values at adjacent bores, or by a decline in the health (vigour) of remnant vegetation at wetlands immediately to the north. None of these conditions have been met for the period of review.

The results of surveys for tree canopy health in 2021 showed consistent trends across all quadrat sites for the health of dominant tree species over the period of review. At each site, both *Melaleuca preissiana* and *Corymbia calophylla* showed an increase in overall health and no new tree deaths were recorded. Between 94% and 100% of individual *M. preissiana* and *C. calophylla* trees showed either an improvement in health or no change from the previous assessment in 2020. *Eucalyptus rudis* is only present at one photo monitoring point within wetland 14807 and it appeared to be in good overall health in 2021.

Photographic monitoring at five sites in 2021 has not indicated any negative trends in vegetation health that could require a management response in accordance with the WMP. Photographic monitoring sites PMP 3, 5, 6 and 7 have previously been removed from the survey programme as they no longer fall within the 1 km mining buffer that triggers the requirement to monitor them. As of November 2021, there are additional PMP sites that could potentially be removed from the monitoring programme, in accordance with the requirements of the WMP. The WMP stipulates that photographic monitoring is required while

pits within one kilometre of PMP sites are active, and post mining "until groundwater levels in the area return to pre-mining levels". Following further rehabilitation in the southern mining area, and mining moving further north over the last two review periods, PMP sites 8, 9, 10 and 11 are also beyond the 1km mining buffer and could therefore be removed from the monitoring schedule. Further assessment of groundwater levels, to determine if they are at pre-mining levels at all sites that are >1 km from active mining pits, should be undertaken to determine whether any sites could be permanently removed from this monitoring programme.

The overall condition of vegetation (using the Keighery 1994 scale) at three wetlands immediately south of the approved mining boundary was unchanged over the period of review and ranged from completely degraded (wetland 14472) to degraded (wetlands 14473, 14465). Vegetation condition within wetland 14807 (Yangedi Swamp) to the northwest of the project area improved from degraded to good in 2021. At this site, vegetation condition improves during wetter periods when surface water suppresses germination of many exotic terrestrial herbs, and declines in response to the presence of aggressive weed species in drier years and during drier stages in the wetland hydroperiod.

Multiple disturbances from rural development and agricultural land uses at all monitoring sites within and adjacent to the Keysbrook mining areas have resulted in much of the remnant vegetation in the area being fragmented. Livestock (horses and cattle) and kangaroos have grazed much of the remnant bushland within the properties surveyed and understorey vegetation in most bushland areas is limited. Clearing and other development at all locations has resulted in a landscape of degraded, parkland-cleared vegetation. Exceptions are at monitoring sites within Bushland Forever Site 77 (Yangedi Swamp), where vegetation on freehold land is managed for conservation purposes. Monitoring of vegetation monitoring sites within conservation areas is undertaken through Doral's community monitoring programme and there are no compliance criteria or trigger/management actions associated with these sites.

Extensive grazing within some sites prevents regeneration of the understorey, and removal of native understorey by clearing and grazing has historically promoted proliferation of weed species in bushland remnants on private agricultural land. In addition, occasional inundation of the landscape by surface water during wetter years at vegetation monitoring sites within wetlands 14472, 14473 and 14807 during winter/spring changes the structure and composition of understorey vegetation. These changes can be seen until water recedes in the drier summer and autumn months, at which time exotic species germinate and begin to dominate the lower strata.

Favourable weather during the 2021 winter period resulted in rainfall of at least 834 mm at the Keysbrook site; however, data for the review period are incomplete. Data from nearby BoM station at Cloon (Station 9242) indicate that rainfall of 1,134 mm was received over the period of review, which is 33% above average (1994-2021).

Groundwater levels in the superficial aquifer at the site fluctuate seasonally, as a result of rainfall and streamflow recharge, with water levels generally peaking around August to September (following winter rainfall) and then reaching a low point around March to April each year. For 2021, the average fluctuation was 1.80 m across all superficial aquifer bores, with the highest variability observed near the wetlands where recharge during winter is higher and evaporative losses during summer/autumn are greater (GRM 2022). The groundwater level in the Leederville Aquifer also demonstrates a seasonal variability, indicating active rainfall recharge is also occurring in the deeper aquifer.

Soil moisture at the southern wetland sites (14472, 14473 and 14465) is influenced more by rainfall and surface water than by groundwater, as the Superficial aquifer water levels in the vicinity of the southern

mining block are below the base of the ore. Consequently, several Conservation Category wetlands in this vicinity (Fig. 2) are unlikely to be subjected to dewatering effects.

Doral is permitted to abstract up to 1.8 GL per annum from its Leederville Aquifer production bores for water supply, and up to a further 0.6 GL per annum from the Superficial Aquifer for the purpose of mine dewatering. During 2021, extraction from the Leederville Aquifer was 59.7% of the licensed annual allocation, and the volume of water added to the pits in tailings exceeded the volume removed from the pits via the in-pit sumps (i.e. annual nett recharge to the pits) (GRM 2022).

Annual monitoring of wetland monitoring bores was undertaken in accordance with regulatory requirements, apart from several bores that could not be accessed (GRM 2022). Groundwater monitoring data for the review period do not indicate trends that would indicate adverse impacts to the Superficial Aquifer due to groundwater abstraction from the Leederville Aquifer for project water supply.

The monitoring data for the reporting period does not indicate any impacts to the Superficial Aquifer associated with pit dewatering and tailings discharge, apart from within the immediate mining areas (GRM 2022).

7 CONCLUSION

Wetland vegetation at Doral's Keysbrook mine was monitored in spring 2021, in accordance with commitments within the Project Water Management Plan (WMP) and Groundwater Licence Operating Strategy (GLOS). Results from the 2021 survey indicate that vegetation health improved for all species and in each quadrat surveyed, compared with the previous period. Rainfall was well above average for the period of review and groundwater monitoring does not indicate any impacts to the Superficial Aquifer associated with pit dewatering and tailings discharge, apart from within the immediate mining areas.

The wetlands monitored by Doral are approximately 2.4 km south of any active mining areas, as at March 2022. As a result, the risk of mining impacts to wetland vegetation along the southern boundary of the approved mining area continues to decline, and four additional photographic monitoring sites (PMP 8, 9, 10 and 11) can be removed from the Wetland Vegetation Health Monitoring Programme in accordance with the WMP.

Dated: 23 March 2022

Daisy Scott
Senior Environmental Scientist

Nick Evelegh
Principal Environmental Scientist

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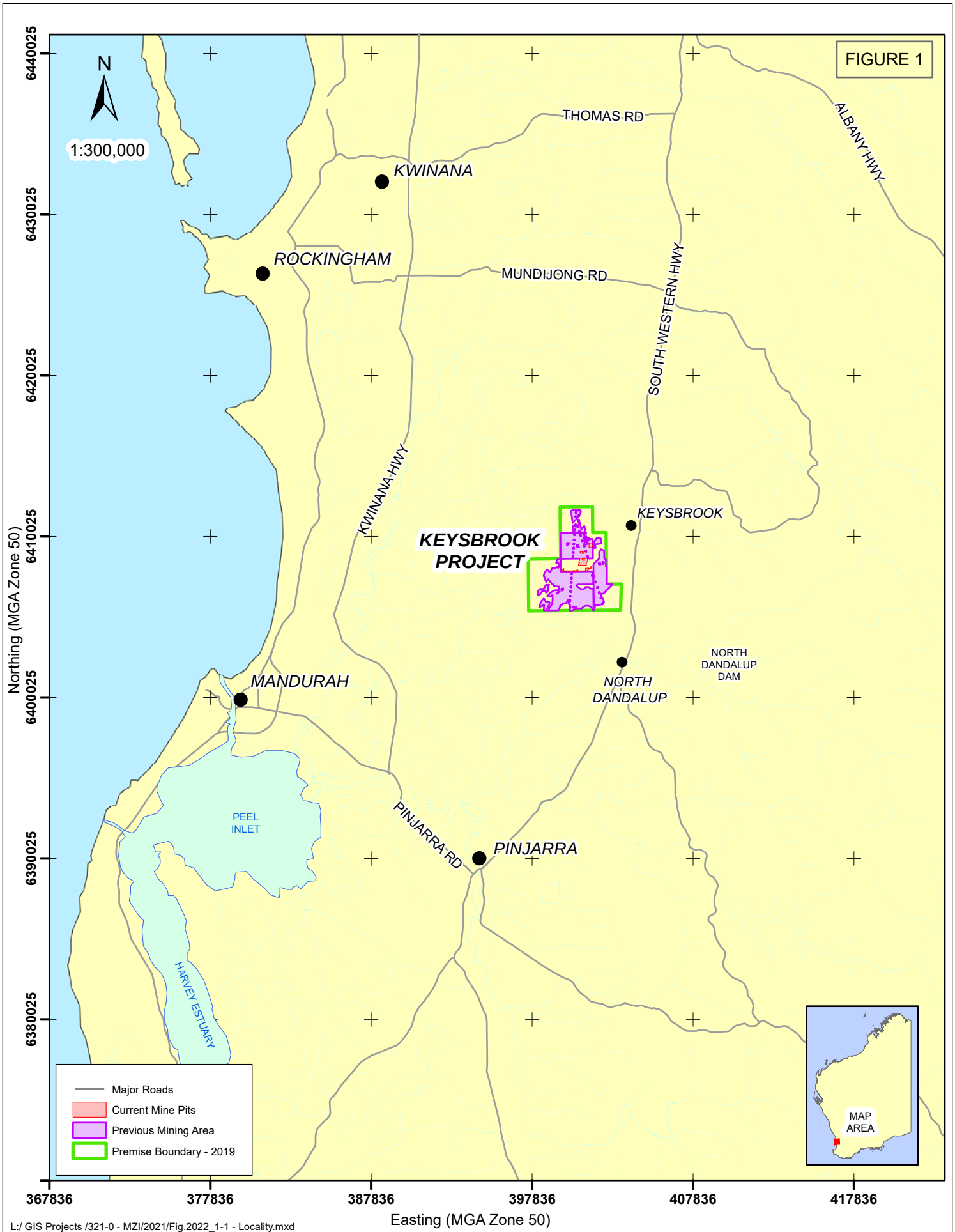
FIGURES



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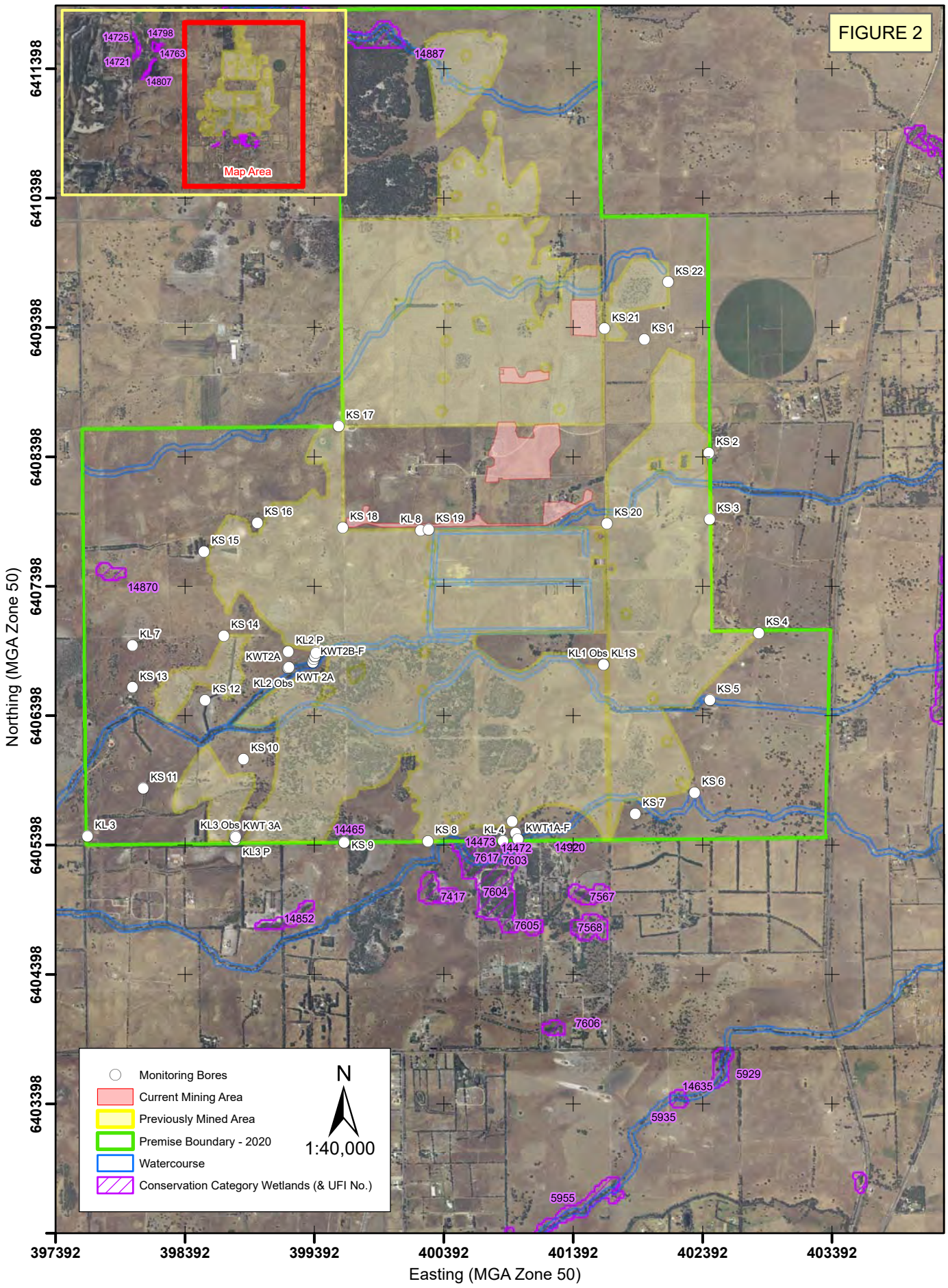
PROJECT:	Keysbrook Minerals Sands
DATE:	January 2022
DWG NO:	321-0/22/01-1

LOCALITY PLAN

Rockwater PROPRIETARY LIMITED



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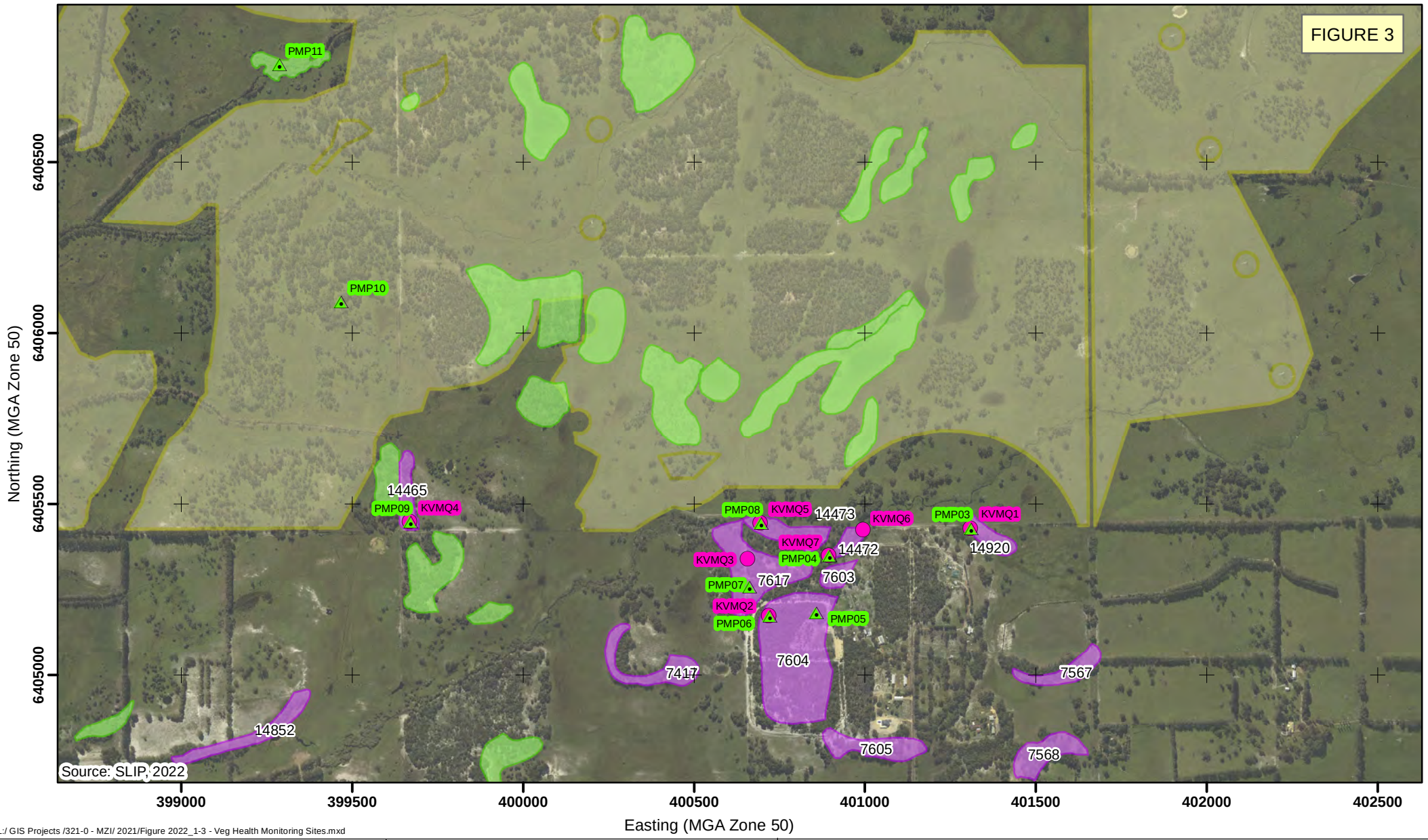
CLIENT:	Doral Pty Ltd
PROJECT:	Keysbrook Minerals Sands
DATE:	January 2022
DWG NO:	321-0/22/01-2

CONSERVATION CATEGORY WETLANDS

Rockwater PROPRIETARY LIMITED



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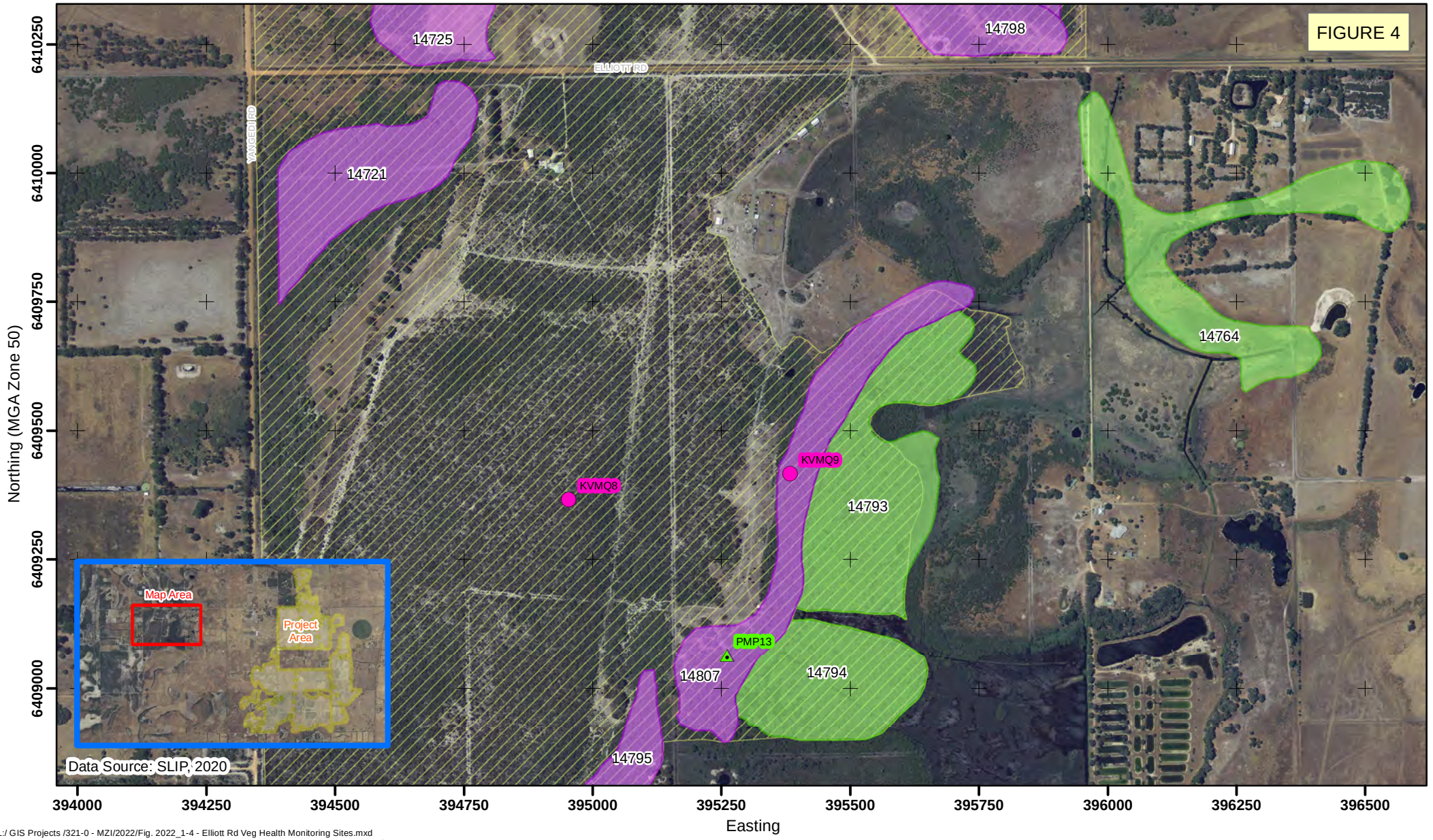
CLIENT:	Doral Pty Ltd
PROJECT:	Keysbrook Minerals Sands
DATE:	January 2022
DWG NO:	321-0/23/01-3

Geomorphic Wetland (DPAW, 2020)
- Conservation (& UFI No.)
- Resource Enhancement
- Mining Area

- Photo Monitoring Point
- Quadrat
- N
- MGA Zone 50
- 1:15,000 (A4)

VEGETATION HEALTH MONITORING SITES AND PHOTOGRAPHIC MONITORING POINTS



L:/ GIS Projects /321-0 - MZI/2022/Fig. 2022_1-4 - Elliott Rd Veg Health Monitoring Sites.mxd

CLIENT:	Doral Pty Ltd
PROJECT:	Keysbrook Minerals Sands
DATE:	January 2022
DWG NO:	321-0/22/01-4

Quadrat

Bush Forever Site 77

Geomorphic Wetland (DPAW, 2020)

Conservation

Resource Enhancement

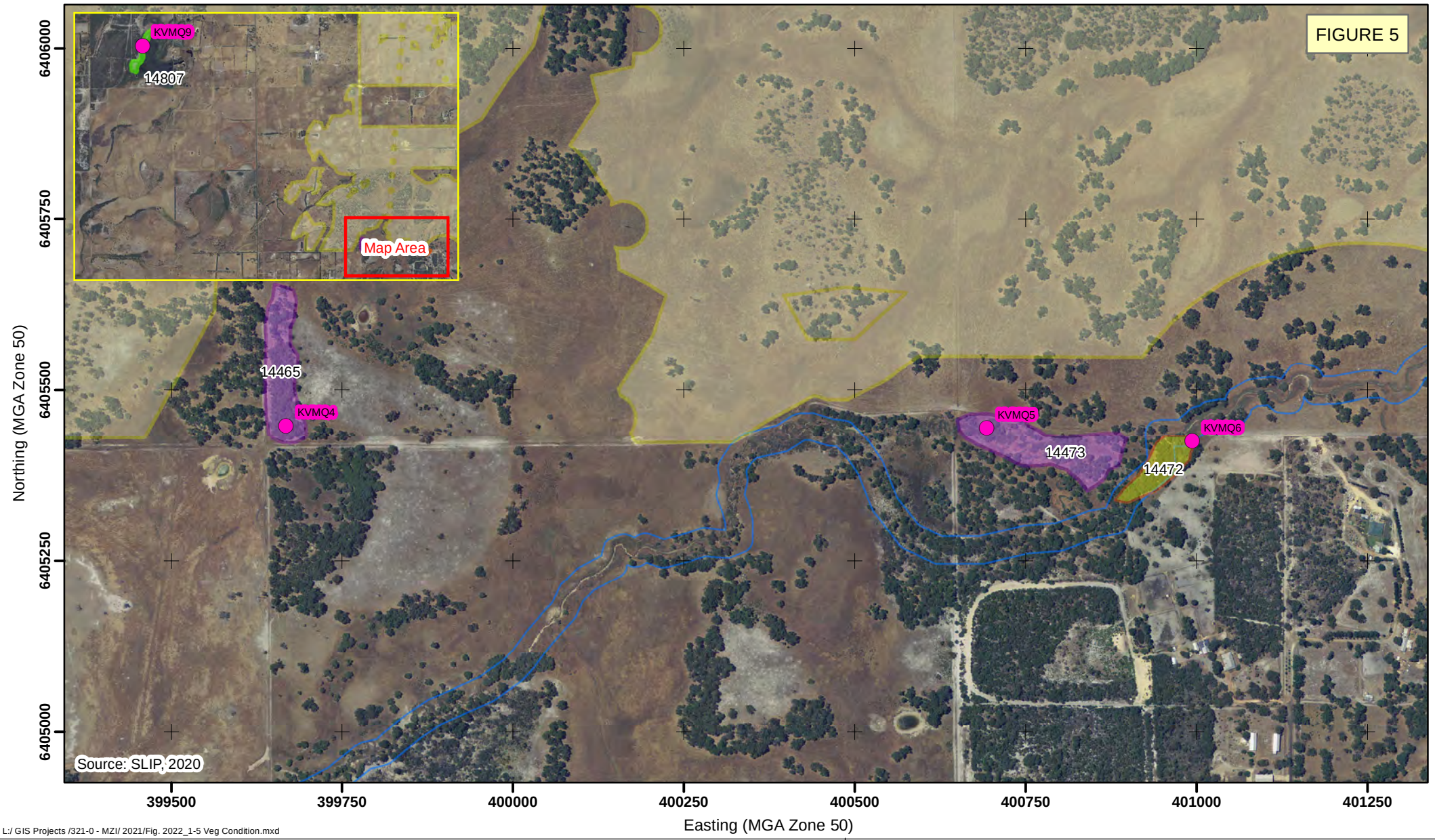
N

MGA Zone 50

1:10,000

A4

ADDITIONAL VEGETATION HEALTH MONITORING SITES AND PHOTOGRAPHIC MONITORING POINTS AT ELLIOTT RD



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CLIENT:	Doral Pty Ltd
PROJECT:	Keysbrook Minerals Sands
DATE:	January 2022
DWG NO:	321-0/22/01-5

Spring 2021 Quadrat
Mining Area
Watercourse

1:7,500

Conervation Category Wetlands (& UFI No.)
(Condition Scale of Keighery, 1994)
Very Good
Good
Degraded
Completely Degraded

N

CONSERVATION CATEGORY WETLANDS
SPRING 2021
VEGETATION CONDITION

APPENDIX I:

Vegetation Condition Scale (Keighery 1994)

Appendix I: Condition Scale (Keighery 1994)

1. Pristine	Pristine or nearly so, no obvious signs of disturbance
2. Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species
3. Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
4. Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
5. Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
6. Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX II

Individual Tree Health Ratings for Spring 2021

Appendix II: Individual Tree Health Ratings Spring 2015−2020

Plot	Species	Tag Number	DBH, 2021 (cm)	Health						
				Spring 2015	Spring 2016	Spring 2017	Spring 2018	Spring 2019	Spring 2020	Spring 2021
KVMQ4	*Melaleuca preissiana*	1	11.0, 7.2, 31.0	5, 5, 5 – 15	7, 7, 5 – 19	5, 5, 4 – 14	5, 5, 4 – 14	5, 5, 4 – 14	5, 5, 4 – 14	5, 7, 5 – 17
		2	12.2	3, 3, 5 – 11	5, 5, 5 – 15	3, 3, 4 – 10	3, 3, 5 – 11	5, 5, 4 – 14	3,3, 4 – 10	9, 7, 4 – 20
		3	17.7	5, 3, 5 – 13	7, 5, 5 – 17	3, 5, 4 – 12	5, 5, 4 – 14	5, 5, 5 – 15	3,3, 4 – 10	3, 5, 4 – 12
	Corymbia calophylla	4	4.4	3, 3, 3 – 9	5, 5, 3 – 13	3, 5, 3 – 11	3, 3, 3 – 9	3, 5, 4 – 12	1, 3, 2 – 6	3, 3, 3 – 9
		5	31.2	7, 7, 5 – 19	7, 7, 4 – 18	7, 7, 4 – 18	5, 7, 3 – 15	7, 7, 4 – 18	7, 7, 4 – 18	9, 7, 5 – 21
		6	15.2	5, 3, 5 – 13	7, 5, 3 – 15	7, 5, 3 – 15	7, 5, 4 – 16	5, 5, 3 – 13	3, 5, 3 – 11	3, 5, 3 – 11
		7	10.6	3, 3, 4 – 10	3, 3, 4 – 12	3, 3, 4 – 10	3, 3, 4 – 10	7, 5, 4 – 16	1, 1, 3 – 5	1, 1, 3 – 5
		8	20.7	7, 5, 4 – 16	7, 5, 3 – 15	7, 7, 4 – 18	7, 7, 4 – 18	7, 5, 4 – 16	7, 5, 4 – 16	7, 7, 4 – 18
		9	26.5	5, 3, 2 – 10	7, 5, 2 – 14	5, 5, 3 – 13	5, 3, 2 – 10	7, 5, 3 – 15	5, 5, 2 – 12	5, 5, 3 – 13
		10	10.0	3, 3, 4 – 10	5, 5, 3 – 13	5, 5, 4 – 14	5, 5, 4 – 14	5, 3, 4 – 12	3, 3, 2 – 8	5, 5, 3 – 13
		11	51.8	7, 3, 5 – 15	5, 5, 4 – 14	5, 3, 3 – 11	7, 5, 3 – 15	5, 5, 3 – 13	7, 5, 3 – 15	7, 7, 4 – 18
		12	19.2	5, 5, 3 – 13	5, 3, 3 – 11	3, 3, 2 – 8	5, 3, 3 – 11	3, 3, 3 – 9	5, 3, 3 – 11	5, 5, 3 – 13
		13	Dead							
		14	8.0	5, 5, 3 – 13	5, 3, 2 – 10	5, 3, 2 – 10	3, 1, 2 – 6	3, 3, 3 – 9	1, 1, 2 – 4	3, 3, 2 – 8
		15	Dead	3, 3, 1 – 7	3, 1, 2 – 6	3, 5, 2 – 10	1, 3, 2 - 6	Dead		
		16	12.1, 36.4 20.5	7, 5, 4 -16	7, 5, 4 -16	7, 5, 3 – 15	7, 5, 3 - 15	7, 5, 4 - 16	7, 5, 3 - 15	7, 5, 3 – 15
KVMQ5B	*Corymbia calophylla*	1	9.2, 9.7, 38.7	7, 7, 4 – 18	7, 7, 3 – 17	7, 7, 5 – 19	5, 5, 4 – 14	5, 7, 4 – 16	5, 7, 4 – 16	5, 7, 4 – 16
		2	17.1, 31	7, 5, 7 – 19	7, 5, 4 – 16	7, 7, 4 – 18	5, 7, 4 – 16	5, 7, 4 – 16	7, 5, 4 – 16	9, 7, 4 – 20
		3	8.2	5, 5, 3 – 13	5, 5, 3 – 14	5, 5, 4 – 14	3, 3, 3 – 9	3, 5, 4 – 12	3, 5, 4 – 12	5, 5, 4 – 14
		4	29.5	7, 5, 4 – 16	5, 3, 4 – 12	7, 5, 4 – 16	7, 5, 4 – 16	5, 5, 4 – 14	7, 5, 4 – 16	9, 7, 4 – 20
		5	10.9	7, 7, 4 – 18	7, 5, 3 – 15	7, 7, 5 – 19	5, 5, 3 – 13	5, 5, 4 – 14	5, 5, 4 – 14	7, 5, 3 – 14
		6	3.9	3, 5, 3 – 11	5, 5, 3 – 13	5, 5, 4 – 14	3, 5, 3 – 11	1, 1, 2 – 4	3, 3, 3 – 9	5, 5, 4 – 14
		7	7.9	3, 3, 2 – 8	3, 3, 2 – 8	5, 3, 3 – 11	3, 3, 3 – 9	1, 1, 2 – 4	3, 1, 2 – 6	5, 3, 3 – 11
		8	10	7, 5, 4 – 16	5, 3, 4 – 12	5, 5, 4 – 14	5, 5, 4 – 14	3, 3, 3 – 9	3, 5, 3 – 11	5, 5, 4 – 14
		9	1.8	5, 3, 3 – 11	3, 3, 3 – 9	3, 3, 5 – 11	3, 3, 3 – 9	1, 1, 1 – 3	1, 1, 3 – 5	3, 3, 3 – 9
		10	17.4	9, 7, 4 – 20	7, 5, 4 – 16	9, 7, 5 - 21	7, 5, 5 – 17	3, 3, 3 – 9	5, 5, 4 – 14	7, 7, 5 – 19
		11	21.3	7, 7, 4 – 18	7, 5, 3 – 15	5, 7, 4 – 16	7, 5, 4 – 16	7, 5, 4 – 16	7, 5, 4 – 16	7, 7, 4 – 18
		12	38.2	9, 7, 5 – 21	9, 7, 5 – 21	9, 7, 5 – 19	9, 7, 5 – 21	7, 5, 4 – 16	7, 7, 5 – 19	7, 7, 4 – 18
		13	11.9	7, 7, 4 – 18	7, 5, 5 – 17	5, 5, 4 – 14	7, 5, 4 – 18	3, 3, 3 – 9	5, 5, 3 – 13	7, 7, 4 – 18
		14	11.6	5, 5, 3 – 13	5, 3, 3 – 11	5, 3, 3 – 11	5, 5, 3 – 13	3, 3, 3 – 9	5, 3, 3 – 11	5, 5, 3 – 13
		15	38.6	7, 3, 2 – 12	5, 3, 3 – 11	5, 3, 3 – 11	7, 3, 4 – 14	5, 5, 3 – 13	7, 5, 3 – 15	7, 5, 3 – 15
		16	3.0	3, 3, 2 – 8	5, 3, 3 – 11	5, 5, 5 – 15	5, 5, 5 – 15	3, 1, 2 – 6	3, 3, 3 – 9	5, 5, 3 – 13
KVMQ6	*Melaleuca preissiana*	1	35.5, 22, 27.2	7, 5, 5 – 17	5, 5, 5 – 15	5, 5, 4 – 14	5, 5, 4 – 14	5, 5, 3 – 13	7, 5, 4 – 16	7, 5, 4 – 16
		2	6.8, 5.3, 2.2	7, 5, 5 – 17	7, 7, 5 – 19	3, 5, 3 – 11	5, 5, 4 – 14	3, 3, 3 – 9	5, 5, 4 – 14	7, 5, 4 – 16
KVMQ9	*Melaleuca preissiana*	1	5.6	-	3, 1, 5 – 9	3, 1, 4 – 8	1, 1, 2 – 4	1, 1, 1 – 3	1, 1, 1 – 3	3, 1, 2 – 6
		2	14.7	-	3, 3, 5 – 11	5, 3, 4 – 12	3, 5, 3 – 11	3, 3, 2 – 8	3, 5, 3 – 11	5, 7, 4 – 16
		3	35.9	-	5, 3, 5 – 13	3, 3, 3 – 9	5, 5, 4 – 14	3, 3, 3 – 9	3, 1, 2 – 6	5, 3, 3 – 11
		4	12.2	-	5, 3, 5 – 13	5, 3, 4 – 12	5, 5, 4 – 14	3, 3, 3 – 9	3, 3, 2 – 8	5, 3, 5 – 13
		5	20.1	-	5, 5, 5 – 15	5, 5, 4 – 14	3, 5, 4 – 12	5, 3, 3 – 11	3, 3, 3 – 9	5, 5, 3 – 13
		6	Dead							
		7	Dead	-	3, 3, 5 – 11	3, 3, 4 – 10	3, 3, 3 - 9	3, 1, 2 - 6	3, 1, 2 - 6	Dead
		8	Dead	-	1, 1, 5 – 7	Dead				
		9	Dead							
		10	6.1	-	3, 3, 5 – 11	1, 3, 4 – 8	3, 3, 3 - 9	1, 1, 2 - 4	1, 1, 2 - 4	3, 2, 3 - 8

APPENDIX III

Spring 2021 Vegetation Quadrat Monitoring Data Sheets

Appendix III: Vegetation Quadrat Data Sheets

Vegetation Health Assessment							
PROJECT DETAILS							
Client: MZI / Doral		Client #: 321-0			Date: 19/11/2021		
Project: Keysbrook		R/W Personnel: NE					
QUADRAT DETAILS							
Site #:**KVMQ4**							
Location description: Lot 62 MZI Tenements							
MGA coordinates: (50) 399 668 mE 640 5447 mN					Elevation (mAHD:) 33		
Conservation Category Wetland UFI No: 14465							
Topography: Flat/slightly undulating							
Litter: 30%	Bark: 1 %	Branches: 3 %		Leaves: 24 %			
Vegetation Description: Low Forest of *Corymbia calophylla* and *Melaleuca preissiana* over open low sedges (*Tetraria capillaris*, *Mesomelaena tetragona*).							
Vegetation Condition: Degraded							
DRF/Priority Flora & Number of Plants: nil							
Fire Age: >10 Old burnt sections (still black)							
NOTES: (Dieback, Insect/Disease, Other of Interest)							
PHOTOGRAPHY							
Photo numbers:							
TAGGED TREES (10 X 10 m)							

Tag Number	Species	Crown Density	Dead Branches	Epicormic cover	DBH	Height (m)	% Cover
KVMQ4-1	*Melaleuca preissiana*	7	7	5	11.0, 7.2, 31.0		1.5
KVMQ4-2	*Melaleuca preissiana*	5	5	5	12.2	7.5	<1
KVMQ4-3	*Melaleuca preissiana*	3	5	4	17.7		
KVMQ4-4	*Corymbia calophylla* (juv)	3	3	3	4.4		
KVMQ4-5	*Corymbia calophylla (mat)*	9	7	5	31.2		
KVMQ4-6	*Corymbia calophylla (mat)*	3	5	3	15.2		<1
KVMQ4-7	*Corymbia calophylla (mat)*	1	1	3	10.6	6.2	<1
KVMQ4-8	*Corymbia calophylla (mat)*	7	7	4	20.7		4
KVMQ4-9	*Corymbia calophylla (mat)*	5	5	3	26.5		2
KVMQ4-10	*Corymbia calophylla (mat)*	5	5	3	10.0		<1
KVMQ4-11	*Corymbia calophylla (mat)*	7	7	4	51.8		
KVMQ4-12	*Corymbia calophylla (mat)*	5	5	3	19.2		
KVMQ4-13	*Corymbia calophylla (mat)*	Dead					
KVMQ4-14	*Corymbia calophylla (mat)*	3	3	2	8.0		
KVMQ4-15	*Corymbia calophylla (mat)*	Dead					
KVMQ4-16	*Corymbia calophylla (mat)*	7	5	3	12.1, 36.4, 20.5		

COMMENTS

M.preissiana in fruit

Site fenced and understorey planted with native seedlings

Appendix III: Vegetation Quadrat Data Sheets (cont.)

Vegetation Health Assessment							
PROJECT DETAILS							
Client: MZI	Client #: 321-0				Date: 19/11/2021		
Project: Keysbrook	R/W Personnel: N.E.						
QUADRAT DETAILS							
Site #:**KVMQ5**							
Location description: NW Corner Property							
MGA coordinates: (50) 400 693 mE 640 5444 mN					Elevation (mAHD:)		
Conservation Category Wetland UFI No: 14473							
Topography: Creekline							
Soil: -							
Litter %	Bark:<1%	Branches: 1 %		Leaves: 5 %			
Vegetation Description: Heath of *Astartea scoparia* over open tall sedges of *Lepidosperma longitudinale* and *Juncus pallidus* over low grasses dominated by exotic species (*Cynodon dactylon and Paspalum dilatatum*)							
Vegetation Condition: Degraded							
DRF/Priority Flora & Number of Plants:							
Fire Age: -							
NOTES: (Dieback, Insect/Disease, Other of Interest)							
PHOTOGRAPHY							
Photo numbers:							
TAGGED TREES (10 X 10 m)							
Tag Number	Species	Crown Density	Dead Branches	Epicormic cover	DBH	Height (m)	% Cover
KVMQ5-1	*Corymbia calophylla*	5	7	4	9.2, 9.7, 38.7	11.5	10.5
KVMQ5-2	*Corymbia calophylla*	9	7	4	17.1, 31	12	10
KVMQ5-3	*Corymbia calophylla*	5	5	4	8.2	4.5	<1
KVMQ5-4	*Corymbia calophylla*	9	7	4	29.5	~30	12
KVMQ5-5	*Corymbia calophylla*	7	5	3	10.9	6.5	<1
KVMQ5-6	*Corymbia calophylla*	5	5	4	3.9	2.5	<1
KVMQ5-7	*Corymbia calophylla*	5	3	3	7.9	5.5	<1
KVMQ5-8	*Corymbia calophylla*	5	5	4	10	7.5	<1
KVMQ5-9	*Corymbia calophylla*	3	3	3	1.8	2.3	<1
KVMQ5-10	*Corymbia calophylla*	7	7	5	17.4	10.5	3
KVMQ5-11	*Corymbia calophylla*	7	7	4	21.3	8.5	3
KVMQ5-12	*Corymbia calophylla*	7	7	4	38.2	16	35
KVMQ5-13	*Corymbia calophylla*	7	7	4	11.9	9.5	1
KVMQ5-14	*Corymbia calophylla*	5	5	3	11.6	9.5	1
KVMQ5-15	*Corymbia calophylla*	7	5	3	38.6	11	5
KVMQ5-16	*Corymbia calophylla*	5	5	3	3.0	1.6	<1
COMMENTS							
General condition of trees: (stagging, insect attach etc.) Good, some trees have evidence of termites (5 – 15 heavy) Creek bed- damp							

Appendix III: Vegetation Quadrat Data Sheets (cont.)

Vegetation Health Assessment							
PROJECT DETAILS							
Client: MZI	Client #: 321-0				Date: 19/11/2021		
Project: Keysbrook	R/W Personnel: N.E. & D.S.						
QUADRAT DETAILS							
Site #:**KVMQ6**							
Location description: North corner horse paddock							
MGA coordinates: (50) 400 994 mE 640 5425 mN					Elevation (mAHD:)		
Conservation Category Wetland UFI No: 14472							
Topography: Drainage Line							
Soil: Sandy Loam							
Litter: 8 %	Bark: 1%	Branches: 1 %		Leaves: 6 %			
Vegetation Description: Low Forest of *Melaleuca preissiana* over open tall sedges of *Juncus pallidus* over open low grasses and weeds.							
Vegetation Condition:							
DRF/Priority Flora & Number of Plants: -							
Fire Age: -							
NOTES: (Dieback, Insect/Disease, Other of Interest)							
PHOTOGRAPHY							
Photo numbers:							
TAGGED TREES (10 X 10 m)							
Tag Number	Species	Crown Density	Dead Branches	Epicormic cover	DBH	Height (m)	% Cover
KVMQ6-1	*Melaleuca preissiana*	7	5	4	35.5, 22, 27.2		18
KVMQ6-2	*Melaleuca preissiana*	7	5	4	6.8, 5.3, 2.2	6.2	<1
Comments: General condition of trees: (stagging, insect attach etc.) Higher weed and native cover in understorey Soil damp in creekline Sheep grazing							

Appendix III: Vegetation Quadrat Data Sheets (cont.)

Vegetation Health Assessment							
PROJECT DETAILS							
Client: MZI	Client #: 321-0				Date: 19/11/2021		
Project: Keysbrook	R/W Personnel: N.E. & D.S.						
QUADRAT DETAILS							
Site #:**KVMQ9**							
Location description: On neighboring property to KVMQ8, on wetland edge							
MGA coordinates: (50) 395 383 mE 640 9416 mN					Elevation (mAHD:) 23		
Conservation Category Wetland UFI No: 14807 'Sumpland' "Conservation'							
Topography: Flat (very slight slope towards east)							
Litter (%)	Bark: %	Branches: %		Leaves: %			
Vegetation Description: *M. Pressiana* >30% cover over *Astartea scoparia* 10-30% up to 3 m over *Astartea scoparia* 40% 1-2 m over *Astartea scoparia* and weeds, over aquatic herbs (covering 80% of quadrat							
Vegetation Condition: Degraded							
DRF/Priority Flora & Number of Plants: 0							
Fire Age: long unburnt							
NOTES: (Dieback, Insect/Disease, Other of Interest)							
PHOTOGRAPHY							
Photo numbers:							
TAGGED TREES (10 X 10 m)							

Tag Number	Species	Crown Density	Dead Branches	Epicormic cover	DBH (cm)	Height (m)	% Cover
KVMQ9-1	*Melaleuca preissiana*	3	1	2	5.6	3.3	<1
KVMQ9-2	*Melaleuca preissiana*	5	7	4	14.7		1
KVMQ9-3	*Melaleuca preissiana*	5	3	3	35.9		3
KVMQ9-4	*Melaleuca preissiana*	5	3	5	12.2		
KVMQ9-5	*Melaleuca preissiana*	5	5	3	20.2		1.5 alive, 1.5 dead
KVMQ9-6	*Melaleuca preissiana*	Dead					
KVMQ9-7	*Melaleuca preissiana*	Dead					
KVMQ9-8	*Melaleuca preissiana*	Dead					
KVMQ9-9	*Melaleuca preissiana*	Dead					
KVMQ9-10	*Melaleuca preissiana*	3	2	3	6.1		<1

General condition of trees: (stagging, insect attach etc.)

Site under water

APPENDIX IV

Spring 2021 Photographic Monitoring Point Data Sheets

Appendix IV: Photographic Monitoring Point Data Sheets

Vegetation Health Assessment		
PROJECT DETAILS		
Client: Doral	Client #: 321-0	
Project: Keysbrook	R/W Personnel: N.E.	
Date: 18/10/2021	Time: 16:45	
SITE DETAILS		
MGA coordinates: (50) 399 668 mE 640 5447 mN		
Photographic Monitoring Point (PMP): **PMP09**		
Conservation Category Wetland UFI No: 14465		
Photographs Taken:		
Notes: Recently fenced off		
HEALTH ASSESSMENT		
Parameter	Description	Result
% Herbaceous Cover	Percentage of ground covered by native grasses and herbs (incl. sedges)	10%
% Weed Species	Percentage of ground covered by weeds	<1%
Recent Plant Deaths	Number of dead plants in quadrat (if any)	0
Plant Stress	Number of plants showing signs of stress (dead branches etc)	A few *Corymbia Calophylla* with epicormic growth
Insects	Evidence of insect pests on the trees and shrubs. Minor, Moderate or Severe	Moderate

Vegetation Health Assessment		
PROJECT DETAILS		
Client: Doral	Client #: 321-0	
Project: Keysbrook	R/W Personnel: N.E.	
Date: 19/11/2021	Time: 14:35	
SITE DETAILS		
MGA coordinates: (50) 399 465 mE 640 6091 mN		
Photographic Monitoring Point (PMP): **PMP10**		
Photographs Taken:		
Notes:		
HEALTH ASSESSMENT		
Parameter	Description	Result
% Herbaceous Cover	Percentage of ground covered by native grasses and herbs (incl. sedges)	0
% Weed Species	Percentage of ground covered by weeds	85%
Recent Plant Deaths	Number of dead plants in quadrat (if any)	0
Plant Stress	Number of plants showing signs of stress (dead branches etc)	0
Insects	Evidence of insect pests on the trees and shrubs. Minor, Moderate or Severe	Minor

Appendix IV: Photographic Monitoring Point Data Sheets (cont.)

Vegetation Health Assessment		
PROJECT DETAILS		
Client: Doral	Client #: 321-0	
Project: Keysbrook	R/W Personnel: N.E. & D.S.	
Date: 18/10/2021	Time: 16:15	
SITE DETAILS		
MGA coordinates: (50) 399 284 mE 640 6785 mN		
Photographic Monitoring Point (PMP): **PMP11**		
Photographs Taken:		
Notes:		
HEALTH ASSESSMENT		
Parameter	Description	Result
% Herbaceous Cover	Percentage of ground covered by native grasses and herbs (incl. sedges)	0
% Weed Species	Percentage of ground covered by weeds	90-95%
Recent Plant Deaths	Number of dead plants in quadrat (if any)	0
Plant Stress	Number of plants showing signs of stress (dead branches etc)	0
Insects	Evidence of insect pests on the trees and shrubs. Minor, Moderate or Severe	Minor

Vegetation Health Assessment			
PROJECT DETAILS			
Client: Doral	Client #: 321-0		
Project: Keysbrook	R/W Personnel: N.E. & D.S.		
Date: 19/11/2021	Time: 14:40		
SITE DETAILS			
MGA coordinates: (50) 395 259 mE	640 9064 mN	Elevation (mAHD): 34	
Photographic Monitoring Point (PMP): **PMP13**			
Conservation Category Wetland UFI No: 14807 'Sumpland' "Conservation'			
Photographs Taken:			
Notes: Conservation Category Wetland number 7028 Mostly under water			
HEALTH ASSESSMENT			
Parameter	Description	Result	
% Herbaceous Cover	Percentage of ground covered by native grasses and herbs (incl. sedges)	80% aquatic herbs	
% Weed Species	Percentage of ground covered by weeds	<1	
Recent Plant Deaths	Number of dead plants in quadrat (if any)	1 x *Corymbia calophylla* nearby	
Plant Stress	Number of plants showing signs of stress (dead branches etc)	Several Eucalyptus and Corymbia trees	
Insects	Evidence of insect pests on the trees and shrubs. Minor, Moderate or Severe	Moderate	