Appendix 3
Desktop assessment results (Parks and Wildlife 2007-, DotE 2015c)

NatureMap
Mapping Western Australia's biodiversity

URE15096.01_flora_3km

Created By Daniel Panickar on 11/05/2015

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115°49' 27" E,32°23' 07" S
Buffer	3km
Group By	Family

Family	Species	Records
Apiaceae	3	5
Araliaceae	3	5
Asparagaceae	3	3
Asteraceae	6	9
Campanulaceae	4	5
Casuarinaceae	1	1
Celastraceae	1	1
Centrolepidaceae	2	3
Colchicaceae	1	1
Commelinaceae	1	1
Crassulaceae	3	4
Cyperaceae	16	23
Dennstaedtiaceae	1	2
Dilleniaceae	1	1
Droseraceae	3	3
Ericaceae	4	6
Euphorbiaceae	1	2
Fabaceae	12	23
Geraniaceae	1	1
Goodeniaceae	3	4
Haemodoraceae	3	5
Haloragaceae	1	2
Hemerocallidaceae	1	1
Juncaceae	1	3
Lamiaceae	1	2
Lauraceae	1	2
Loganiaceae	1	1
Menyanthaceae	2	2
Myrtaceae	10	12
Orchidaceae	5	6
Orobanchaceae	1	1
Poaceae	8	8
Polygalaceae	1	1
Proteaceae	3	3
Ranunculaceae	1	2
Restionaceae	7	15
Rubiaceae	1	2
Scrophulariaceae	2	2
Selaginellaceae	1	1
Stylidiaceae	5	6
Thymelaeaceae	2	2
TOTAL	**128**	**182**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Apiaceae					
1.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
2.	6222	*Homalosciadium homalocarpum*			
3.	6289	*Xanthosia huegelii*			
Araliaceae					
4.	6229	*Hydrocotyle diantha*			
5.	19041	*Trachymene coerulea subsp. coerulea*			
6.	6280	*Trachymene pilosa (Native Parsnip)*			
Asparagaceae					
7.	1231	*Lomandra maritima*			
8.	14542	*Lomandra micrantha subsp. micrantha*			
9.	1318	*Thysanotus arbuscula*			
Asteraceae					
10.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
11.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
12.	8175	*Podolepis gracilis (Slender Podolepis)*			
13.	8182	*Podotheca angustifolia (Sticky Longheads)*			
14.	8224	*Siloxerus filifolius*			
15.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
Campanulaceae					
16.	9289	*Lobelia anceps (Angled Lobelia)*			
17.	7408	*Lobelia tenuior (Slender Lobelia)*			
18.	37440	*Monopsis debilis var. depressa*	Y		
19.	7389	*Wahlenbergia preissii*			
Casuarinaceae					
20.	1742	*Casuarina obesa (Swamp Sheoak, Kuli)*			
Celastraceae					
21.	4733	*Stackhousia monogyna*			
Centrolepidaceae					
22.	1117	*Aphelia cyperoides*			
23.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
Colchicaceae					
24.	1383	*Burchardia bairdiae*			
Commelinaceae					
25.	1162	*Cartonema philydroides*			
Crassulaceae					
26.	3137	*Crassula colorata (Dense Stonecrop)*			
27.	3140	*Crassula glomerata*	Y		
28.	15706	*Crassula natans var. minus*	Y		
Cyperaceae					
29.	741	*Baumea articulata (Jointed Rush)*			
30.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
31.	763	*Chorizandra enodis (Black Bristlerush)*			
32.	768	*Cyathochaeta avenacea*			
33.	783	*Cyperus congestus (Dense Flat-sedge)*	Y		
34.	20200	*Isolepis cernua var. setiformis*			
35.	917	*Isolepis marginata (Coarse Club-rush)*			
36.	921	*Isolepis producta*			
37.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
38.	940	*Lepidosperma pubisquameum*			
39.	945	*Lepidosperma squamatum*			
40.	955	*Mesomelaena pseudostygia*			
41.	980	*Schoenus capillifolius*		P3	
42.	986	*Schoenus efoliatus*			
43.	1018	*Schoenus subfascicularis*			
44.	1036	*Tetraria octandra*			
Dennstaedtiaceae					
45.	13758	*Histiopteris incisa*			
Dilleniaceae					
46.	5172	*Hibbertia stellaris (Orange Stars)*			
Droseraceae					
47.	3106	*Drosera macrantha (Bridal Rainbow)*			
48.	3114	*Drosera nitidula (Shining Sundew)*			
49.	3131	*Drosera stolonifera (Leafy Sundew)*			
Ericaceae					
50.	6323	*Astroloma ciliatum (Candle Cranberry)*			
51.	30142	*Brachyloma preissii subsp. obtusifolium*			
52.	30136	*Brachyloma preissii subsp. preissii*			
53.	6349	*Conostephium preissii*			
Euphorbiaceae					
54.	4582	*Adriana quadripartita (Bitter Bush)*			
Fabaceae					
55.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
56.	3688	*Aotus gracillima*			
57.	3845	*Daviesia triflora*			
58.	3863	*Dillwynia dillwynioides*		P3	
59.	3880	*Eutaxia virgata*			
60.	20473	*Gastrolobium ebracteolatum*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
61.	10909	*Gompholobium confertum*			
62.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
63.	8564	*Lotus subbiflorus*	Y		
64.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
65.	4292	*Trifolium campestre (Hop Clover)*	Y		
66.	4295	*Trifolium dubium (Suckling Clover)*	Y		
Geraniaceae					
67.	4341	*Geranium solanderi (Native Geranium)*			
Goodeniaceae					
68.	7484	*Dampiera trigona (Angled-stem Dampiera)*			
69.	7538	*Goodenia pulchella*			
70.	7603	*Scaevola canescens (Grey Scaevola)*			
Haemodoraceae					
71.	11826	*Conostylis aculeata subsp. aculeata*			
72.	1472	*Haemodorum simplex*			
73.	1478	*Phlebocarya ciliata*			
Haloragaceae					
74.	34676	*Meionectes brownii (Swamp Raspwort)*			
Hemerocallidaceae					
75.	1276	*Caesia micrantha (Pale Grass Lily)*			
Juncaceae					
76.	1188	*Juncus pallidus (Pale Rush)*			
Lamiaceae					
77.	6886	*Mentha x piperita*	Y		Y
Lauraceae					
78.	11799	*Cassytha racemosa forma racemosa*			
Loganiaceae					
79.	16177	*Phyllangium paradoxum*			
Menyanthaceae					
80.	36160	*Liparophyllum capitatum*			
81.	36179	*Liparophyllum violifolium*			
Myrtaceae					
82.	20283	*Astartea scoparia*			
83.	5439	*Calytrix angulata (Yellow Starflower)*			
84.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
85.	20808	*Eucalyptus petiolaris*	Y		
86.	13273	*Melaleuca incana subsp. incana*			
87.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
88.	5952	*Melaleuca preissiana (Moonah)*			
89.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
90.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
91.	20135	*Taxandria linearifolia*			
Orchidaceae					
92.	15330	*Caladenia arenicola*			
93.	15419	*Microtis media subsp. media*			
94.	1660	*Microtis orbicularis (Dark Mignonette Orchid)*			
95.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
96.	1708	*Thelymitra fuscolutea (Chestnut Sun Orchid)*			
Orobanchaceae					
97.	15037	*Bartsia trixago*	Y		
Poaceae					
98.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
99.	17234	*Austrostipa compressa*			
100.	17240	*Austrostipa flavescens*			
101.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
102.	476	*Lolium perenne (Perennial Ryegrass)*	Y		
103.	11073	*Lolium x hybridum*	Y		
104.	635	*Sporobolus virginicus (Marine Couch)*			
105.	33101	*Vulpia myuros forma myuros*	Y		
Polygalaceae					
106.	4564	*Comesperma virgatum (Milkwort)*			
Proteaceae					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
107.	1834	*Banksia menziesii (Firewood Banksia)*			
108.	2197	*Hakea prostrata (Harsh Hakea)*			
109.	2329	*Synaphea spinulosa*			
Ranunculaceae					
110.	2938	*Ranunculus trilobus (Buttercup)*	Y		
Restionaceae					
111.	17691	*Desmocladus fasciculatus*			
112.	16595	*Desmocladus flexuosus*			
113.	17838	*Dielsia stenostachya*			
114.	17841	*Hypolaena pubescens*			
115.	1085	*Lepyrodia glauca*			
116.	17679	*Meeboldina coangustata*			
117.	17694	*Meeboldina scariosa*			
Rubiaceae					
118.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
Scrophulariaceae					
119.	7054	*Dischisma arenarium*	Y		
120.	7055	*Dischisma capitatum (Woolly-headed Dischisma)*	Y		
Selaginellaceae					
121.	6	*Selaginella gracillima (Tiny Clubmoss)*			
Stylidiaceae					
122.	7677	*Levenhookia stipitata (Common Stylewort)*			
123.	7712	*Stylidium despectum (Dwarf Triggerplant)*			
124.	7717	*Stylidium divaricatum (Daddy-long-legs)*			
125.	7756	*Stylidium longitubum (Jumping Jacks)*		P3	
126.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
Thymelaeaceae					
127.	5252	*Pimelea lanata*			
128.	18117	*Pimelea rosea subsp. rosea*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Australian Government
Department of the Environment

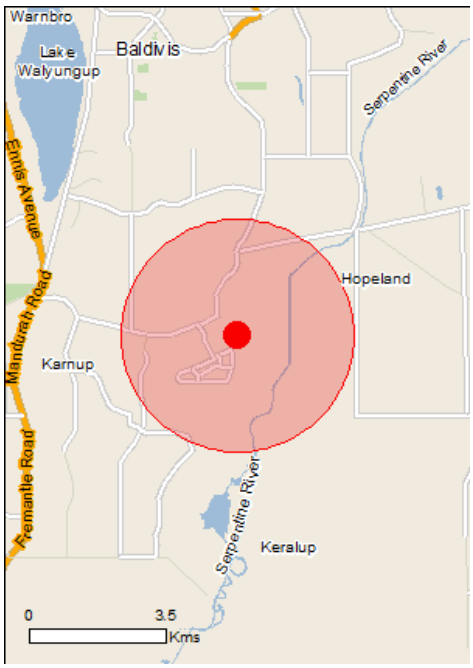
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

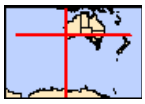
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/05/15 13:12:47



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 3.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Peel-yalgorup system	Upstream from Ramsar

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Pandion cristatus Eastern Osprey [82411]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		

Name	Status	Type of Presence
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.39 115.82286

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 4
Conservation significant flora and ecological community definitions

Conservation Codes for Western Australia (Western Australian Herbarium 1998-)

Under the *Wildlife Conservation Act* (1950), the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

Species which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List Criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild
- X: Presumed Extinct Flora (Declared Rare Flora – Extinct).

Species that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).

Priority Flora

Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Priority One: Poorly-known Species

Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Two: Poorly-known Species

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Three: Poorly-known Species

Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

Priority Four: Rare, Near Threatened and other species in need of monitoring

1. Rare: Species that are considered to be have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
2. Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Priority 5: Conservation Dependent Species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within 5 years.

Definition of Threatened Ecological Communities (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies:

- records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- all occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria:

1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:
   (a) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
   (b) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
2. Current distribution is limited, and one or more of the following apply:
   (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
   (b) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
   (c) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
3. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:
   (a) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
   (b) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

2. Current distribution is limited, and one or more of the following apply"
   (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
   (b) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
   (c) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
3. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
2. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
3. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2010)

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

1. Rare.Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
2. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 5
Vascular plant taxa recorded within the Survey area

Family	Species
Aizoaceae	*Carpobrotus edulis*
Anarthriaceae	*Lyginia barbata*
Asteraceae	*Conyza sumatrensis*
	Hypochaeris glabra
	Lagenophora huegelii
	Olearia axillaris
Casuarinaceae	*Allocasuarina fraseriana*
Colchicaceae	*Burchardia congesta*
Cyperaceae	*Ficinia nodosa*
	Lepidosperma pubisquameum
	Tetraria octandra
Dasypogonaceae	*Dasypogon bromeliifolius*
Dilleniaceae	*Hibbertia hypericoides*
Ericaceae	*Brachyloma preissii*
	Conostephium pendulum
Fabaceae	*Acacia pulchella* var. *glaberrima*
	Acacia saligna
	Acacia stenoptera
	Daviesia triflora
	Gompholobium tomentosum
	Jacksonia furcellata
	Jacksonia sternbergiana
	Kennedia prostrata
Goodeniaceae	*Dampiera linearis*
	Lechenaultia biloba
Haemodoraceae	*Conostylis aculeata* subsp. *aculeata*
	Phlebocarya ciliata
Iridaceae	*Patersonia occidentalis*
Lamiaceae	*Hemiandra pungens*
Myrtaceae	*Corymbia calophylla*
	Eucalyptus marginata
	Eucalyptus rudis
	Eucalyptus sp. (planted)
	Kunzea glabrescens
	Regelia ciliata
Poaceae	*Briza maxima*
	Eragrostis curvula
	Lagurus ovatus
	Poaceae sp.
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*
	Banksia attenuata
	Banksia menziesii
	Banksia sessilis
	Xylomelum occidentale
Restionaceae	*Desmocladus flexuosus*
Stylidiaceae	*Stylidium* sp.
Zamiaceae	*Macrozamia fraseri*

Appendix 2
Mine Closure Plan

Karnup Sand Mining Project

Mine Closure Plan: Urban Resources Pty Ltd M70/1262

Prepared for
Urban Resources
by Strategen

June 2015

STRATEGEN
environmental consultants

Karnup Sand Mining Project

Mine Closure Plan: Urban Resources Pty Ltd M70/1262

Company: Urban Resources Pty Ltd
Contact: Stephen Elliot (Manager)
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Document ID: URE15096_01 R001 Rev 0
Submission date: 30 June 2015
Mineral Field: South West

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ACN: 056 190 419

June 2015

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consulting Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Client: Urban Resources

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	For client review	D White, N Zago, E Congear / D Newsome	Electronic	9 June 2015
Final Report	0	For submission to DMP	E Congear / D Newsome	Electronic	30 June 2015

Filename: URE15096_01 R001 Rev 0 - 30 June 2015

Mine closure plan checklist

DMP has prepared a checklist for a Mine Closure Plan designed to ensure the proponent has submitted the required information. This will enable an efficient and accurate assessment without the need for the assessing officer to seek further information or clarification.

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
1	Has the checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of Checklist)	Y	Checklist page 2				
Public availability							
2	Are you aware that from 2015 all MCPs will be made publicly available?	Y					
3	Is there any information in this MCP that should not be publicly available?	N					
4	If "Yes" to Q3, has confidential information been submitted in a separate document/ section?						
Cover Page, Table of Contents							
5	Does the cover page include; • project title • company name • contact details (including telephone and email addresses) • document ID and version number • date of submission (needs to match the date of this checklist)	Y	Fly leaf				
Scope and Purpose							
6	State why the MCP is submitted (e.g. as part of a Mining Proposal, a reviewed MCP or to fulfil other legal requirements)			As part of the Mining Proposal			

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
Project Overview							
7	Does the project summary include: • land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land/ reserve [including surrounding land] is being managed) • location of the project • comprehensive site plan(s) • background information on the history and status of the project.	Y	Section 2.1				
Legal Obligations and Commitments							
8	Does the MCP include a consolidated summary or register of closure obligations and commitments?	Y	Section 3				
Stakeholder Engagement							
9	Have all stakeholders involved in closure been identified?	Y	Section 4				
10	Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?	Y	Section 4				
11	Does the MCP include a stakeholder consultation strategy to be implemented in the future?	Y	Section 4				
Post-mining land use(s) and Closure Objectives							
12	Does the MCP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram?	Y	Section 5				

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post-mining land use (including contaminated sites)?	Y	Section 5				
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the mine, been reported to DER as required under the *Contaminated Sites Act 2003*?	N					
Development of Completion Criteria							
15	Does the MCP include a set of specific closure criteria and / closure performance indicators?	Y	Section 6				
Collection and Analysis of Closure Data							
16	Does the MCP include baseline data (including pre-mining studies and environmental data)?	Y	Section 7.1				
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?	Y	Section 7.2.5				
18	Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites?	-	-				
19	Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)?	Y	Section 8				
20	Does the MCP include information relevant to mine closure for each domain or feature?	Y	Section 8				

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
Identification and Management of Closure Issues							
21	Does the MCP include a gap analysis/risk assessment to determine if further information is required in relation to closure of each domain or feature?	Y	Section 8, Appendix 1				
22	Does the MCP include the process, methodology, and has the rationale been provided to justify identification and management of the issues?	Y	Section 8				
Closure Implementation							
23	Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	Section 9				
24	Does the MCP include a closure work program for each domain or feature?	Y	Section 9.4				
25	Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?	Y	Section 2.1				
26	Does the MCP contain a schedule of research and trial activities?	Y	Section 9.4				
27	Does the MCP contain a schedule of progressive rehabilitation activities?	Y	Section 9.4				
28	Does the MCP include details of how unexpected closure and care and maintenance will be handled?	Y	Section 9.4				
29	Does the MCP contain a schedule of decommissioning activities?	Y	Section 9.4				
30	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?	Y	Section 9.4, Section 10				

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
Closure Monitoring and Maintenance							
31	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	Section 10				
Financial Provision for Closure							
32	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	Section 11				
33	Does the MCP include a process to regular review of the financial provision?	Y	Section 11				
Management of Information and Data							
34	Does the mine closure plan contain a description of management strategies including systems, and processes for the retention of mine records?	Y	Section 11				

Corporate Endorsement:

I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Director General of the Department of Mines and Petroleum.

Name: STEPHEN ELLIOTT Signed: SElliott

Position: DIRECTOR Date: 30/6/2015

(NB: The corporate endorsement must be given by tenement holder(s) or a senior representative authorised by the tenement holder(s), such as a Registered Manager or Company Director).

Table of contents

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1. Introduction

Urban Resources Pty Ltd (Urban Resources) proposes to operate the Karnup Sand Mining Project (the Project) on (pending) Mining Tenement M70/1262, located approximately 48 km south of Perth, Western Australia (Figure 1-1). Mining Tenement M70/1262 is currently held by Eclipse Resources Pty Ltd (Eclipse); however, Urban Resources propose to mine within the tenement as part of a sub-lease arrangement. The sand will be used predominantly in the construction industry.

The Project involves the mining of sand from 41.96 ha of the site to remove approximately 1 553 800 m^3 of sand over a 5 year period. The Project area will be mined down to 4.2 – 4.5 m AHD, 1.2 m above assessment groundwater level (AGL). Urban Resources will rehabilitate the land to a form suitable for the future land use as proposed by LandCorp, primarily parks and recreation with several protected wetlands and potentially some areas of urban development.

1.1 Scope and purpose of document

This plan has been prepared to comply with the provisions of the *Mining Act 1978.* It has been prepared in accordance with the *Strategic Framework for Mine Closure* (ANZMEC & MCA 2000) and conforms to the structure and content requirements outlined in *Guidelines for Preparing Mine Closure Plans* (DMP & EPA 2015). The planning content is based on *Leading Practice Sustainable Development in Mining* handbooks and *Planning for Integrated Mine Closure: Toolkit* (ICMM 2008).

This plan addresses the following aspects and is structured accordingly:

1. Summary of the Project (Section 2).
2. Identification of closure obligations and commitments (Section 3).
3. Collection and analysis of closure data, including a directory of existing baseline data (Section 5).
4. Stakeholder consultation (Section 4).
5. Post-mining land use and closure objectives (Section 5).
6. Identification and management of closure issues (Section 8).
7. Development of completion criteria (Section 6).
8. Financial provisioning processes (Section 11).
9. Closure implementation, including unexpected closure (Sections 9 and 9.4).
10. Closure monitoring and maintenance (Section 10).
11. Information management and reporting (Section 11).

This plan has been prepared to accompany a Mining Proposal for the Karnup Sand Mining Project, as required for submission to the Department of Mines and Petroleum (DMP) under the provisions of the *Mining Act 1978*. The plan has been prepared based on the information available at the time of writing. The plan will be progressively amended during the life of the project through regular reviews, as more information becomes available, or if circumstances relating to mine closure change.

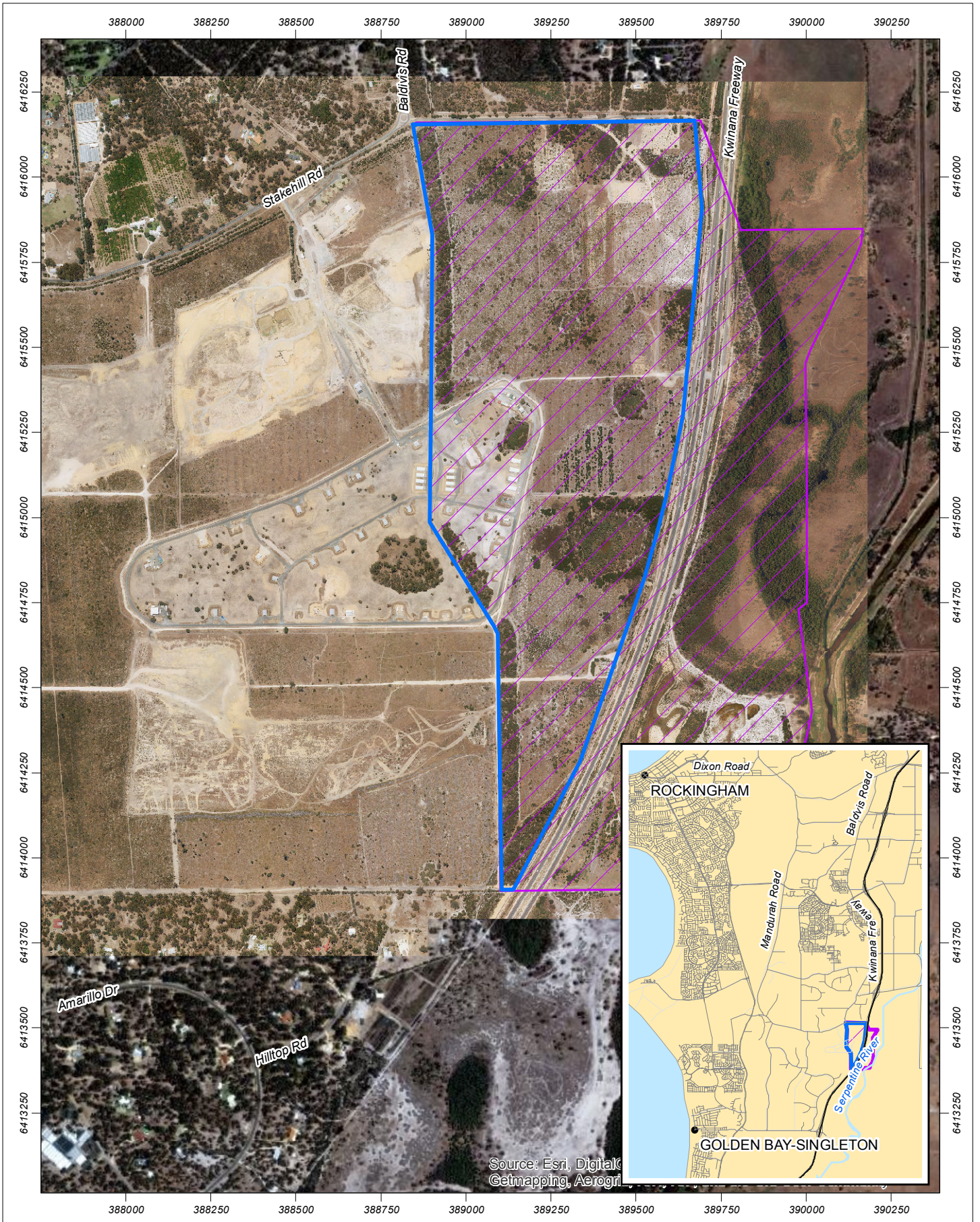

Figure 1-1: Regional location of the Project

Scale 1:15,000 at A4

0 100 200 300 400 500 m

N

Legend

- Project area
- Tenement M70/1262

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 5/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Aerial image background: ESRI approx. 2010.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R001\RevA\URE15096_01_R001_RevA_F001_1.mxd

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2. Project summary

2.1 Project location, land ownership and tenure

The Karnup Sand Mining Project is located in the City of Rockingham approximately 48 km south of Perth (Figure 1-1). The Project is located 14 km south east of Rockingham and 18 km north east of Mandurah. The Project area is defined as the portion of M70/1262 that is west of the Kwinana Freeway boundary, as outlined by Figure 2-1, and will include the mining area, haul road (located within Miscellaneous Tenement L70/160), site compound and undisturbed land. The Project area is located within the City of Rockingham.

The Project area comprises predominately regrowth vegetation and six small wetlands. The majority of the Project area was cleared and planted with pine trees between 1965 and 1974 before the pine trees were cleared after 2004. Wetlands located within the Project area are ephemeral sumplands (i.e. only seasonally inundated) and include both Resource Enhancement and Conservation Category wetlands as determined by the Department of Environment Regulation (DER) (Strategen 2010), and will not be mined.

A portion of the Project area is a vegetated linear corridor on the western boundary of the Project area, and is an area of remnant bushland that includes foraging habitat for Black Cockatoos.

The central portion of the Project area also contains part of the DMP Explosive Reserve Facility adjacent to the western Project area boundary. A portion of the Explosive Reserve Facility is contained within M70/1262 and the balance is located to the west of the Project area on M70/1046 (currently held by Holcim Australia Pty Ltd [Holcim]) and M70/1241 (currently held by Holcim). The Explosives Facility will be relocated at the end of 2016 to the McLarty Site within the Myalup State Forest Shire of Waroona and Shire of Harvey. Sand mining will be undertaken within the Explosives Reserve Facility area once it is decommissioned and removed.

M70/1262 is dissected by the Kwinana Freeway, forming the eastern Project area boundary. The surrounding land use is a combination of low density rural residential housing, market gardens and special rural lots that include activities such as horse agistment. A pedestrian underpass was also constructed under the Kwinana Freeway approximately 50 m south of the northern Project area boundary (Eclipse Resources 2009).

Mining tenements relevant to the Project are listed in Table 2-1 and presented in map form in Figure 2-2.

Table 2-1: Status of mining tenements

Tenement ID	Tenement name	Tenement area (ha)	Type	Owner
M70/1262	Eclipse Resources Pty Ltd	225 ha	Mining	Eclipse Resources Pty Ltd
L70/160	Holcim Australia Pty Ltd	1.9 ha	Miscellaneous	Holcim Australia Pty Ltd

The types of disturbance to occur on the site will include:

- excavation of sand
- construction of haul roads and access roads
- site compound
  - offices
  - ablutions
  - laydown/hardstand areas
  - generator and storage
- overburden and vegetative stockpiles.

Figure 2-2 presents the locations of the various types of disturbance to occur across the site.

The site and postal addresses are:

Site address:	Stakehill Road Baldivis WA 6171
Postal address:	c/- PO Box 739, Como, Western Australia 6152

The Project comprises the following major components:

- haul road and access tracks
- site compound area
- mining area.

The proposed mining area is adjacent to the western Project area boundary. A haul road will traverse the Project area from the active mining areas to Stakehill Road during Stage 1. Once Stage 1 is completed Holcim will construct a haul road within Miscellaneous Licence tenement L70/160 for use by both Holcim and Urban Resources staff and customers. Urban Resources will extend the haul road at an undefined time in the future to access and transport sand from Stages 2 and 3.

The site compound area will be comprised of limestone hardstand and include the following infrastructure:

- site office and administration
- generator and storage
- refuelling pad and equipment storage.

As stated above, mining will be undertaken in areas of regrowth vegetation, vegetation on the western boundary of the Project area and the decommissioned Explosive Reserve Facility area.

For the purpose of closure planning, the site has been grouped into domains to enable better management and prioritisation of works going forward. The Project includes the following key domains:

- infrastructure and ancillary areas
- mining area (in previously cleared and decommissioned explosives area)
- mining area (western boundary of the Project area to be potentially revegetated to Black Cockatoo foraging habitat—to be confirmed at a later date following discussions with LandCorp).

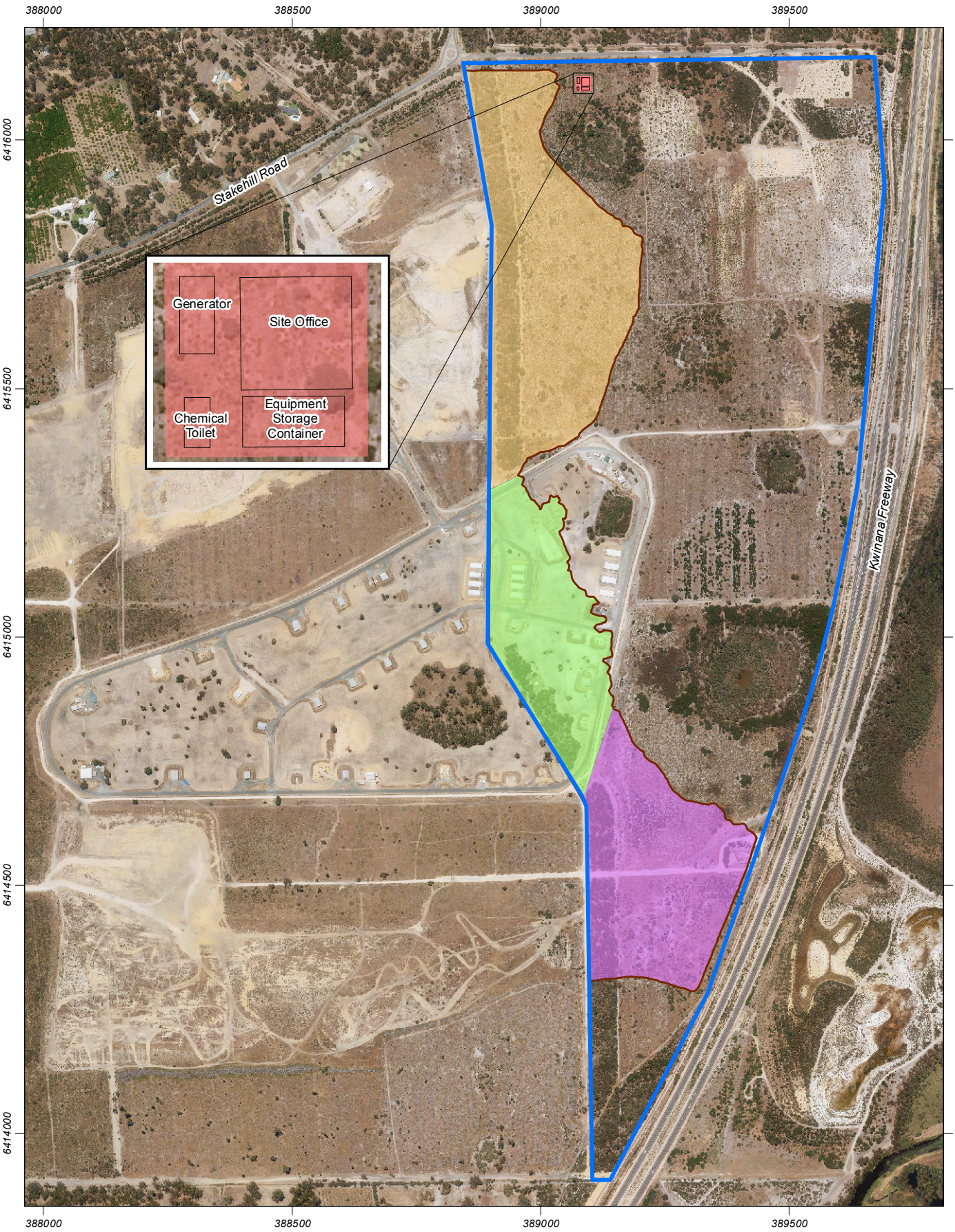

Figure 2-1: Site plan – general layout

Scale 1:10,500 at A4

0 50 100 150 200 250 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 5/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Tenement: DMP 2014.

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Legend

- Site compound boundary
- Project area
- Mine area

Mining stages

- Stage 1
- Stage 2
- Stage 3

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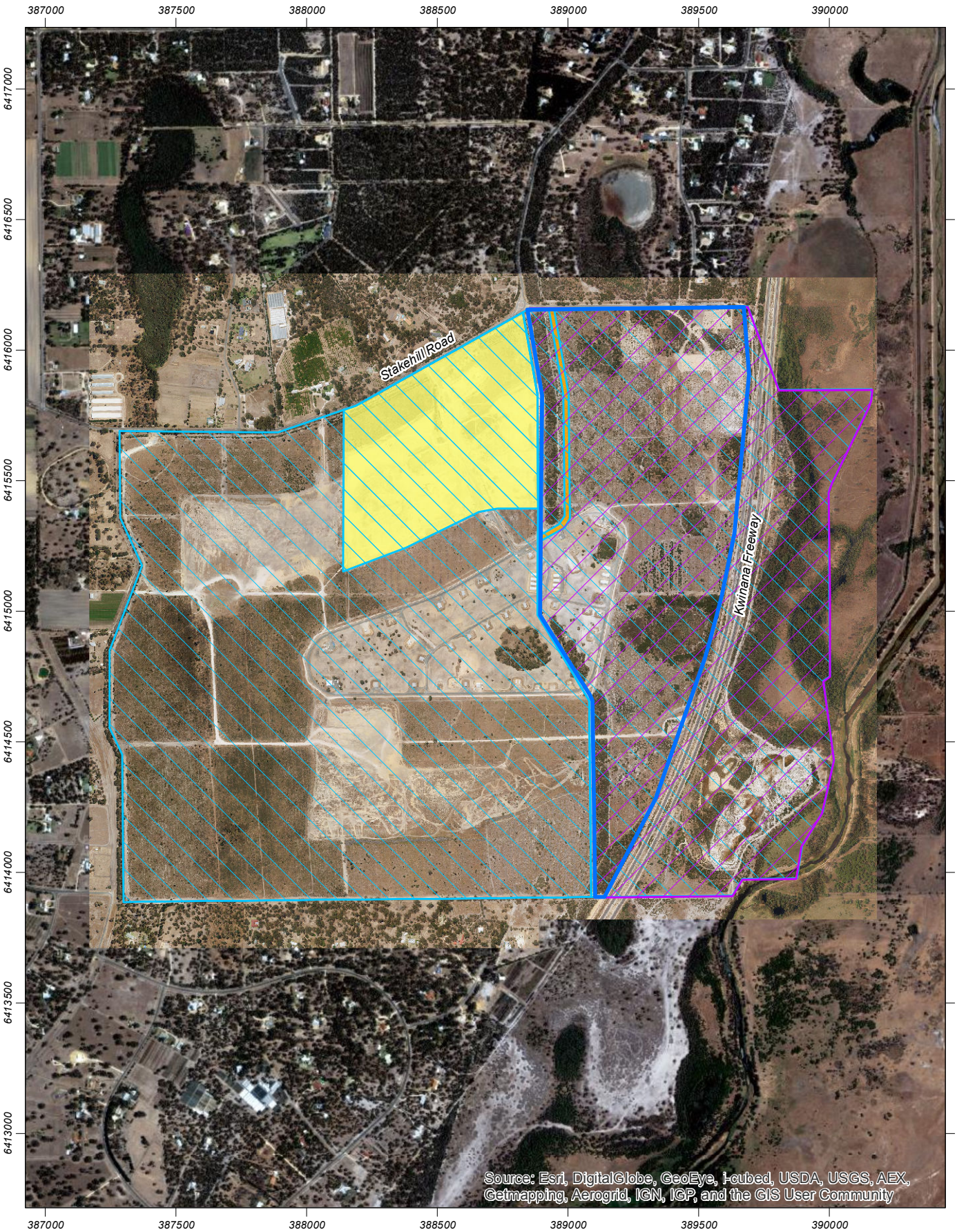

Figure 2-2: Mining tenements and disturbance types

Scale 1:20,000 at A4

0 100 200 300 400 500 m

N

Legend

Project area

Tenements

M70/1262

M70/1241

L 70/160

M 70/1046

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 5/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Tenement: DMP 2014.

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3. Identification of closure obligations and commitments

3.1 Legal obligations register

No legal obligations are established for the tenement or the Project to date. Permits are currently being sought for the project and the legal obligations will be updated into a register as they become available.

Urban Resources will develop the legal obligations register to record all site-specific conditions and commitments relevant to closure and rehabilitation. The register will include, when available, all legally binding conditions and commitments and/or legal obligations applicable under relevant State and Federal legislation. The Register will include safety obligations and non-legally binding commitments relevant to closure and rehabilitation.

Future revisions of closure objectives and completion criteria as described in this plan will be informed by the commitments and conditions.

4. Stakeholder consultation

4.1 Stakeholder consultation program

Stakeholder consultation has been undertaken by Urban Resources with respect to closure planning, with the objectives of:

- identifying relevant internal and external stakeholders
- identifying stakeholder issues, expectations and concerns
- enabling development of closure measures aligned to meeting reasonable stakeholder expectations
- assessing stakeholder issues and areas of concerns to ensure closure planning addresses these matters to the most reasonably practicable extent
- establishing collaborative relationships with stakeholders to assist with managing closure related expectations
- obtaining stakeholder feedback on proposed closure measures
- establishing a robust consultation approach to demonstrate that appropriate and effective consultation has been undertaken.

The consultation program was initiated in Q1 2015 that allowed Urban Resources to inform stakeholders on details of the project and to enable stakeholder comments to be considered in the preliminary engineering design. This provided the opportunity to modify the project in response to the issues raised and to consider these issues in the approvals process. Stakeholders have been engaged throughout development of this plan, and an ongoing dialogue will be maintained with stakeholders as the project progresses towards closure.

4.2 Identification of key stakeholders

Key external stakeholders consulted during preparation of this MCP include:

- City of Rockingham
- Department of Mines and Petroleum
- Department of Water
- Department of Parks and Wildlife
- LandCorp
- Holcim.

Key internal stakeholders consulted as part of the MCP preparation and planning include:

- Mine Manager
- Mine supervisor.

4.3 Stakeholder consultation register

The consultation program has included briefings with key stakeholders including an opportunity to comment on the proposed mining activities, particularly in relation to final land use.

Stakeholder consultation is presented in Table 4-1.

Table 4-1: Stakeholder consultation

Stakeholder Engagement Register 2015					
Date	Description of engagement	Stakeholder	Stakeholder comments / issue	Proponent response and/or resolution	Stakeholder response
18 May 2015	Meeting at City of Rockingham offices	City of Rockingham	Final land use Groundwater levels and final finished levels	Strategen to provide additional information as requested	Additional information relating to impacts on flora and fauna requested (Strategen survey report). The City to seek further information from the executive team once the proposed mine plan was finalised.
23 March 2015	Email correspondence	DMP	Final land use Groundwater levels and final finished levels	-	-
16 April 2015	Meeting at LandCorp offices	LandCorp	Final land use Groundwater levels and final finished levels Mining Agreement	Provide final mine plan and Mining Proposal to LandCorp for review / endorsement	Agreement on challenging final groundwater levels. Confirmation of proposed final land-use. Proposed schedule for presentation of proposed mine plan and submission of approvals document.s

A consultation register is maintained by Urban Resources and proposes to continue consultation on closure issues with relevant stakeholders as project implementation progresses and the register will be updated accordingly and published in future amendments of this plan. This forms part of an overall consultation strategy designed to ensure all parties maintain communication on closure issues as planning develops and the measures become more defined.

4.4 Stakeholder engagement strategy

Urban Resources will continue to implement the stakeholder consultation program throughout project planning, implementation and when closure and rehabilitation activities are in the near future. The program will be implemented to ensure that engagement of stakeholders is undertaken and maintained throughout operations, and that the interests and concerns of key stakeholders have been considered.

The program will be rolled out to key stakeholders and other interested parties as the Project progresses. Urban Resources will consult with stakeholders through meetings, briefings and phone conversations as required.

5. Post-mining land use and closure objectives

5.1 Post mining land use

Urban Resources proposes to develop agreed final landforms and post-mining land use(s) consistent with stakeholder expectations. The overall post-mining land use is expected to be zoned as Parks and Recreation to support the adjacent proposed LandCorp residential development. The area will contain open parklands with potentially a vegetated corridor on the western boundary of the Project area which will focus on providing food resources for Black Cockatoos. However, as closure planning is in its early phase, this expectation is provisional, and may be modified as planning progresses, including further consultation with key stakeholders. The key considerations will align to ensuring the post-mining land use is:

1. Relevant to the environment in which the mine will operate.
2. Achievable in the context of post-mining land capability.
3. Acceptable to key stakeholders.
4. Ecologically sustainable in the context of the local and regional environment.

The land use hierarchy as presented in the mine closure planning guidelines (DMP/EPA 2015) will provide a guide to determine post-mining land use(s) as follows:

1. "Natural" ecosystems will be reinstated as similar as possible to the original ecosystem.
2. An alternative land use with higher beneficial uses than the pre-mining land use will be developed.
3. The pre-mining land use will be reinstated.
4. An alternative land use will be developed with beneficial uses other than the pre-mining land use.

5.2 Closure planning objectives

The ANZMEC Strategic Framework on Mine Closure (ANZMEC 2000) advises that the objective of mine closure is to "*prevent or minimise adverse long-term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land-use based on an agreed set of objectives*."

Urban Resources has adopted this principle as the closure planning objective for the Karnup Sand Mining Project.

Specific closure objectives for key closure outcomes have been developed in accordance with these broad objectives and are presented in Section 6.

6. Development of completion criteria

Completion criteria and associated performance indicators have been developed to define measureable rehabilitation and mine closure objectives. Completion criteria are effectively defined by EPA (2006) as "*Specific targets (defined by measured outcomes or milestones) are required for monitoring and reporting of rehabilitation projects*."

Given the early stage of project implementation and closure planning, the completion criteria presented in this plan are indicative, based on a conservative estimate of closure performance and on the best available data. As project implementation proceeds, more information will become available and more comprehensive and detailed completion criteria will be progressively determined. This will be documented in amended plans following the three-yearly reviews required by the DMP/EPA (2015) guidelines.

Completion criteria as currently proposed for the Karnup Sand Mining Project are presented in Table 6-1. Table 6-1 presents objectives and criteria relevant to the key domains as well as general closure aspects.

The objectives and criteria presented with respect to the various domains take account of the potential post-closure land uses that might apply to each domain.

Table 6-1: Completion criteria for key domains

Aspect	Closure objective	Completion Criteria	Measurement Tools
Key domains			
Infrastructure	To ensure that all infrastructure not required to remain post-closure is removed, reused or recycled in accordance with approval requirements.	All infrastructure (including barriers, tracks, buildings and signs) to be removed unless retention is agreed in writing with relevant Government agencies and the local Shire.	Verification from Government agencies.
Mine area	To design and build a safe and stable mine area that can be integrated into surrounding areas.	All sites to be safe to access as determined by DMP. Any overburden/topsoil/vegetative material stockpiles will backfilled into mine void or respread on site.	Geotechnical investigations and audit. Soil monitoring.
	Topography and surface drainage are consistent with, and complementary to the overall landscape.	All constructed landforms and disturbed areas are to be stable and resistant to erosion, or at least comparable to naturally-occurring erosion in the area.	
		Drainage should be consistent with LandCorp's requirements for future land use.	
	The western boundary of the project area is to be revegetated to establish native vegetation suitable for Black Cockatoo foraging, and appropriate for the area and final land use.*	Flora and vegetation on the rehabilitated site is representative of the target ecosystem as defined by species richness, diversity, and density, weed species number and weed density targets to be developed.	Rehabilitation monitoring report.
General aspects			
Land use	To ensure that an agreed post-mining land use exists and has been communicated to all relevant stakeholders.	Land use and access agreements have been/will be finalised with LandCorp and conveyed to key stakeholders.	Verification from key stakeholders.
Contamination	To ensure that there is no significant contamination or risk of contamination to the existing soils and water resources of the project area.	No contaminated sites (as defined by the *Contaminated Sites Act 2003*) requiring ongoing management beyond five years post-closure.	Contaminated sites inspections/ audits over LOM area. Final DER audit.
Topsoil	Maximise recovery and maintain quality of topsoil, and utilise direct return where practicable, to conserve soil structure, nutrients, seed, and soil biota.	Topsoil sources are appropriately utilised in rehabilitation and closure activities.	Rehabilitation progress reported in the Annual Environmental Report.
Fauna	Western boundary rehabilitated areas will provide fauna habitat and facilitate movement of fauna between rehabilitated areas and remnant vegetation.*	Key fauna habitat characteristics are present in rehabilitation, including vegetation structure, a diversity of flowering species and a developing litter layer.	Fauna habitat assessments. Flora and vegetation quadrat monitoring.
Wetlands	To ensure wetlands are maintained consistent with the pre-mining condition.	No disturbance within wetland buffer areas. Visual wetland monitoring shows no evidence of decreased wetland function.	Visual wetland monitoring.
Legal	To ensure that there is a low risk of occurrence of significant breaches of legal obligations and commitments following closure of the project.	Develop Mine Closure Plan consistent with DMP/EPA guidelines, updating every three years. Undertake stakeholder consultation throughout operations. Implement Mine Closure Plan.	Mine Closure Plan.

Aspect	Closure objective	Completion Criteria	Measurement Tools
Public health/ safety	Minimise hazards (including stability, subsidence) during rehabilitation and after closure.	Buildings and signage are removed. Excavations are filled. Mine voids are securely demarcated. Fencing and signage is erected regarding any residual safety issues. Rubbish is removed from the site, or encapsulated within waste rock dumps and landfills (if environmentally appropriate to do so).	Final risk assessment.
Visual amenity	To achieve rehabilitation and revegetation results that are compatible with the immediate and surrounding landscape.	Final landform will integrate with the surrounding landscape, as defined by design specifications to be developed.	Final landform audit with visual assessment.

* These objectives to be confirmed following future discussion and agreement with LandCorp on final land use of the western boundary.

7. Collection and analysis of closure data

This section of the plan provides:

- a summary of the most up-to-date available data on aspects of the physical and biological environment of the Project areas and surrounds, including chemical characterisation of mine materials
- an overview of the role of this plan regarding identification of information gaps and collection of new information to fill those gaps
- repositories of operational information such as spatial datasets and scheduling information.

Baseline and predictive assessments conducted to date are summarised below. This section presents available information and identifies where additional information will be collected throughout implementation of the project.

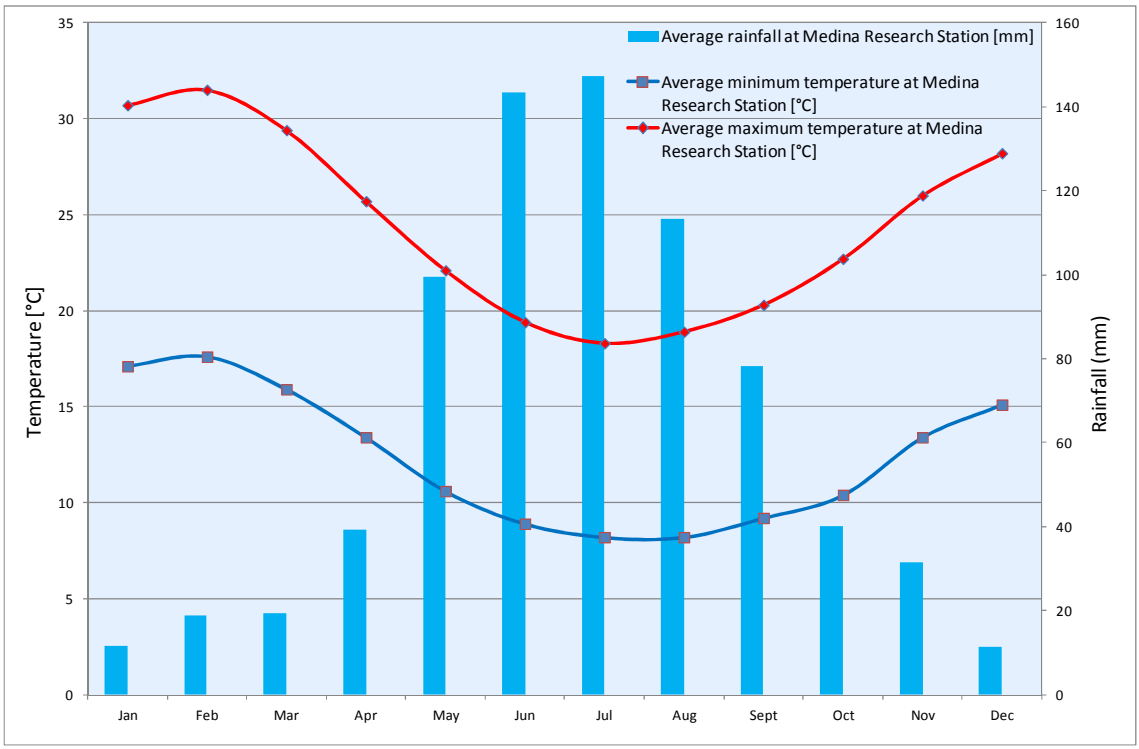
As rehabilitation and closure planning progresses, additional assessments relating to closure will be identified and implemented based on gaps in closure data. Closure domains, information gaps, and closure risks will be updated in each revision of this plan, as appropriate.

7.1 Baseline environmental data

7.1.1 Climate

The Karnup locality experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology (BoM) weather station at Medina Research Station (Station No. 9194) provides average monthly climate statistics for the Karnup locality (Figure 7-1).

Average annual rainfall recorded at Medina since 1983 is 753.4 mm (BoM 2015). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur between December and March, with average monthly maximums ranging from 28.2℃ in December to 31.5℃ in February (BoM 2015). Lowest temperatures occur between June and September, with average monthly minimums ranging from 8.2℃ in July to 9.2℃ in September (BoM 2015).



Source: BoM (2015)

Figure 7-1: Mean monthly climate characteristics

7.1.2 Geology

The Rockingham Mapsheet in the Perth Metropolitan Region 1:50,000 Environmental Geology Series describes the geology across the majority of the Project area as 'Bassendean Sand' (Figure 7-2) which comprises predominately of light grey sand at the surface, becoming yellow with depth, fine to medium grained, sub-rounded, moderately well sorted sand of aeolian origin (Gozzard 1983). The underlying geology at six pockets in the Project area is described as 'Peaty Clay' comprising dark grey and black peaty clay with variable organic content and some sand in places, of lacustrine origin (Gozzard 1983). These pockets are associated with the six wetlands present in the Project area.

Two small slithers of 'Sand derived from Tamala Limestone' occur within the Project area adjacent to the western boundary which is described as pale yellowish brown, medium to coarse-grainer, sub angular quartz, trace of feldspar, moderately sorted, or residual origin (Gozzard 1983).

The balance of M70/1262 and the low lying land adjacent to the Serpentine River east of the Project Area is described as 'Guildford Formation clay ' and comprises a strong brown and dark grey clay, plastic in places, soft when wet, with variable silt content and of alluvial origin (Gozzard 1983). The geology to the west of the Project area is described as 'Sand derived from Tamala Limestone'.

7.1.3 Topography

The topography of the Project area is influenced by a north-south ridge located along the western Project area boundary and a gentle slope towards the banks of the Serpentine River in the east (Golder Associates 2006). The Project area remains relatively consistent with the pre-plantation topography and elevations vary between approximately 2 m and 13 m Australian Height Datum (AHD) (Figure 7-3).

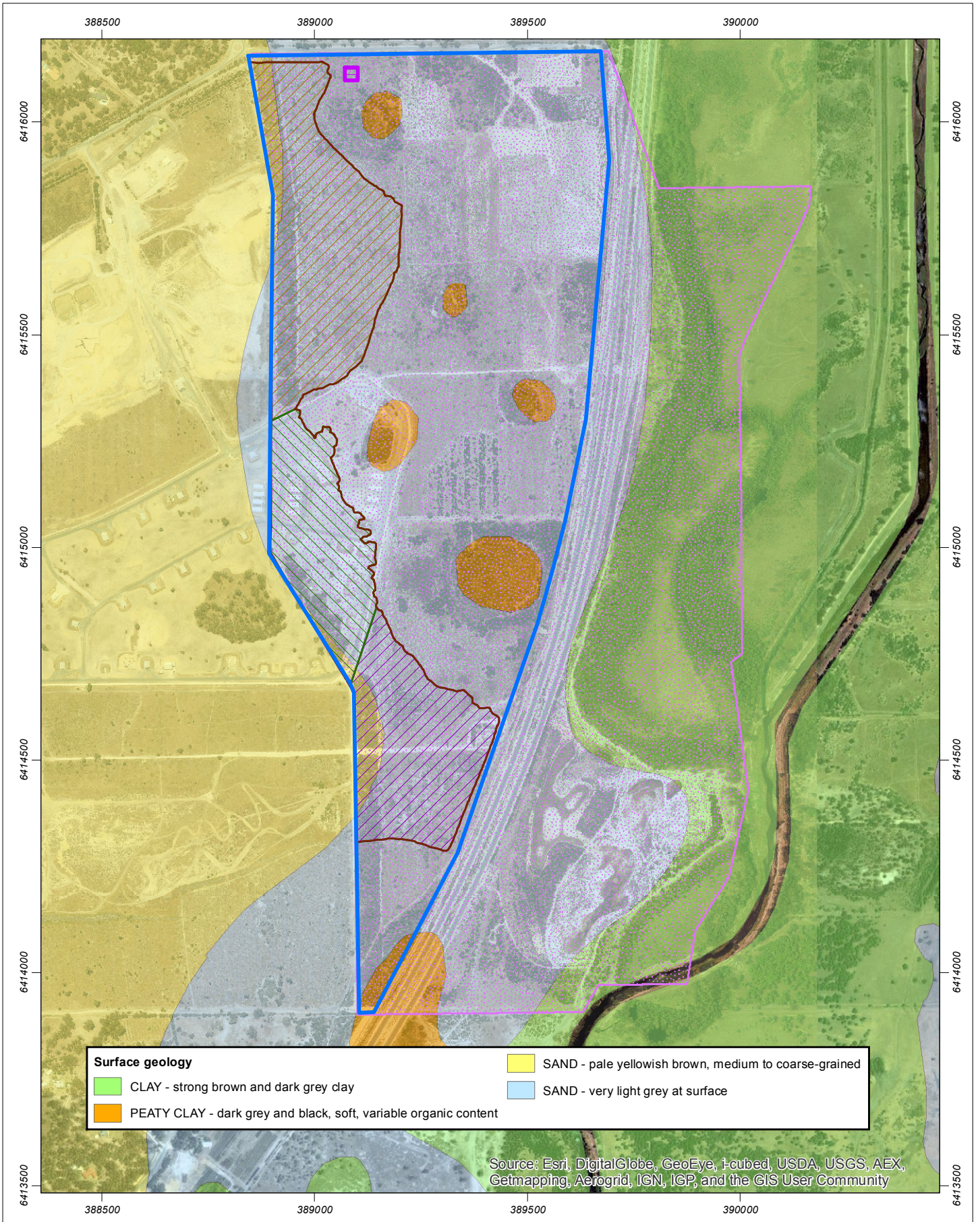


Figure 7-2: Geology of the Project area

Scale 1:12,000 at A4

0 100 200 300 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 5/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Geology 1:50,000: DMP 2014.

Legend

- Site compound boundary
- Project area
- Mine area
- Tenement M70/1262

Mining stages

- Stage 1
- Stage 2
- Stage 3

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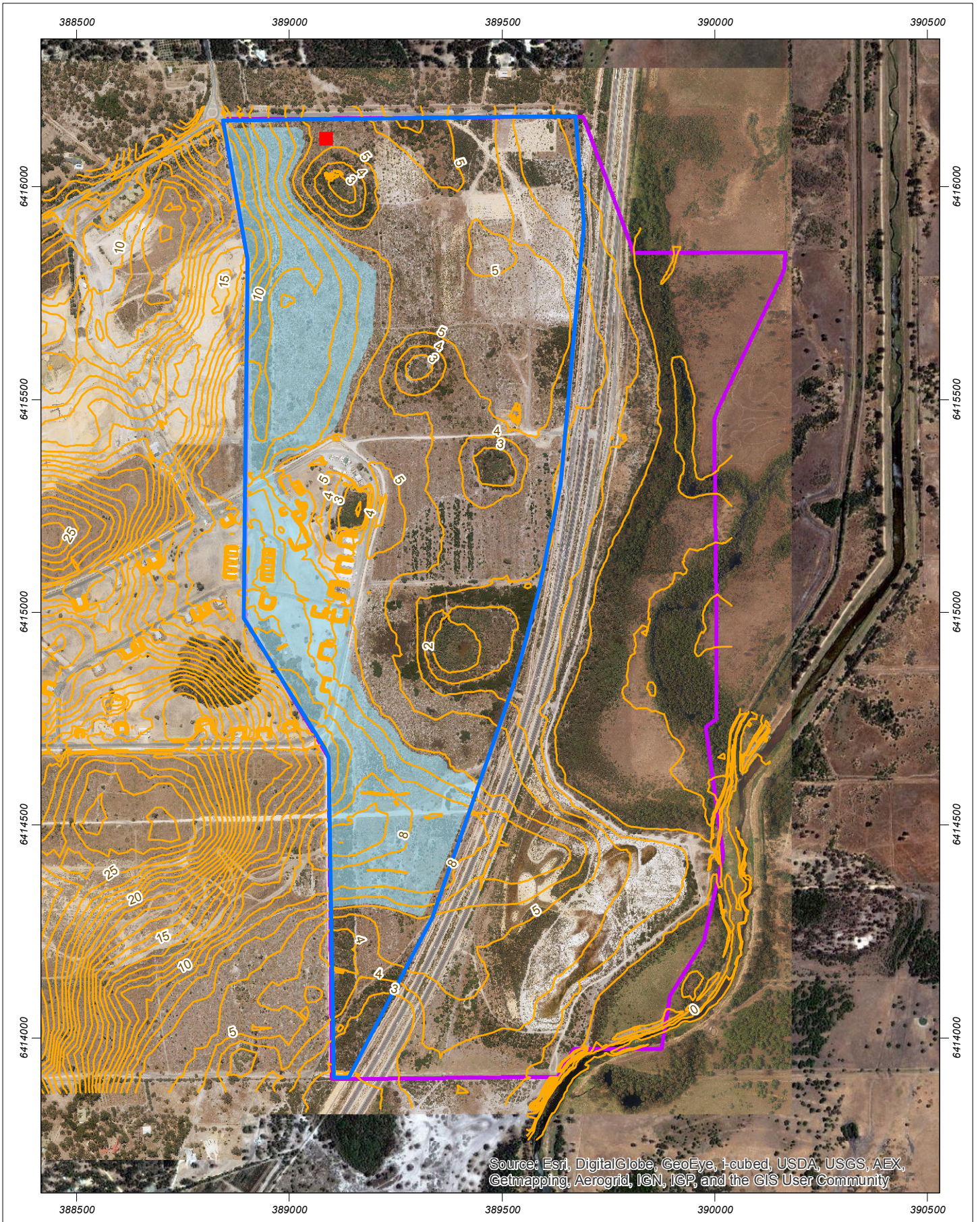

Figure 7-3: Topography of the Project area

Scale 1:12,000 at A4

0 100 200 300 m

N

Legend

- Surface elevation (mAHD)
- Site compound boundary
- Project area
- Mine area
- Tenement M70/1262

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 5/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Contours: Client 2015.

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7.1.4 Hydrogeology

Regional groundwater

The Project area is located within the Stakehill Mound groundwater subregion of the Perth Basin (GHD 2014). The subregion covers an area of approximately 150 km^2 and occurs within the superficial formations flow system that is recharged directly by rainfall infiltration (Golder Associates 2010). It is estimated that the average thickness of the aquifer is approximately 20 m with a minimum transmissivity of approximately 1000 m^2/day (Golder Associates 2010).

Groundwater levels and flow direction

Golder Associates undertook monthly groundwater level monitoring of the Project area and surrounds between March 2007 and March 2010 (Golder Associates 2010) and further quarterly groundwater monitoring was undertaken by Strategen between April 2013 and January 2014 (Strategen 2014).

Groundwater levels beneath the Project area fluctuate by approximately 1 m annually. Levels are generally at their maximum in September/October following winter, and minimum in April/May (Golder Associates 2010).

Groundwater levels for the Project area reflect the Assessment Groundwater Level (AGL) set through the Karnup District Water Management Strategy (DWMS) (GHD 2014). This document and the associated AGL has been approved by the Department of Water and the City of Rockingham. The AGL is proposed to be used to set finished levels for future urban development in the Karnup district. Data from the Project area was used in calibrating the AGL model (GHD 2014). The AGL has been set to represent a peak groundwater level under a wet rainfall scenario (GHD 2014), condition that have not been reflected in groundwater monitoring undertaken for the Project area. As such, the AGL is considered a conservative groundwater level for the area and is above water levels recorded on site (Strategen 2014).

The AGL is outlined in Figure 7-5 and is generally less than 3.25 mAHD beneath the Project area. Based on the AGL contours there appears to be a groundwater saddle present beneath the Project area with groundwater to the east of this saddle flowing east towards Serpentine River, while groundwater west of the saddle flows in a westerly direction towards the Indian Ocean.

Groundwater quality

Strategen undertook four quarterly groundwater monitoring events (monitoring of levels and quality) between April 2013 and January 2014 at two bores within and five bores surrounding the Project area (Strategen 2014). Monitoring demonstrated groundwater pH beneath the site and surrounds varies between 6.1 and 7.7 pH units and is generally within the ANZECC and AARMCANZ (2000) guideline values for slightly disturbed ecosystems of 6.5 to 8.5 pH units. Groundwater below the Project area and surrounds is generally fresh with electrical conductivity (EC) values varying between 0.20 mS/cm and 2.89 mS/cm. EC levels were generally within the ANZECC and AARMCANZ (2000) guideline values for slightly disturbed ecosystems in south-west Australia of 0.3-1.5 mS/cm (Strategen 2014).

Median nutrient concentrations were generally below the ANZECC & ARMCANZ (2000) guidelines and are considered comparatively low in the context of the broader Peel-Harvey catchment (Strategen 2014). Concentrations of heavy metals below the Project area and surrounds generally met ANZECC & ARMCANZ (2000) guideline values and is considered to be consistent with concentrations observed in the southern suburbs of Perth (Strategen 2014).

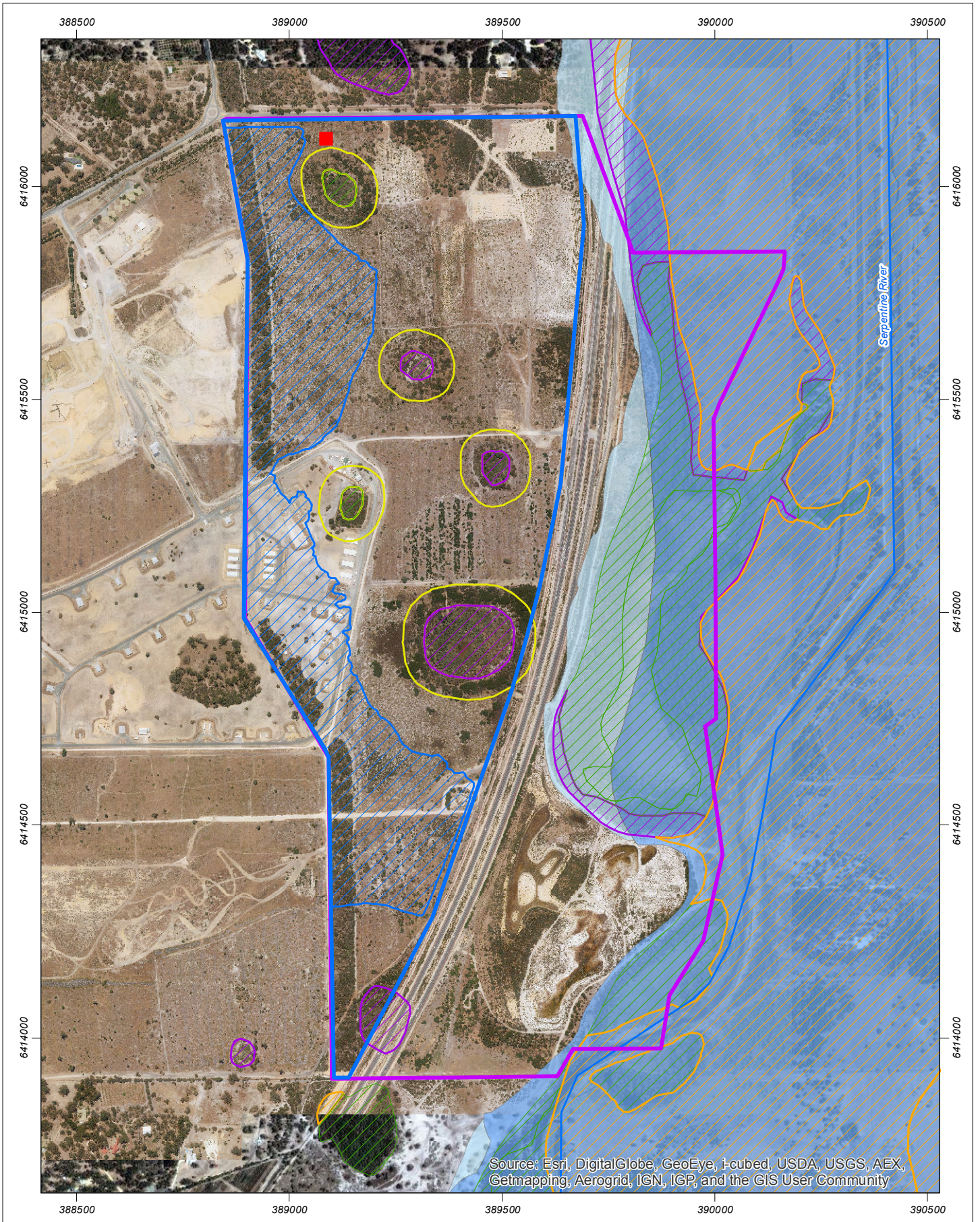

Figure 7-4: Surface water and wetlands of the Project area

Scale 1:12,000 at A4

0 100 200 300 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 5/06/2015
Author: JCrute

Legend

- River
- Site compound boundary
- Project area
- Mine area
- Tenement M70/1262
- Floodway
- Flood fringe
- 50m wetland buffer

Wetland classification

- Conservation
- Multiple Use
- Resource Enhancement

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Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Wetlands: DPAW 2014. Flood: DoW 2014.

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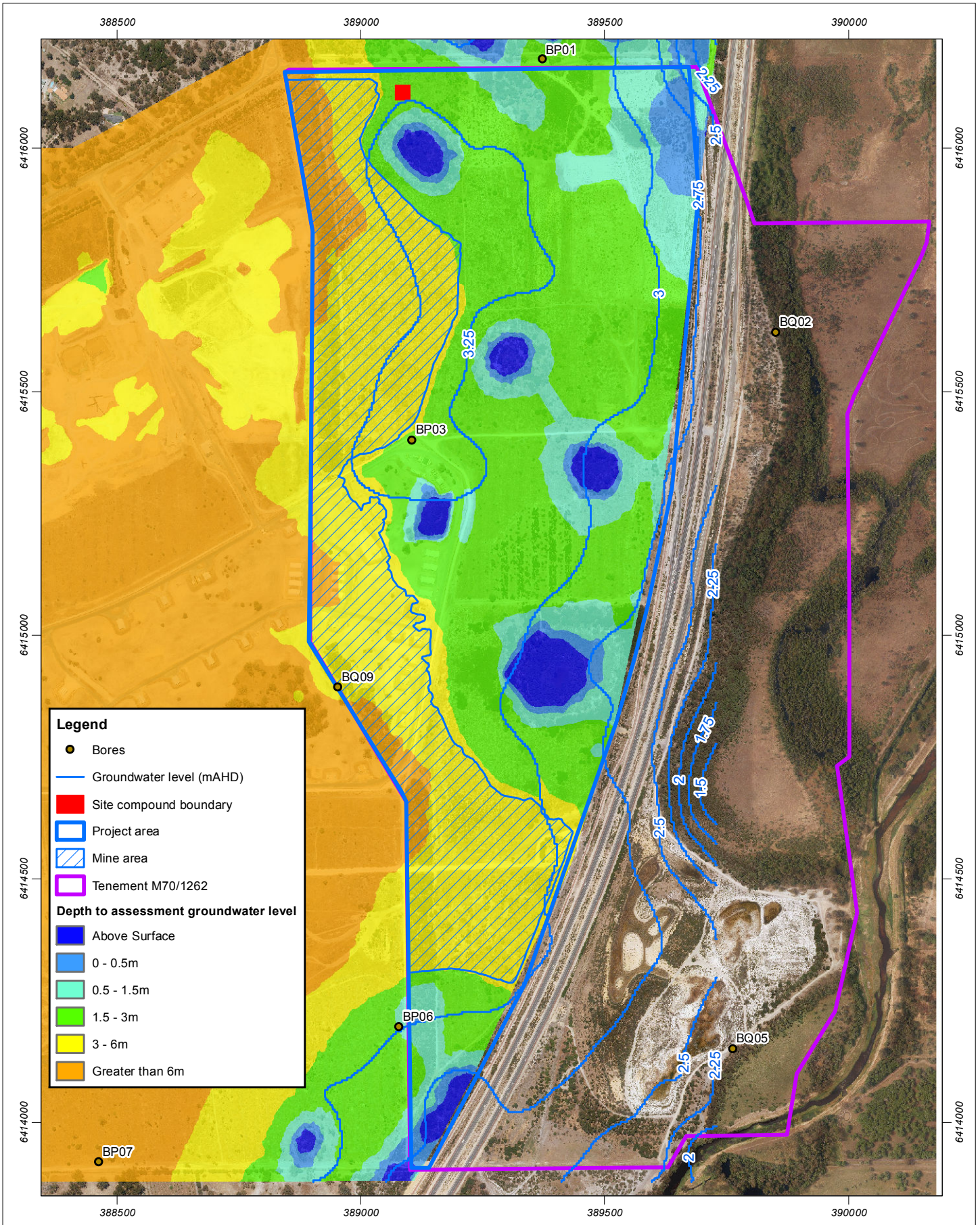

Figure 7-5: Groundwater of the Project area

Scale 1:10,500 at A4

0 100 200 300 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 5/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. GW data: LandCorp 2014.

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7.1.5 Hydrology

The Project area lies in the catchment of the Serpentine River which flows the Peel-Harvey Estuary approximately 20 km south of the Project area. A small portion of the Project area near the north-eastern boundary is located within the 1 in 100-year Average Return Interval (ARI) floodway and flood fringe of Serpentine River (Figure 7-4); however, this part of the Project area will not be disturbed by the Project.

Rain falling on the Project area is expected to infiltrate due to the high permeability of the local sands. Surface water is not expected to flow from the Project area in the 1 in 100-year ARI event. The Project area is considered unlikely to receive runoff from the land adjacent to the west, given that this land is comprised of Tamala Limestone sands also with high infiltration rates.

If, during high rainfall events, there is surface water flow across the Project area, surface water would be expected to characteristically follow the natural topography to the east towards Kwinana Freeway and Serpentine River. The wetlands in and east of the Project Area, adjacent to the Serpentine River, are subject to seasonal inundation (Golder Associates 2006). Surface water management infrastructure is already be present along Kwinana Freeway and would convey any flows from the Project area (if any) to Serpentine River.

Wetlands

A north-south running chain of seasonally damp and inundated wetlands occur in the eastern portion of the Project area. The wetlands are isolated from each other by sparse areas of regrowth following pine plantation clearing, range from 0.3 to 3.1 ha in size and comprise predominately of remnant paperbark (Figure 7-4). All wetlands within the Project area were assessed in 2006 to have been in a degraded state and substantially invaded by weeds (Bancroft & Bamford 2006). A recent inspection of these wetlands in May 2015 confirmed that the 2006 findings are still valid and the wetlands are degraded (Strategen 2015).

Wetlands located within the Project area are ephemeral sumplands (i.e. only seasonally inundated) and include both Resource Enhancement and Conservation Category wetlands as determined by DER (Strategen 2010). These wetlands are considered to represent an expression of local groundwater levels.

7.1.6 Landform and soils

The Project area is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell et al. 2002). The Swan Coastal Plain comprises five major geomorphological systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson et al. 1994). Each major system is composed of further subdivisions in the form of detailed geomorphological units (Churchward & McArthur 1980; Semeniuk 1990; Gibson et al.1994). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sandhills also containing dissected country rising to the duricrusted Dandaragan plateau on Mesozoic, mainly sandy, yellow soils.

The Project area is characterised predominately by Bassendean Sand (Figure 7-2). Mining will target these Bassendean Sands that are predominately light grey at the surface before becoming yellow at depth and of aeolian origin.

Acid sulfate soils

Acid Sulfate Soils (ASS) are naturally occurring soils, sediments and peats that contain iron sulfide or sulfide oxidation products. When ASS are disturbed and exposed to oxidising conditions, the iron sulfides can oxidise to produce sulfuric acid, iron precipitates and low pH groundwater with elevated concentrations of dissolved metals such as aluminium, iron and arsenic. Although ASS are typically benign when undisturbed in the natural environment as they are in an anoxic state, the dewatering, excavation and/or stockpiling of ASS that lies below the naturally occurring watertable may promote the oxidation of these soils and the occurrence of these adverse environmental impacts (DoE 2003).

A search of the WA Atlas ASS Swan Coastal Plain risk map (Landgate 2015) (search conducted 21 April 2015) located six areas classified as Class 1 (High to Moderate risk of ASS occurring within 3 m of natural soil surface) within the Project area associated with the 'Peaty Clay' underlying the wetlands (Figure 7-6). The majority of the balance of the Project area is classified as Class 2 (Moderate to Low risk of ASS occurring within 3 m of natural soil surface) associated with the mapped 'Bassendean Sand'; however, there are two slithers of land adjacent the western Project area that is mapped as having nil ASS risk and are associated with the mapped 'Sand derived from Tamala Limestone' (Figure 7-6).

The mining area is mapped as either have a Class 2 or nil risk of ASS being encountered within the top 3 m of natural soil surface (Figure 7-6).

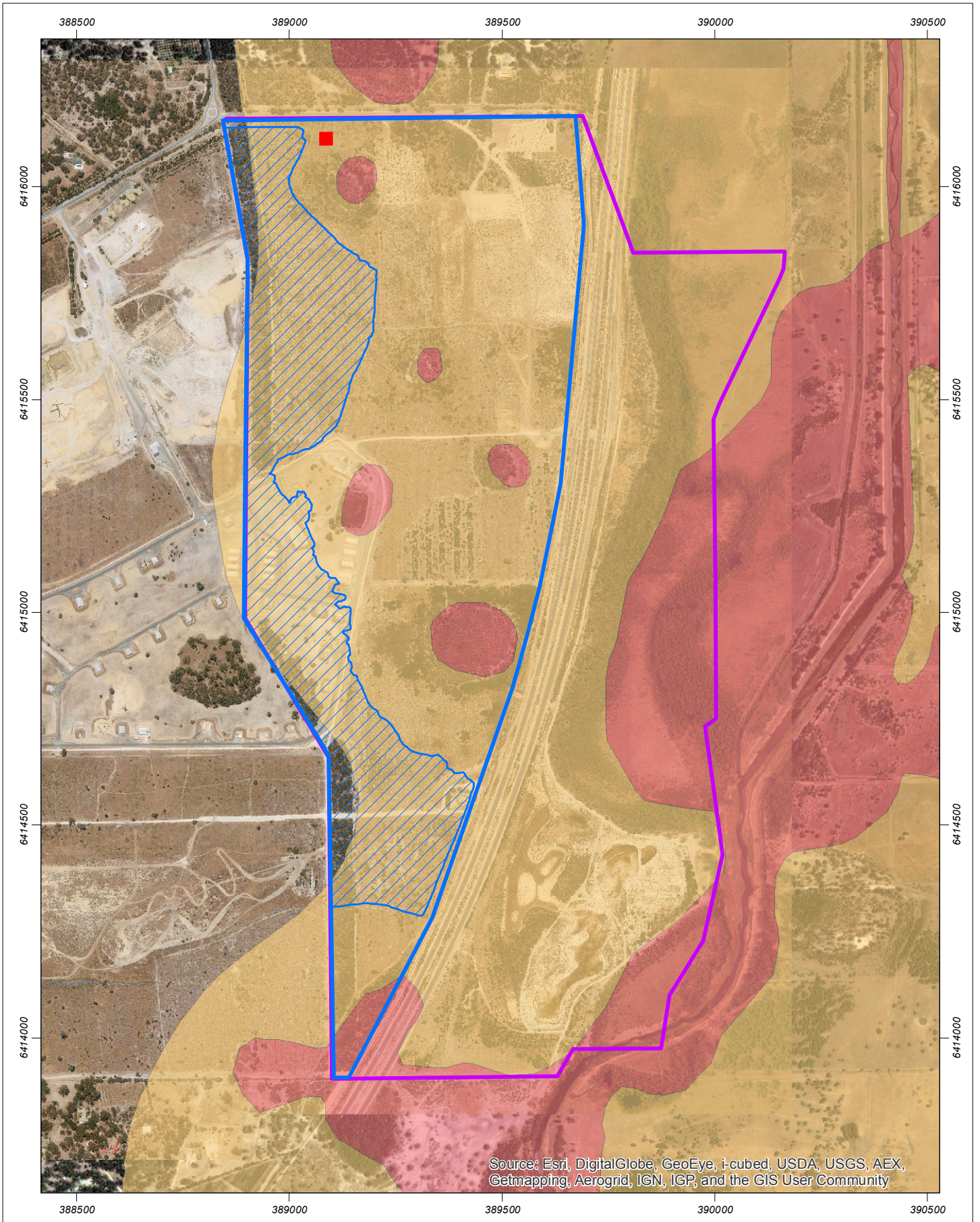

Figure 7-6: Acid Sulfate Soil mapping of the Project area

Scale 1:12,000 at A4

0 100 200 300 m

N

Legend

- Site compound boundary
- Project area
- Mine area
- Tenement M70/1262

ASS risk category

- High to moderate risk
- Moderate to low risk

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 5/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. ASS: DER 2014.

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7.1.7 Flora and vegetation

The Project area occurs within the Swan Coastal Plain 2 'Interim Biogeographic Regionalisation for Australia' subregion which is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas (Mitchell et al. 2002).

The majority of the Project area was identified to be in various stages of natural regeneration following the clearing of existing pine plantations from approximately 2004 (Strategen 2015). Five native vegetation types (VTs), in addition to cleared areas and residual pine plantation, were defined and mapped within the Project area (Figure 7-7):

1. VT 1: *Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* mid open shrubland over *Lyginia barbata, Conostylis aculeata* and *Phlebocarya ciliata* low open sedgeland with *Xylomelum occidentale* and *Eucalyptus rudis* occurring as isolated trees (natural regeneration of cleared pine plantation).
2. VT 2: *Banksia menziesii*, *B. attenuata*, *Allocasuarina fraseriana* and *Eucalyptus marginata* open woodland over *Kunzea glabrescens, Acacia pulchella* and *Macrozamia fraseri* mid sparse shrubland over *Hibbertia hypericoides, Conostephium pendulum* and *Gompholobium tomentosum* low sparse shrubland (remnant vegetation).
3. VT 3: *Jacksonia sternbergiana* and *Adenanthos cygnorum* subsp. *cygnorum* mid shrubland over *Conostylis aculeata* and *Lyginia barbata* low sparse sedgeland (natural regeneration of cleared pine plantation).
4. VT 4: *Banksia menziesii*, *B. attenuata*, *Eucalyptus marginata* and *Allocasuarina fraseriana* low open woodland over *Jacksonia furcellata*, *Regelia ciliata* and *B. sessilis* mid sparse shrubland over *Tetraria octandra* and *Ficinia nodosa* low sparse sedgeland (natural regeneration with rehabilitation).
5. VT 5: *Eucalyptus sp*. (planted) open woodland over *Acacia saligna*, *Jacksonia furcellata* and *Kunzea glabrescens* tall sparse shrubland over **Eragrostis curvula* low sparse tussock grassland (mixture of naturally regenerated vegetation with additional planting).

Vegetation condition within areas of natural regeneration was identified as Good and retained *Banksia* woodland on the western boundary of the Project area was identified as Very Good (Strategen 2015).

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were identified as having the potential to occur within the Project area.

Three Threatened flora species (*Caladenia huegelii, Drakaea elastica* and *Drakaea micrantha*) and four Priority flora species (*Cardamine paucijuga, Sphaerolobium calcicola, Dillwynia dillwynioides* and *Jacksonia sericea*) were considered to have the potential to occur in the Project area based on specific habitat requirements (Strategen 2015).

No Threatened flora species pursuant to Schedule 1 of the WC Act (as listed by the Department of Parks and Wildlife) or Priority flora species (as listed by Western Australian Herbarium) were recorded within the Project area (Strategen 2015).

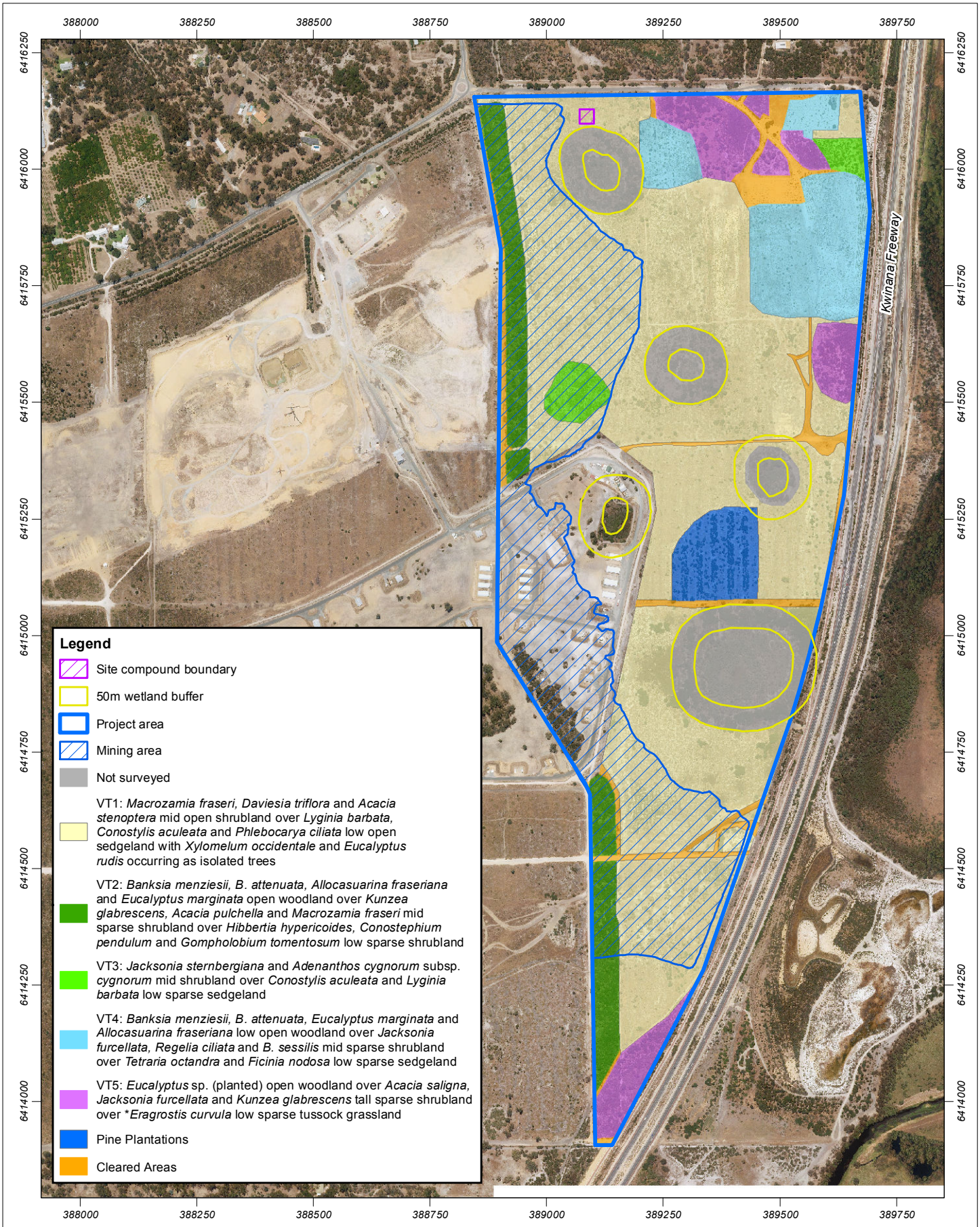

Figure 7-7: Vegetation types mapped within the Project area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 5/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

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7.1.8 Terrestrial fauna

A desktop fauna assessment was conducted using a series of databases including NatureMap and the EPBC Protected Matters Search Tool. Bamford Consulting Ecologists undertook a fauna survey of an area encompassing some parts of the Project area and adjacent wetlands (Bancroft & Bamford 2006). It should be noted that in 2006, the majority of the Project area would have been occupied by pine plantation. During the most recent assessment undertaken by Strategen in 2015, the Project area comprised remnant native woodland vegetation, historical pine plantations and natural regeneration in areas which were previously cleared (Strategen 2015).

A desktop assessment of the likelihood of conservation significant (Threatened or Priority) species occurring within the Project area was undertaken based on results presented by Bancroft & Bamford (2006). The conservation status of each species was updated based on current listings provided by Parks and Wildlife (2007, 2014) and Department of the Environment (2015a, 2015b). Likelihood of occurrence was also updated (where required) based on the change in vegetation within the Project area between 2006 and 2015.

The only conservation significant fauna species considered to have suitable habitat present within the Project area and therefore a likely to occur are three species of Black Cockatoo (Carnaby's, Forest Red-tailed and Baudin's) and the Rainbow Bee-eater (Strategen 2015). The habitat most likely to support the Rainbow Bee-eater is associated with wetland areas that will not be impacted by the Project. Threatened native mammals and ground-dwelling birds are unlikely to occur due to lack of suitable habitat and presence of introduced predators and competitors (cat footprints were observed and the area is home to a large number of goats). Migratory birds have the potential to utilise the Project area for habitat due to the presence of wetlands, but are unlikely to be present for prolonged periods of time (Strategen 2015).

7.1.9 Social environment

Aboriginal heritage

A search of the Department of Aboriginal Affairs (DAA) *Aboriginal Heritage Inquiry System* (DAA 2015) was conducted on 24 April 2015 of the Karnup locality found one Registered Aboriginal Site and one Other Heritage Places within the Project area (Figure 7-8).

In addition to the database search, an indigenous cultural heritage survey was conducted by Big Island Research Pty Ltd (Big Island) in March 2013 to inform the Baldivis (housing) Development Project and included the Project area (Big Island 2013).

The Registered Aboriginal Heritage Site (ID: 3582; Legacy ID: S02407) identified as Serpentine River is a Ceremonial, Mythological Site and covers the entire Project area. This site is not protected and there are no gender restrictions; however, the exact location of the site is restricted. Site 28186 (Other Heritage Places) Nyitting Booya Binja was also identified within the Project area. It covers approximately 50% of the Project area and is registered as an Artefacts/Scatter. The site location is restricted; therefore, the exact location is unknown. Site 31842 Keralup Artefact Scatter 3 was identified fringing the southern boundary of M70/1262 and outside the Project area. Site 31842 is outside the Project area and is registered as an Artefacts/Scatter. There is no gender, file or access restrictions. Site ID 3561 (Legacy ID: S02444), Karnup, is also registered as an Artefacts/Scatter site and borders the north-eastern boundary of the Project area. This site consists of approximately thirty "low quality artefacts" covering an area of 60 m x 5 m (Big Island 2013).

None of the identified Sites are considered to have the potential to be impacted by the Project. All sites are known or are likely to occur outside of the Project area. Site 28186, however the Site is mapped over a wide area and the Project area is not situated centrally to the mapped area and therefore it is unlikely that the Site intersects with the Project Area. Additionally Site 28186 is registered as an Artefacts/Scatter. Areas of the Project area proposed to be disturbed have previously been disturbed by clearing, pine plantation and clearing of the pine plantation again, including removal of stumps and roots.

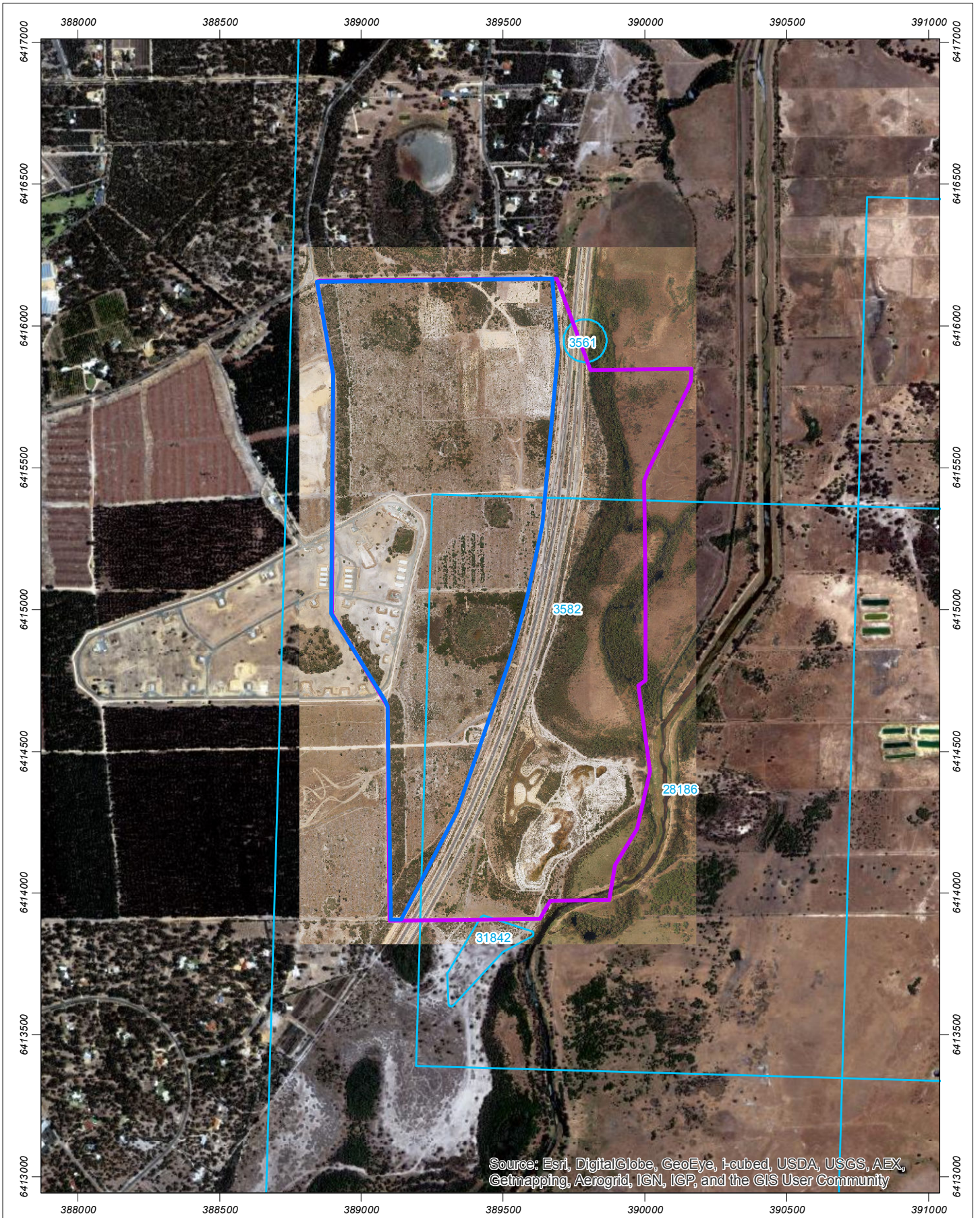

Figure 7-8: Aboriginal heritage sites within the Project area

Scale 1:18,000 at A4

0 100 200 300 m

N

Legend

- Project area
- Tenement M70/1262
- Aboriginal heritage sites

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 5/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Heritage: DIA 2012.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R001\RevA\URE15096_01_R001_RevA_F007_8.mxd

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European heritage

There are no sites listed on State Register of Heritage Places (Heritage Council State Heritage Office 2015) or the City of Rockingham Municipal heritage inventory (City of Rockingham 2012) within the Project area.

The Baldivis Tramway Reserve is approximately 22 km in length and 20-70 m in width that traverses the City of Cockburn, Kwinana and Rockingham. The Baldivis Tramway Reserve starts at Baldivis Road and traverse this road in a north-south direction and ends at Stakehill Road which is immediately north of the Project area (ERM 2000). The City of Rockingham has identified the Baldivis Tramway Reserve as an important area for conservation and recreation values and it was included on the register held by the Heritage Counsel of Western Australia as a significant heritage area (ERM 2000); however, it has not been registered on the State Register of Heritage Places as a heritage site. The Baldivis Tramway Reserve does not occur within the Project area.

The Geogrup Lakes Area (Place No. 16083, also known as the Serpentine River Wetlands) is registered on the Register of Heritage Places (Heritage Council State Heritage Office 2015) and may occur to the east of the Project area adjacent to the Serpentine River as the site is described as occurring from Barragup to Karnup but the heritage site outline is not defined.

Other social receptors

Residents

Baldivis comprises a combination of residential, rural and natural land use. Land neighbouring the Project area is residential and rural, including properties with uncleared vegetation, market gardens, horse paddocks and vineyard. The closest residents are located along Stakehill Road, 200 m north of the Project area.

Kwinana Freeway and local traffic

The Kwinana Freeway is a major state transport route providing access to the Perth CBD and major roads between Perth and Pinjarra, and intersects Mining Tenement M70/1262 but is located outside the Project area.

7.2 Assessment of closure related issues

From a consideration of the environmental data described in the foregoing sections, the collected data has been analysed to enable understanding of the issues and identification of knowledge gaps relevant to mine closure planning and implementation. The results of this analysis are presented in the following sections as relevant to the various environmental factors discussed in the previous sections.

7.2.1 Water resources

There are not expected to be any direct impacts to groundwater by the Project that will result post-closure as there will be no dewatering activities or groundwater abstraction for water supply to facilitate mining.

Due to the sandy nature of the soils of the Project area, there is expected to be minimal stormwater runoff from the mine area as the Bassendean Sands have a high hydraulic conductivity and rainfall infiltrates rapidly. Flooding is not considered an issue in the mine areas due to the high infiltration capacity of the sands and the relatively high clearance to the groundwater table (greater than 1 m) in the area to be mined.

During operations the mine area will be designed, constructed and operated to avoid disruption of surface water flows and ensure that potential contaminants are not released to the environment.

Gaps and future data collection

There are not expected to be any direct impacts to groundwater as a result of the Project following the completion of mining activities, as there will be no dewatering activities or groundwater abstraction for water supply to facilitate mining. Adequate sand will be retained on the site (i.e. 1.2 m above AGL) to ensure that waterlogging and inundation will not occur after rainfall events as a result of the Project. Groundwater flow directions will not be affected by the Project and therefore no further investigations relating to groundwater are required.

There are not anticipated to be any impacts to the wetlands as a result of mining. The mining operations have been designed to ensure a minimum of 1.2 m above AGL is maintained, to facilitate the Parks and Recreation final land use.

Urban Resources will construct the final landforms by backfilling of overburden material to ensure a safe and stable landform compatible with the surrounding areas. Surface water flows, including surface water interactions with the surrounding wetlands will be considered during final landform planning and design.

To ensure no impacts to the wetlands, Urban Resources will not disturb areas within the 50 m buffer between mining areas and the wetland. Urban Resources will undertake visual monitoring of the wetland to observe wetland function and any potential impacts that may have resulted due to mining activities.

7.2.2 Landform and soils

Prior to ground disturbance, the topsoil (nominally the top 10 cm of the soil profile) will be stripped and stockpiled away from the mining area to create a bund of no more than 2 m high to maintain biological integrity. Stockpiles will be located sufficiently distant from mining operations so that they will not be disturbed prior to being used in rehabilitation.

As the proposed activities will not disturb ground below the water table or any areas of high probability of ASS occurrence, it is unlikely that any ASS will be exposed or disturbed, therefore no further investigations into ASS are proposed to inform closure activities.

Following the completion of mining activities, topsoil and overburden will be utilised to backfill the mining pits to create a safe and stable soil profile to facilitate the final land-use of parks and recreation. Where mining of the remnant strip of vegetation on the western boundary of the site has been undertaken, overburden will be used to backfill this area to agreed final levels, prior to revegetation, consistent with the proposed target ecosystem.

Gaps and future data collection

Urban Resources have undertaken preliminary investigations into the balance of material remaining following mine closure. The material balance will inform closure planning and assist in managing any soil and landform management requirements that may result from different soil and material types. Section 7.2.5 provides a summary of the material balance investigations proposed during the operational and closure planning phase of the Project.

The viability of the topsoil stockpiles will also be investigated to ensure that the topsoil to be used during rehabilitation will promote revegetation. If the topsoil is not viable, a process of remediation will be undertaken to add nutrients as required to the topsoil, and in extreme cases, replacement topsoil would be sourced from other sources, such as nurseries.

Geotechnical investigation will be undertaken to assess the stability of the areas being rehabilitated to ensure safe landforms will remain after closure.

7.2.3 Flora and vegetation

No threatened flora species pursuant to Schedule 1 of the WC Act or listed under the EPBC Act have been recorded within the Project area (Strategen 2015). *Dillwynia dillwynioides* and *Schoenus capillifolius* were recorded by Bennett (2006); however, these species were recorded in wetlands which will not be disturbed as part of the Project.

No TECs or PECs were identified as having the potential to occur within the Project area (Strategen 2015). No Declared Plant species pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) were recorded within the Project area.

The closure related issues in relation to flora and vegetation are re-establishing functioning fauna habitat for Black Cockatoos along the western boundary of the Project area[1].

Gaps and future data collection

The major data gap in relation to flora and vegetation relates to the requirements for the potential rehabilitation along the western boundary to re-establish functioning vegetation types that will support foraging by Black Cockatoos. The final land use of this portion of the project area is currently unknown, further consultation and planning will be undertaken to confirm the final land use. To assist in developing an effective rehabilitation program for any areas that may be rehabilitated, Urban Resources will further investigate the vegetation type and composition proposed to be rehabilitated to inform the target ecosystem characteristics, including:

- species density
- percentage cover
- species diversity
- structure and function
- weed presence and density.

The highest quality foraging habitat for black cockatoos was noted within VT 2 which contained high densities of black cockatoo food species including eucalypts and Banksia spp. at canopy and mid-storey levels. Rehabilitation efforts will focus on the VT 2 community to be re-established and an assessment on the methods for re-establishing this community will be undertaken. This assessment will allow the development of successful methods of rehabilitation and will form the foundation of a Rehabilitation Management Plan.

Rehabilitation requirements for the majority of the Project area, will involve soil profiling to a safe and stable landform, followed by respread of topsoil and seeding with pasture species prior to eventual use as parks and recreation.

7.2.4 Terrestrial fauna

The highest quality foraging habitat for black cockatoos was noted within VT 2 which contained high densities of black cockatoo food species including eucalypts and *Banksia* spp. at canopy and midstorey levels. The lowest quality foraging habitat for black cockatoos (not including cleared areas) was noted within VT 5 which contained limited potential food resources for all three species of black cockatoos, and in the pine plantation which provides limited food resources for Carnaby's Black Cockatoo (CBC) only. Based on the results of the foraging assessment, the Project will result in the clearing of 6.54 ha of very good quality foraging habitat and 24.29 ha of low quality foraging habitat for CBC, Baudin's Black Cockatoo (BBC) and Forest Red-tailed Black Cockatoo (FRTBC). Signs of CBC foraging were observed in scattered occurrences within VT 2 (Strategen 2015).

[1] Revegetation of the western boundary of the Project area is to be confirmed following future discussion and agreement with LandCorp on final land use.

Gaps and future data collection

The major data gap in relation to fauna relates to the requirements for the potential rehabilitation along the western boundary in regards to re-establishing functioning fauna habitat that will support foraging by Black Cockatoos. The closure planning process will develop appropriate measures to target terrestrial fauna habitat re-establishment in this area, using species identified in the target ecosystem and other black cockatoo foraging species.

7.2.5 Materials balance and characterisation

Urban Resources has undertaken a preliminary materials balance investigation, estimating the materials and final levels that will be left post-mining. Materials balance estimates undertaken to date have been demonstrated in the bulk earthworks natural surface design drawing provided in Figure 7-9. Materials anticipated to be used in rehabilitation include overburden and topsoil.

Urban Resources propose to undertake a more detailed assessment to identify materials available and required for use in rehabilitation of the site. The assessment will estimate the volume required for rehabilitation and closure, including the mulch/topsoil (or growth medium) required, taking into account the proposed land uses on-site; including the rehabilitated remnant vegetation and re-profile landform to enable parks and recreation land-use. Urban Resources will progressively undertake materials audits to confirm quantities available for rehabilitation and closure during the course of the Project, as part of progressive rehabilitation activities.

The mining process will involve clearing of vegetation, removal of topsoil and overburden material, followed by sand extraction. No waste products or problematic material, such as ASS will be disturbed as part of the operations. Urban Resources will continue to monitor any materials removed for sand mining that may be acid bearing. Outcomes of any ongoing monitoring and materials balance data will further guide post-closure management of the Project area.

Gaps and future data collection

As no waste products or problematic materials, such as ASS, will be disturbed as part of the operations, no further investigations are proposed. However, Urban Resources will progressively undertake materials audits to confirm quantities available for rehabilitation and closure during the course of the Project as outlined above.

7.2.6 Rehabilitation

Urban Resources propose to develop agreed final landforms and post-mining land use(s) consistent with stakeholder expectations. The overall post-mining land use is expected to be Parks and Recreation consistent with the areas current zoning, to support the adjacent future residential development. The area will contain open parklands and recreation land use with a potential vegetated corridor along the western boundary of the Project area which will focus on providing food resources for Black Cockatoos.

The objective of rehabilitation is to re-establish the target ecosystem along the western boundary of the Project area and establish a land-formed soil profile able to support future Parks and Recreation land use. Rehabilitation efforts will focus on the VT 2 community where revegetation is proposed to reinstate Black Cockatoo foraging habitat. Completion criteria will be developed and refined, where applicable and appropriate, as more information comes available, through the life of the Project.

The following actions will be implemented as part of rehabilitation activities:

- stockpiling of cleared vegetation for use during rehabilitation
- stockpiling of topsoil in windrows to enable the soil profile to be reinstated during rehabilitation
- re-profiling of surfaces using site specific criteria developed from studies conducted to determine final design and levels in accordance with the Mine Plan
- mechanical treatment of compacted surfaces (ripping and scarifying)
- replacement of topsoil

- spreading of stockpiled vegetation
- direct seeding of future development areas with pasture species
- potential revegetation of the vegetated corridor on the western boundary of the Project area via seeding with appropriate local species to be confirmed following further discussion and agreement with LandCorp
- monitoring to collect data on revegetation efforts and to demonstrate the ability of the area to support the post-mining land use
- development of contingency actions to address any deficiencies identified from the rehabilitation monitoring.

Following rehabilitation, sign off by landholders and other key stakeholders that rehabilitation is complete will be required.

Gaps and future data collection

A Rehabilitation Plan is to be produced that will include the above requirements and details soil handling, rehabilitation of the landscape, methodology for re-vegetation and the monitoring program to be implemented.

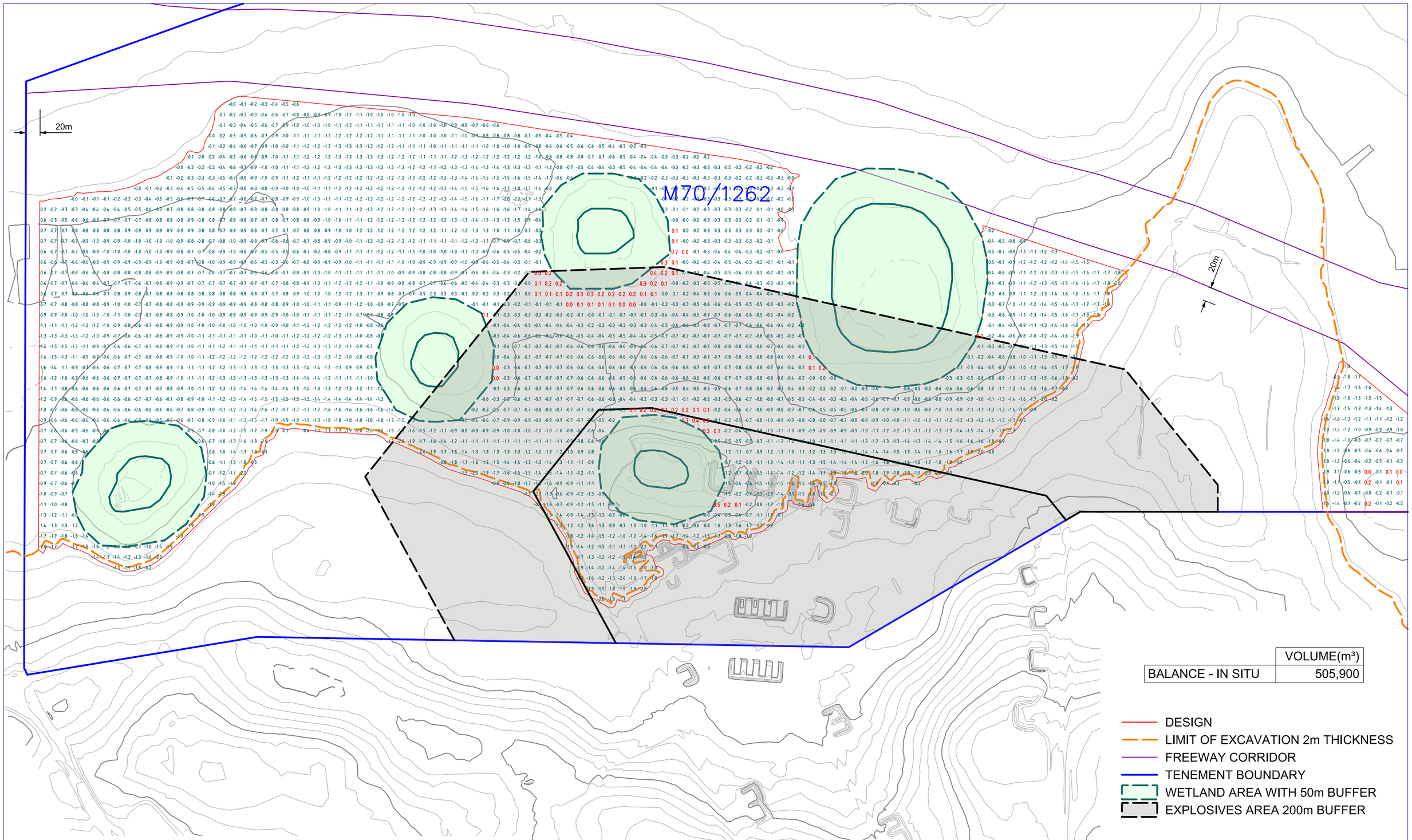

Figure 7 9: Bulk earthworks natural surface design

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A	28/04/15	INITIAL ISSUE	SM	

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NOTES
1. THE VOLUMES ON THIS PLAN HAVE BEEN CALCULATED USING INFORMATION SUPPLIED BY THE CLIENT. THE ACCURACY OF THESE VOLUMES DEPENDS ON THE QUALITY OF THE DATA SUPPLIED.
2. THE VALUES ON THIS PLAN HAVE BEEN CALCULATED USING GRIDDED DATA INTERPOLATED FROM THE ORIGINAL SURVEYS
3. FILL VALUES SHOWN 3 IN METRES
   CUT VALUES SHOWN -3 IN METRES

SCALE 1 : 2500

50 0 200
METRES

DATUM
VERTICAL A.H.D.

HORIZONTAL PERTH COASTAL GRID 94, PCG94

GDA

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URBAN RESOURCES

KARNUP TENEMENT M70/1262
BULK EARTHWORKS
NATURAL SURFACE TO DESIGN
GRIDDED DIFFERENCES

DRAWING NUMBER UR 143.20 - 07 - 03

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