



CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 9071/1
Permit Holder:	City of South Perth
Duration of Permit:	From 19 June 2021 to 19 June 2026

The permit holder is authorised to clear native vegetation subject to the following conditions of this permit.

PART I – CLEARING AUTHORISED

1. Clearing authorised (purpose)

The permit holder is authorised to clear native vegetation for the purpose of removing Typha.

2. Land on which clearing is to be done

Lot 100 on Plan 5947
Lot 100 on Plan 71837
Lot 101 on Plan 5947
Lot 102 on Plan 5947
Lot 103 on Plan 5947
Lot 104 on Plan 5947
Lot 105 on Plan 5947
Lot 11835 on Deposited Plan 240379 (Crown Reserve 34565)
Lot 16 on Plan 3285
Lot 1943 on Deposited Plan 170093 (Crown Reserve 27449)
Lot 198 on Plan 1620
Lot 199 on Plan 1620
Lot 207 on Plan 5950
Lot 208 on Plan 5950
Lot 209 on Plan 5950
Lot 210 on Plan 5950
Lot 300 on Deposited Plan 44440 (Crown Reserve 23967)
Lot 301 on Deposited Plan 44440
Lot 310 on Deposited Plan 47439 (Crown Reserve 48327)
Lot 3305 on Plan 13650
Lot 3306 on Plan 13650 (Crown Reserve 37723)
Lot 3318 on Plan 13650 (Crown Reserve 37712)
Lot 3834 on Plan 18896 (Crown Reserve 428768)
Lot 3858 on Deposited Plan 218457 (Crown Reserve 38794)

Lot 389 on Plan 15472 (Crown Reserve 37712)
Lot 3976 on Plan 16038 (Crown Reserve 37712)
Lot 4000 on Deposited Plan 44883 (Crown Reserve 48530)
Lot 4001 on Deposited Plan 70746 (Crown Reserve 52637)
Lot 4690 on Deposited Plan 27529 (Crown Reserve 46565)
Lot 5000 on Deposited Plan 70746
Lot 920 on Deposited Plan 214831 (Crown Reserve 33804)
Waterford Avenue Road Reserve (PIN 1146737)
Nenagh Grove Road Reserve (PIN 1146739)
Tracy Way Road Reserve (PIN 11416772)
Clydesdale Street Road Reserve (PIN 11569968)
Douglas Avenue Road Reserve (PIN 11579579)
Unnamed Road Reserve (PINs 11580656 and 11614054)
Cygnus Parade Road Reserve (PIN 12028271)

3. Clearing authorised

The permit holder must not clear more than 0.1899 hectares of native vegetation within the area cross-hatched yellow in Figures 1-8 of Schedule 1.

PART II – MANAGEMENT CONDITIONS

4. Avoid, minimise, and reduce impacts and extent of clearing

In determining the native vegetation authorised to be cleared under this permit, the permit holder must apply the following principles, set out in descending order of preference:

- (a) avoid the clearing of native vegetation;
- (b) minimise the amount of native vegetation to be cleared; and
- (c) reduce the impact of clearing on any environmental value.

5. Weed and dieback management

When undertaking any clearing authorised under this permit, the permit holder must take the following measures to minimise the risk of introduction and spread of *weeds* and *dieback*.

- (a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
- (b) ensure that no known *dieback* or *weed*-affected soil, mulch, fill, or other material is brought into the area to be cleared; and
- (c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

6. Directional clearing

The permit holder must conduct clearing activities in a slow, progressive manner from one direction only, to allow fauna to move into adjacent native vegetation ahead of the clearing activity.

7. Fauna Management - nesting water birds

- (a) Prior to undertaking any clearing authorised under this permit within the combined areas cross-hatched red on Figure 8 of Schedule 1, the permit holder must engage a *fauna specialist* to conduct a *fauna survey* of the permit area to identify stands of *Typha* currently utilised by *Oxyura australis* (Blue billed duck).
- (b) Where *Typha* stands utilised by Blue billed duck are identified under condition 7(a), the permit holder must engage a *fauna specialist* to map the Blue billed duck nest within the permit area.
- (c) where Blue billed duck nest/s are present and Blue billed duck identified as *actively breeding*, clearing cannot occur until all juvenile Blue billed duck has permanently left the active nest.

PART III - RECORD KEEPING AND REPORTING

8. Records that must be kept

The permit holder must maintain records relating to the listed relevant matters in accordance with the specifications detailed in Table 1.

Table 1: Records that must be kept

No.	Relevant matter	Specifications
1.	In relation to the authorised <i>clearing</i> activities generally	<ol style="list-style-type: none"> (a) the species composition, structure, and density of the cleared area; (b) the location where the <i>clearing</i> occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings; (c) the date that the area was cleared; (d) the size of the area cleared (in hectares); (e) the method of clearing utilised; (f) actions taken to avoid, minimise, and reduce the impacts and extent of <i>clearing</i> in accordance with <i>condition 4</i>; (g) actions taken to minimise the risk of the introduction and spread of <i>weeds</i> and <i>dieback</i> in accordance with <i>condition 5</i>; and (h) actions taken to conduct <i>clearing</i> in a slow and progressive manner in accordance with <i>condition 6</i>.
2.	In relation to Fauna Management pursuant to condition 7 of this permit	<ol style="list-style-type: none"> (a) Record the location of each nest using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings. (b) actions taken to demarcate each nest

No.	Relevant matter	Specifications
		<p>recorded.</p> <p>(c) The date that juveniles have left the nest.</p> <p>(d) Record the time of clearing after active breeding.</p>

9. Reporting

- (a) The permit holder must provide to the *CEO*, on or before 30 June of each calendar year, a written report containing:
- (i) the records required to be kept under condition 8; and
 - (ii) records of activities done by the permit holder under this permit between 1 January and 31 December of the preceding calendar year.
- (b) If no clearing authorised under this permit has been undertaken, a written report confirming that no clearing under this permit has been undertaken, must be provided to the *CEO* on or before 30 June of each calendar year.
- (c) The permit holder must provide to the *CEO*, no later than 90 calendar days prior to the expiry date of the permit, a written report of records required under condition 8, where these records have not already been provided under condition 9(a).

DEFINITIONS

In this permit, the terms in Table have the meanings defined.

Table 2: Definitions

Term	Definition
actively breeding	Means adult bird/s actively incubating eggs in a nest or actively feeding juvenile birds unable to leave the nest.
CEO	Chief Executive Officer of the department responsible for the administration of the clearing provisions under the <i>Environmental Protection Act 1986</i> .
clearing	has the meaning given under section 3(1) of the EP Act.
condition	a condition to which this clearing permit is subject under section 51H of the EP Act.
dieback	means the effect of <i>Phytophthora</i> species on native vegetation.
department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> (WA) and designated as responsible for the administration of the EP Act, which includes Part V Division 3.
EP Act	<i>Environmental Protection Act 1986</i> (WA)
fauna specialist	means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of two (2) years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the CEO as a

Term	Definition
	suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under the <i>Biodiversity Conservation Act 2016</i>
fauna survey	means a field-based investigation, including a review of established literature, of the biodiversity of fauna and/or fauna habitat of the permit area and where conservation significant fauna are identified in the permit area, also includes a fauna survey of surrounding areas to place the permit area into local context.
native vegetation	has the meaning given under section 3(1) and section 51A of the EP Act.
Typha	means one or more of the following plant species: (a) <i>Typha domingensis</i> (b) <i>Typha. orientalis</i>
weeds	means any plant – (a) that is a declared pest under section 22 of the <i>Biosecurity and Agriculture Management Act 2007</i> ; or (b) published in a Department of Biodiversity, Conservation and Attractions species-led ecological impact and invasiveness ranking summary, regardless of ranking; or (c) not indigenous to the area concerned.

END OF CONDITIONS



Mathew Gannaway
MANAGER
NATIVE VEGETATION REGULATION

*Officer delegated under Section 20
of the Environmental Protection Act 1986*

27 May 2021

Schedule 1

The boundary of the area authorised to be cleared is shown in the map below (Figure 1-8).

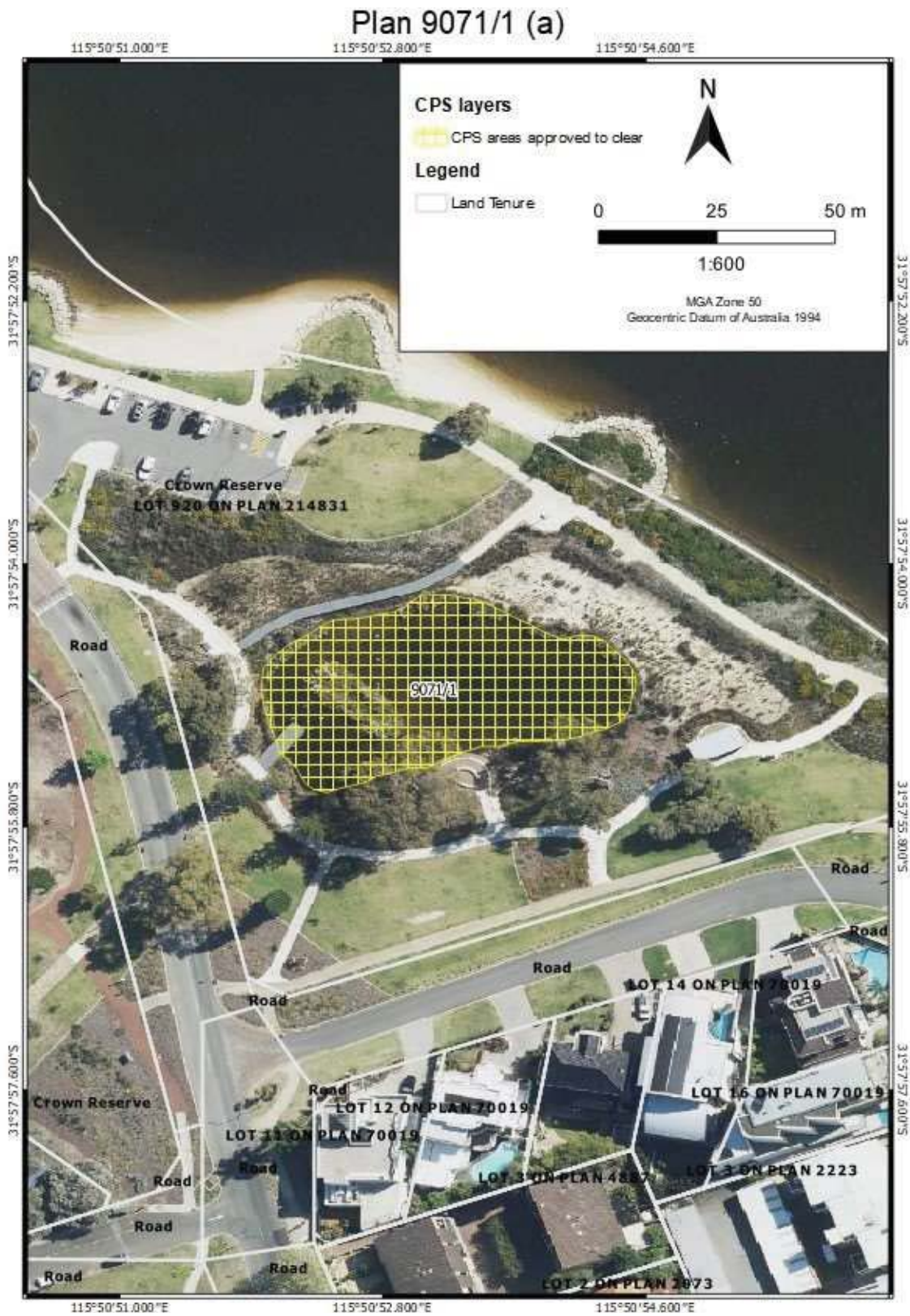


Figure 1: Map of the boundary of the area within which clearing may occur

Plan 9071/1 (b)

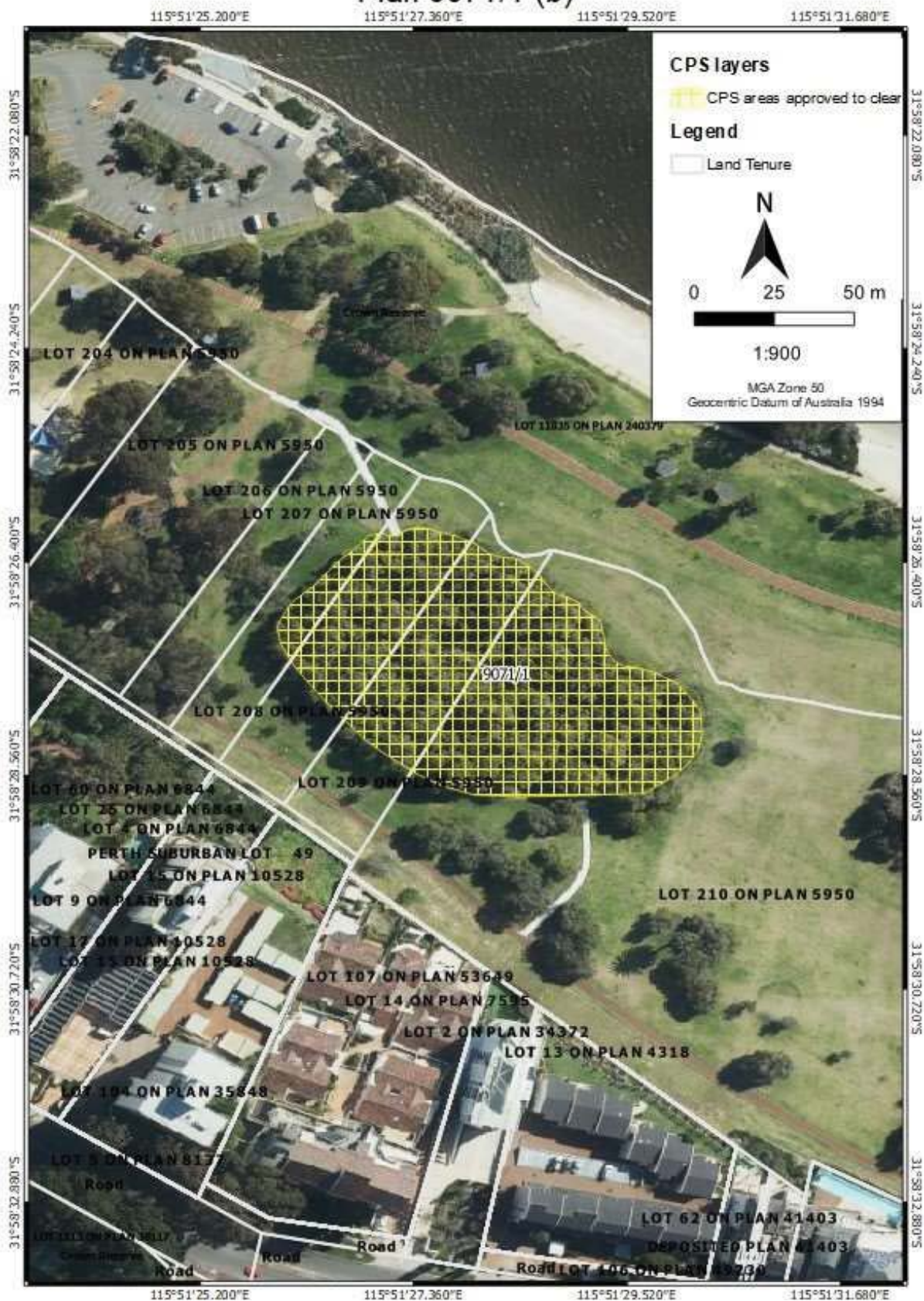


Figure 2: Map of the boundary of the area within which clearing may occur

Plan 9071/1 (c)



Figure 3: Map of the boundary of the area within which clearing may occur

Plan 9071/1 (d)

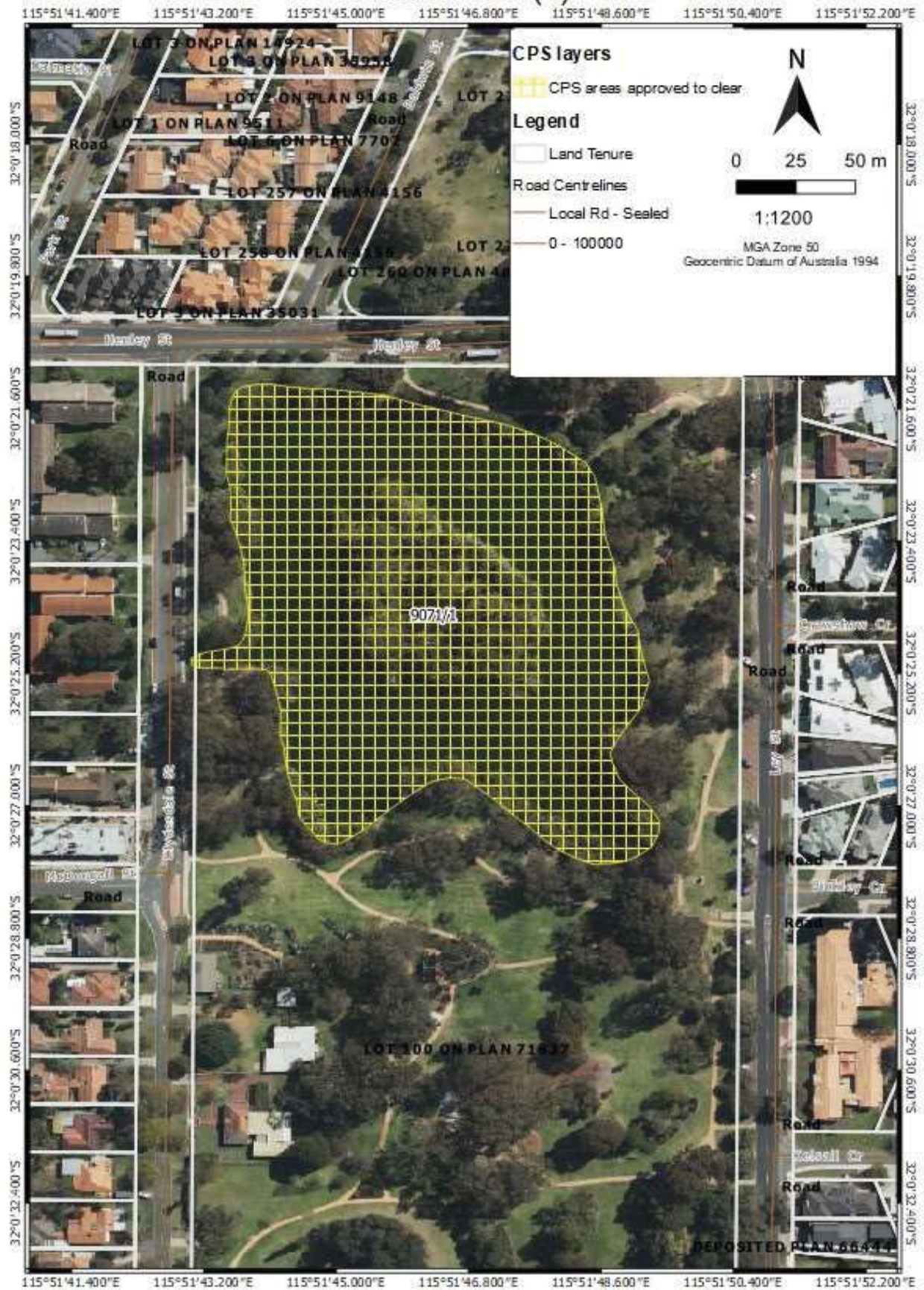


Figure 4: Map of the boundary of the area within which clearing may occur

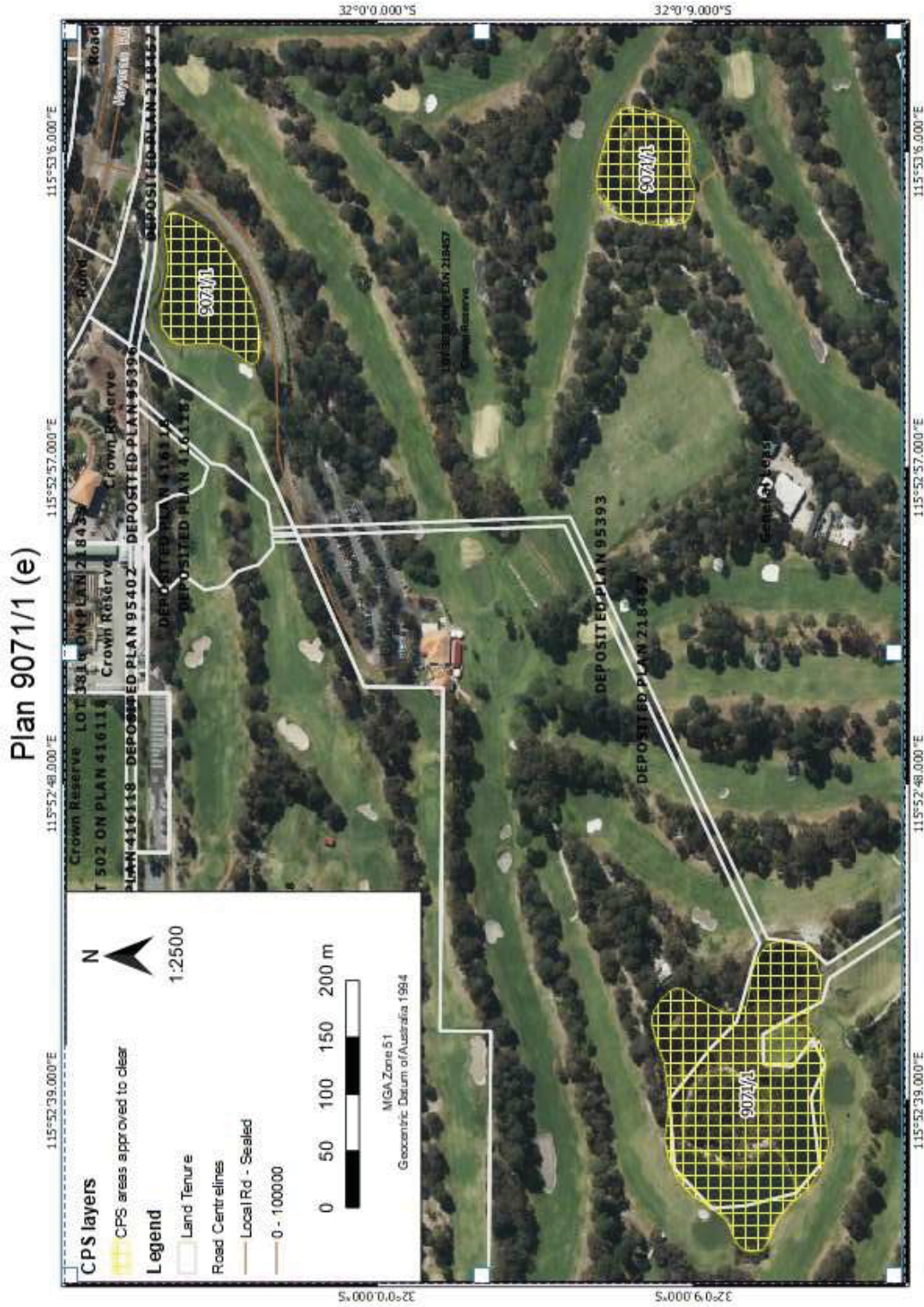


Figure 5: Map of the boundary of the area within which clearing may occur

Plan 9071/1 (f)

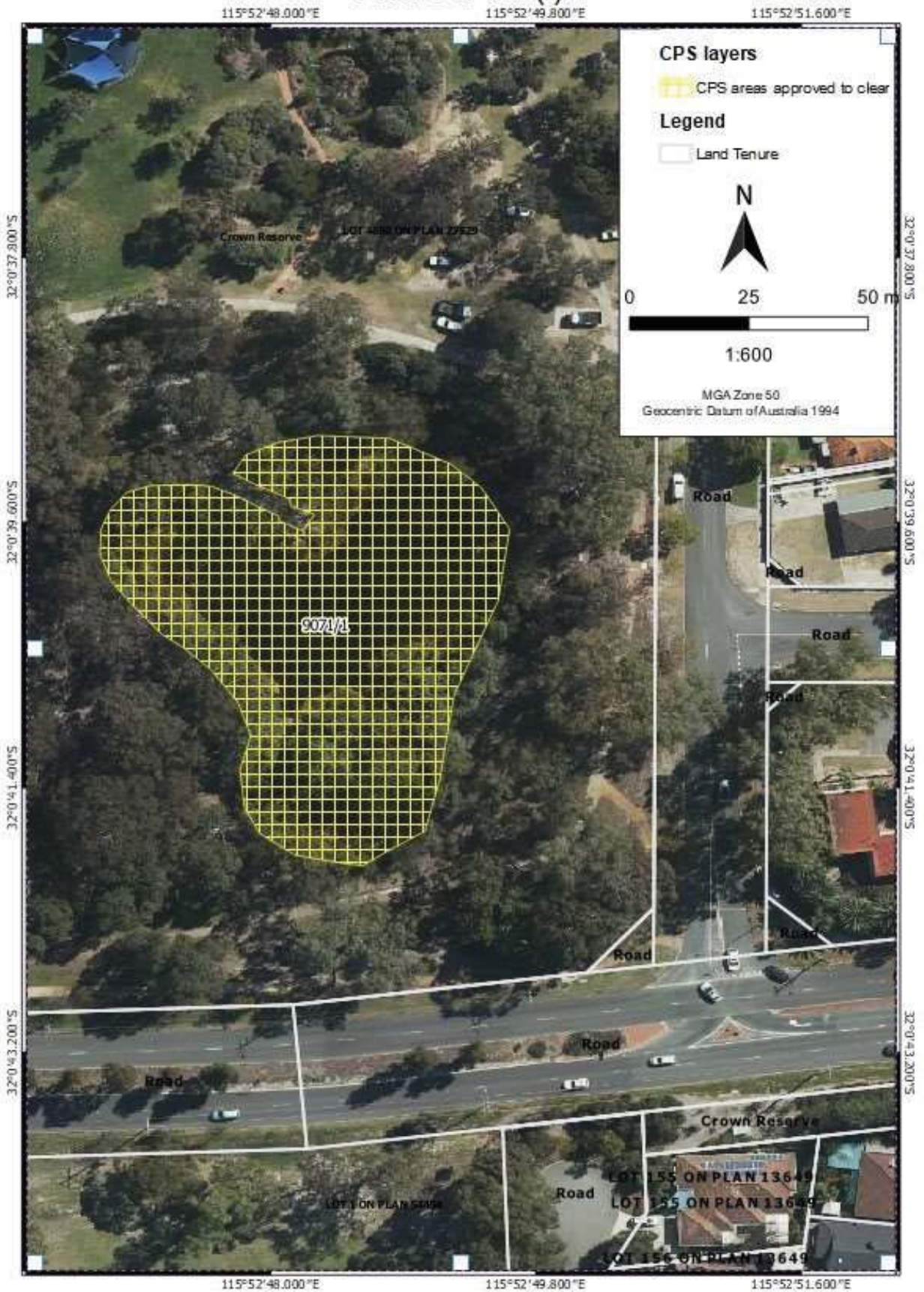


Figure 6: Map of the boundary of the area within which clearing may occur

Plan 9071/1 (g)

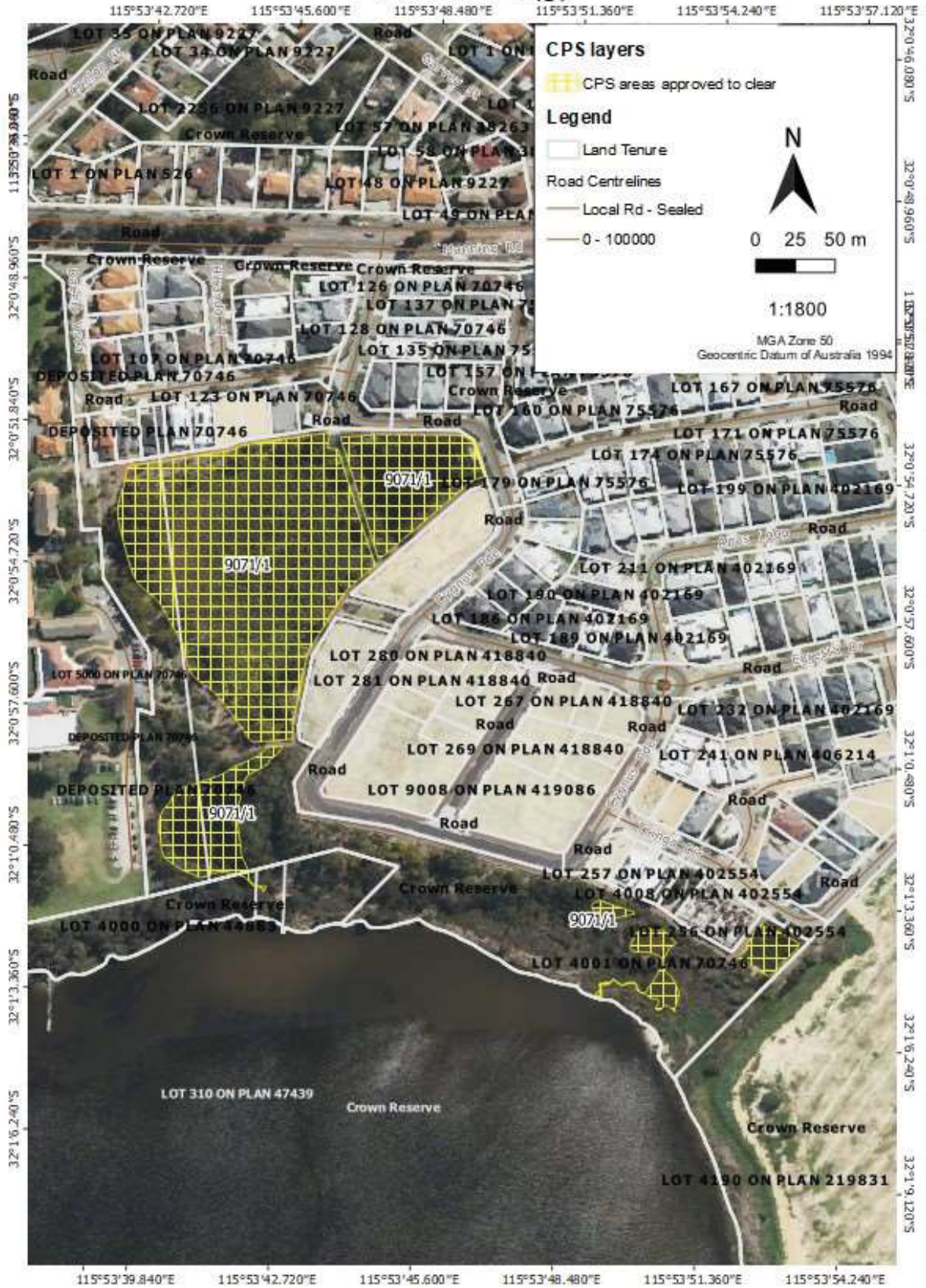


Figure 7: Map of the boundary of the area within which clearing may occur



Figure 8: Map of the boundary of the area within which clearing may occur. The areas cross-hatched red indicates areas within which specific conditions apply.



Clearing Permit Decision Report

1 Application details and outcome

1.1. Permit application details

Permit number:	CPS 9071/1
Permit type:	Purpose permit
Applicant name:	City of South Perth
Application received:	6 October 2020
Application area:	0.189 hectares of native vegetation, within various properties managed by the City of South Perth
Purpose of clearing:	Removing Typha to improve water flow and to create habitats more suited to native animals
Method of clearing:	Cutting and chemical spray
Property:	List of properties attached
Location (LGA area/s):	City of South Perth
Localities (suburb/s):	Como, Karawara, Manning, Salter Point, South Perth, Waterford

1.2. Description of clearing activities

This application is for targeting the removal of two species of robust herbaceous plants, *Typha domingensis* and *T. orientalis*, distributed across 26 separate water bodies (See Section 1, Figure 1 – 9), within various properties managed by the applicant. The species composition of each stand proposed to be cleared has not been verified. Therefore, for the purpose of this report, all stands of either or both species will be referred to as Typha.

The applicant has proposed to implement three methods of Typha control, hand pulling/digging, mechanical removal with a brush cutter and chemical spray (see Section 3.1 for further details). The 26 separate water bodies will be monitored for the duration of the permit, with Typha removed when detected by implementing the three treatment methods and subject to permit conditions.

1.3. Decision on application

Decision:	Granted
Decision date:	27 May 2021
Decision area:	0.189 hectares of native vegetation, as depicted in Section 1.5 below.

1.4. Reasons for decision

This clearing permit application was submitted, accepted, assessed and determined in accordance with sections 51E and 51O of the *Environmental Protection Act 1986* (EP Act). The Department of Water and Environmental Regulation (DWER) advertised the application for 21 days and two submissions were received. Consideration of matters raised in the public submissions is summarised in Appendix B.

In making this decision, the Delegated Officer had regard for the site characteristics (see Appendix C), relevant datasets (see Appendix G.1), the findings of a survey (Syrinx, 2020), the clearing principles set out in Schedule 5 of the EP Act (see Appendix D), relevant planning instruments and any other matters considered relevant to the assessment (see Section 3). The Delegated Officer also took into consideration the purpose of the clearing, to remove Typha, an invasive native species capable of aggressive invasions that can transform ecosystems unless it is actively managed (Western Australian Herbarium 1998-).

The assessment identified that the proposed clearing may result in:

- Potential removal/disturbance of foraging habitat for Endangered *Botaurus poiciloptilus* (Australasian bittern) and the Priority 4 *Ixobrychus dubius* (Australian little bittern)
- Potential removal/disturbance of nesting habitat for Priority 4 *Oxyura australis* (Blue billed duck).
- Potential incidental short-term impacts in the form of land degradation of wind and water erosion.
- Potential incidental short-term impacts to adjacent fauna and flora resulting from the use of Glyphosate Bi-active (Glyphosate).

After consideration of the available information, as well as the applicant's minimisation and mitigation measures (see Sections 3.1), the Delegated Officer decided to grant a clearing permit subject to the following requirements conditioned on the clearing permit, to manage and address the impacts of clearing:

- Each potential Blue billed duck nesting area identified must be inspected by a fauna specialist for evidence of current breeding, before clearing can occur. If breeding Blue billed duck is detected, clearing cannot occur within that portion of the application area until the chicks have fledged.
- Undertake slow, progressive one directional clearing to allow terrestrial and avian fauna to move into adjacent habitat ahead of the clearing activity.
- Undertake spot spraying of Glyphosate during the driest period of the year when the water level is at its lowest.

1.5. Site maps



Figure 1 Context map of the application area. Areas crosshatched yellow indicate the areas authorised to be cleared under the granted clearing permit. The areas cross-hatched red indicates areas within which specific conditions apply.

Plan 9071/1 (a)

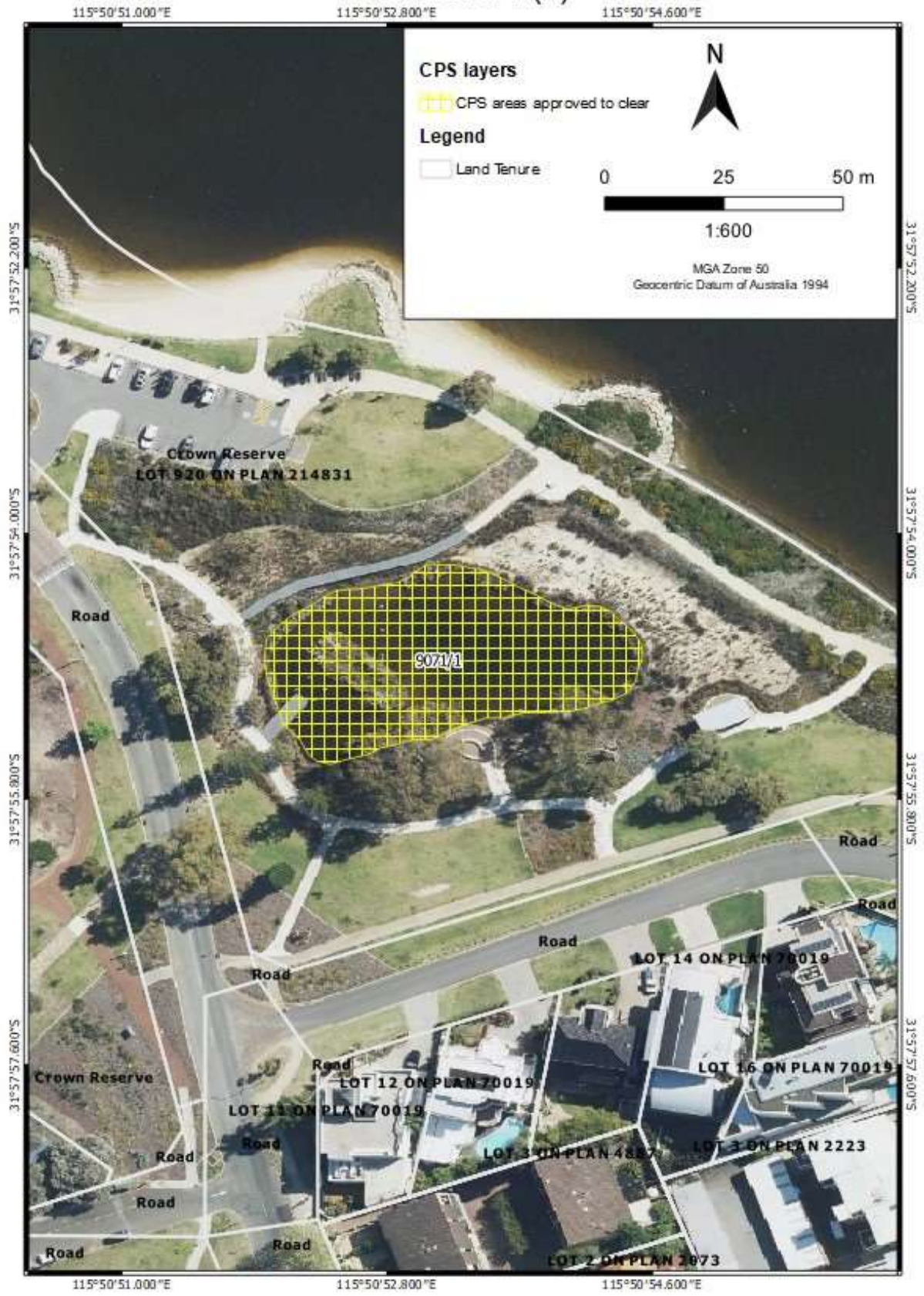


Figure 2 Millers Pond

Plan 9071/1 (b)

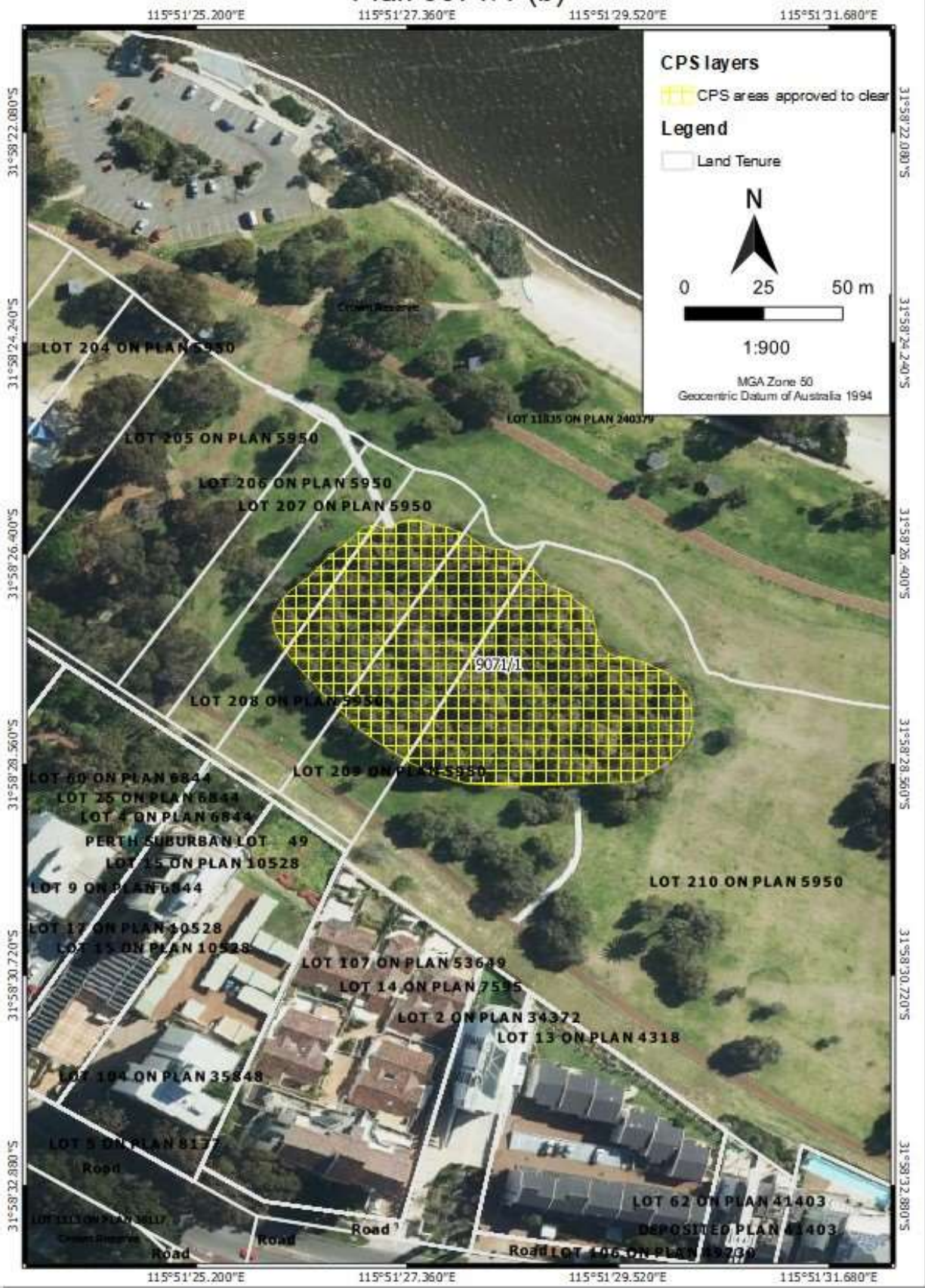


Figure 3 Melaleuca Swamp

Plan 9071/1 (c)

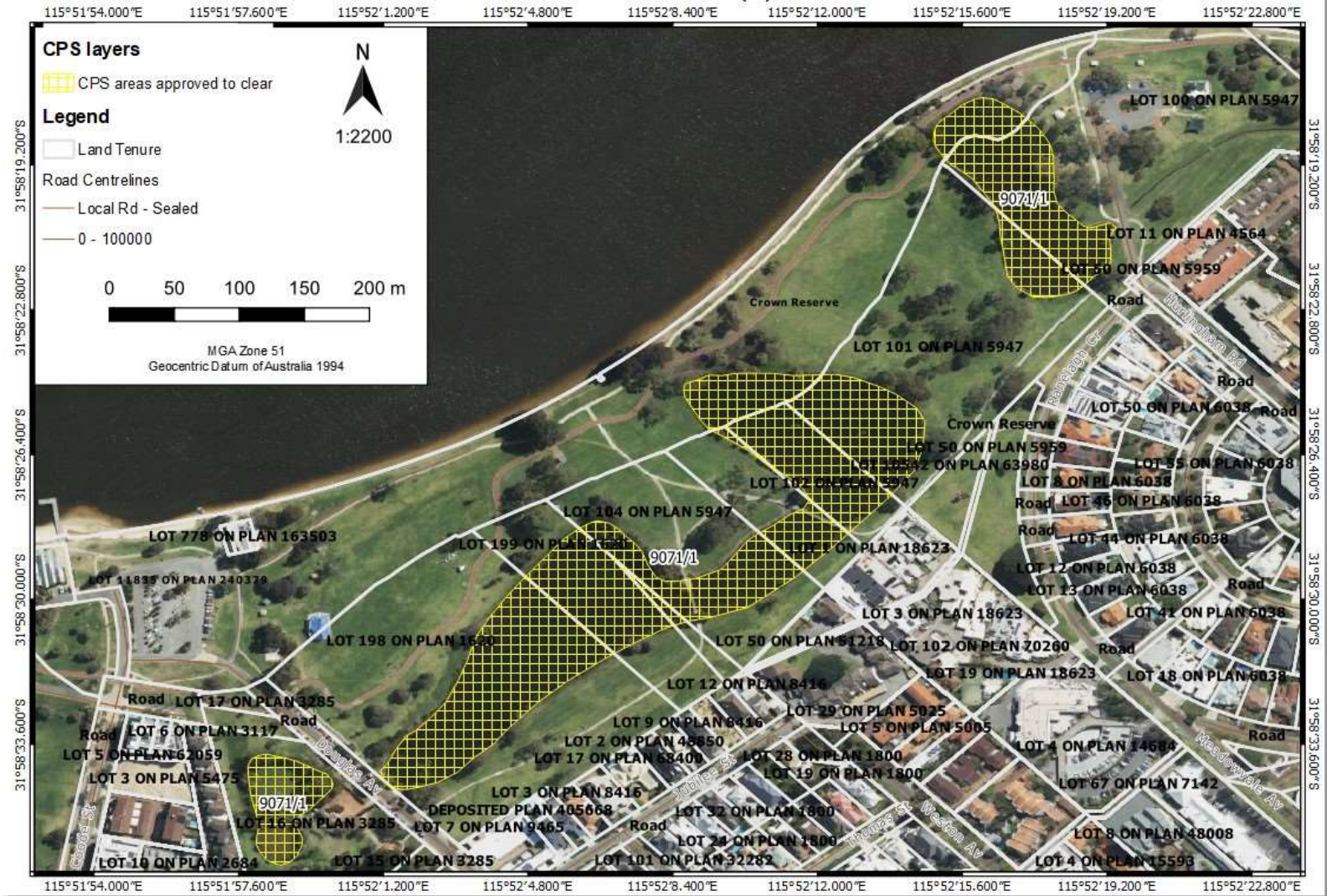


Figure 4 From left to right, Lake Tondut, Lake Douglas and Lake Hurlingham

Plan 9071/1 (d)

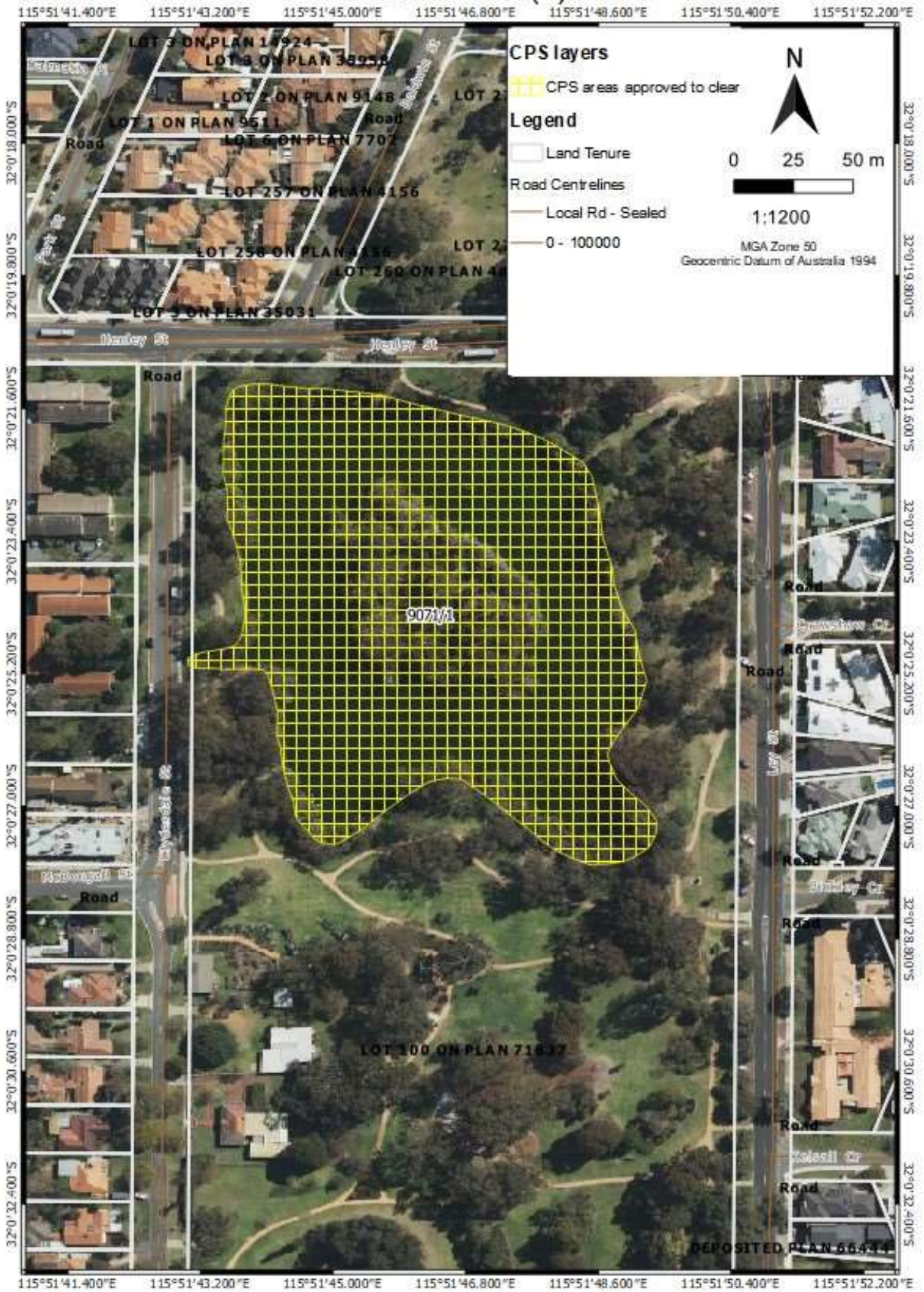


Figure 5 Lake McDougall

Plan 9071/1 (e)



Figure 6 Collier Park Lakes
CPS 9071/1 27 May 2021

Plan 9071/1 (f)

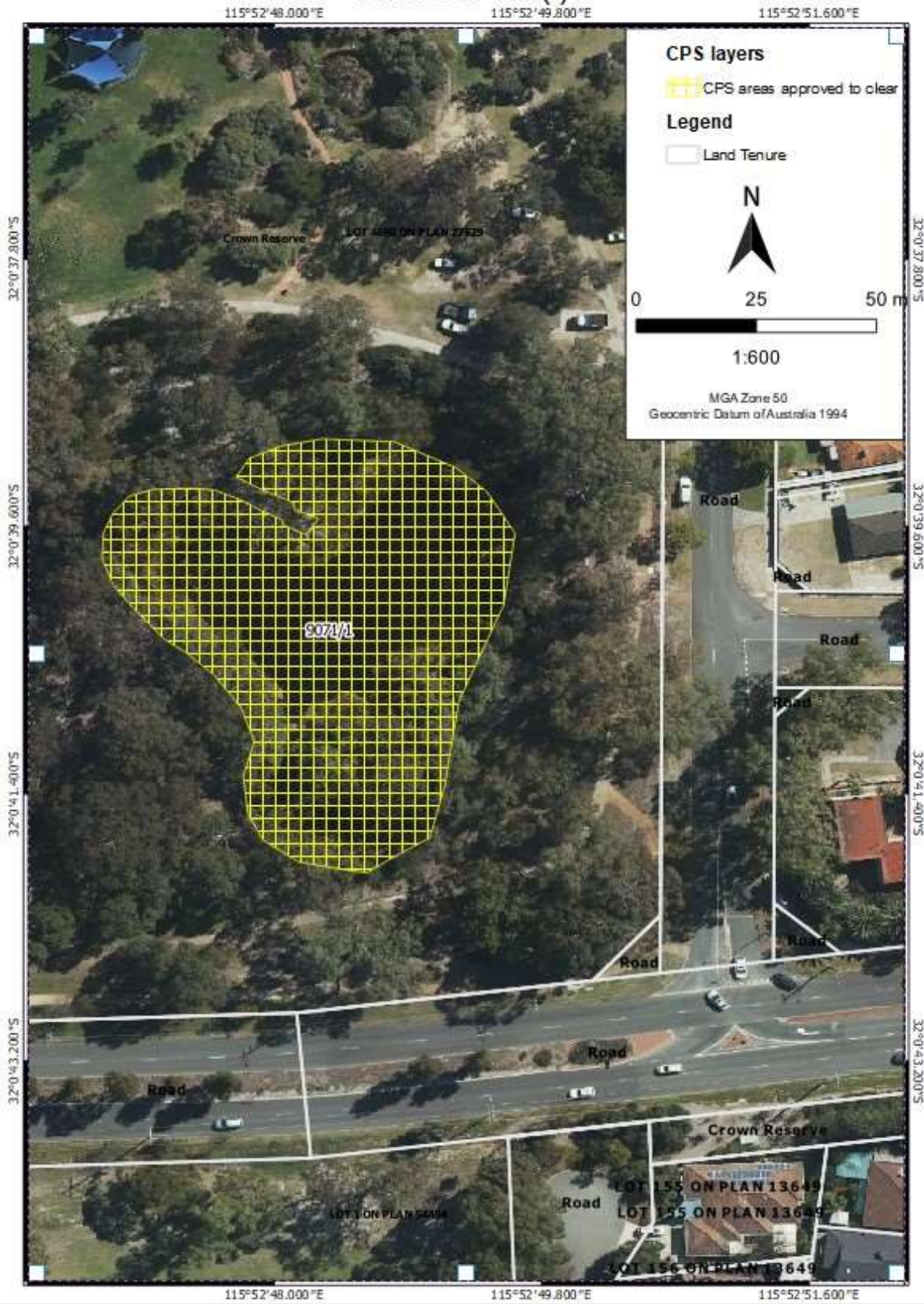


Figure 7 Lake Gillon

Plan 9071/1 (g)

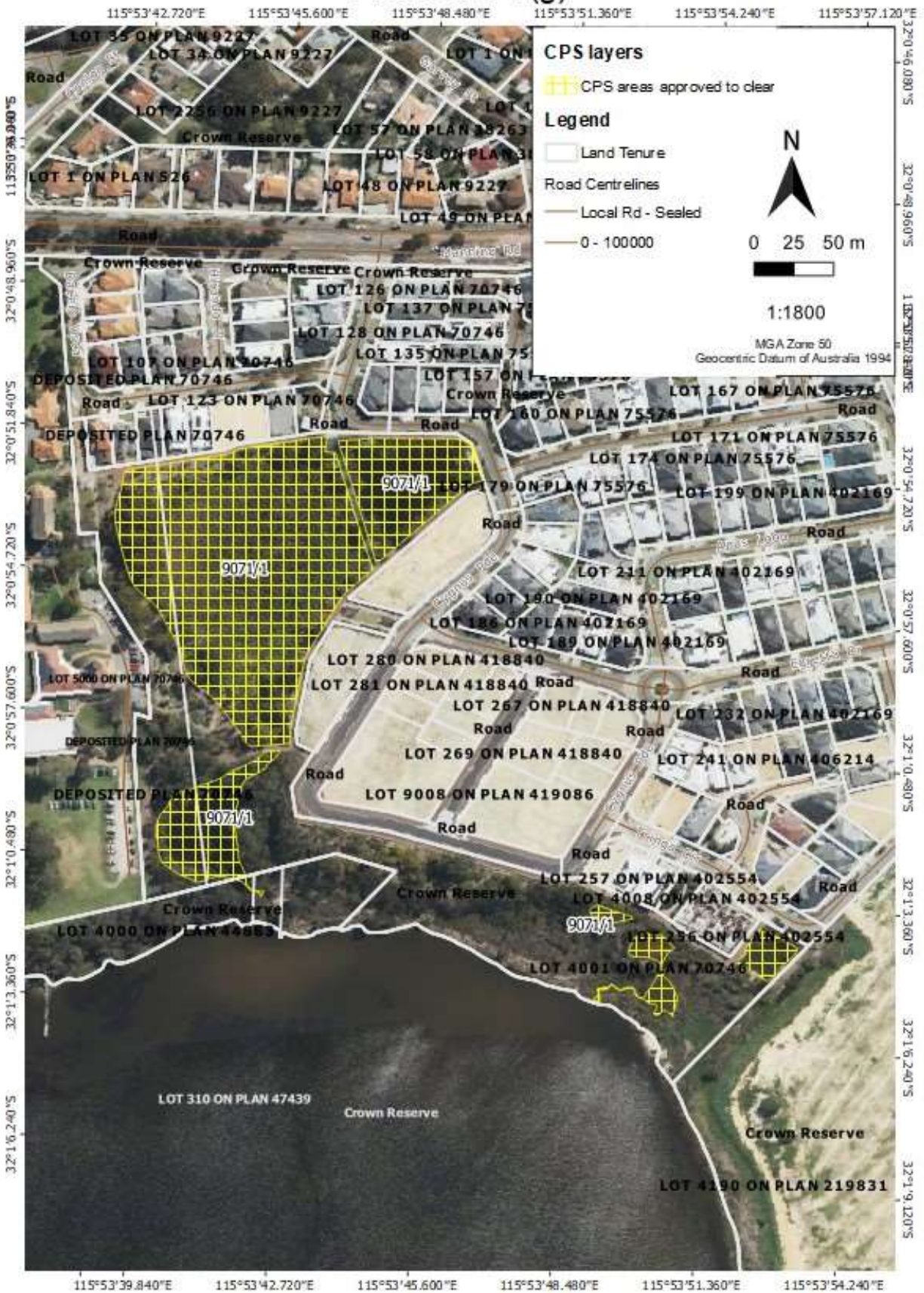


Figure 8 Cygnia Cove Lakes

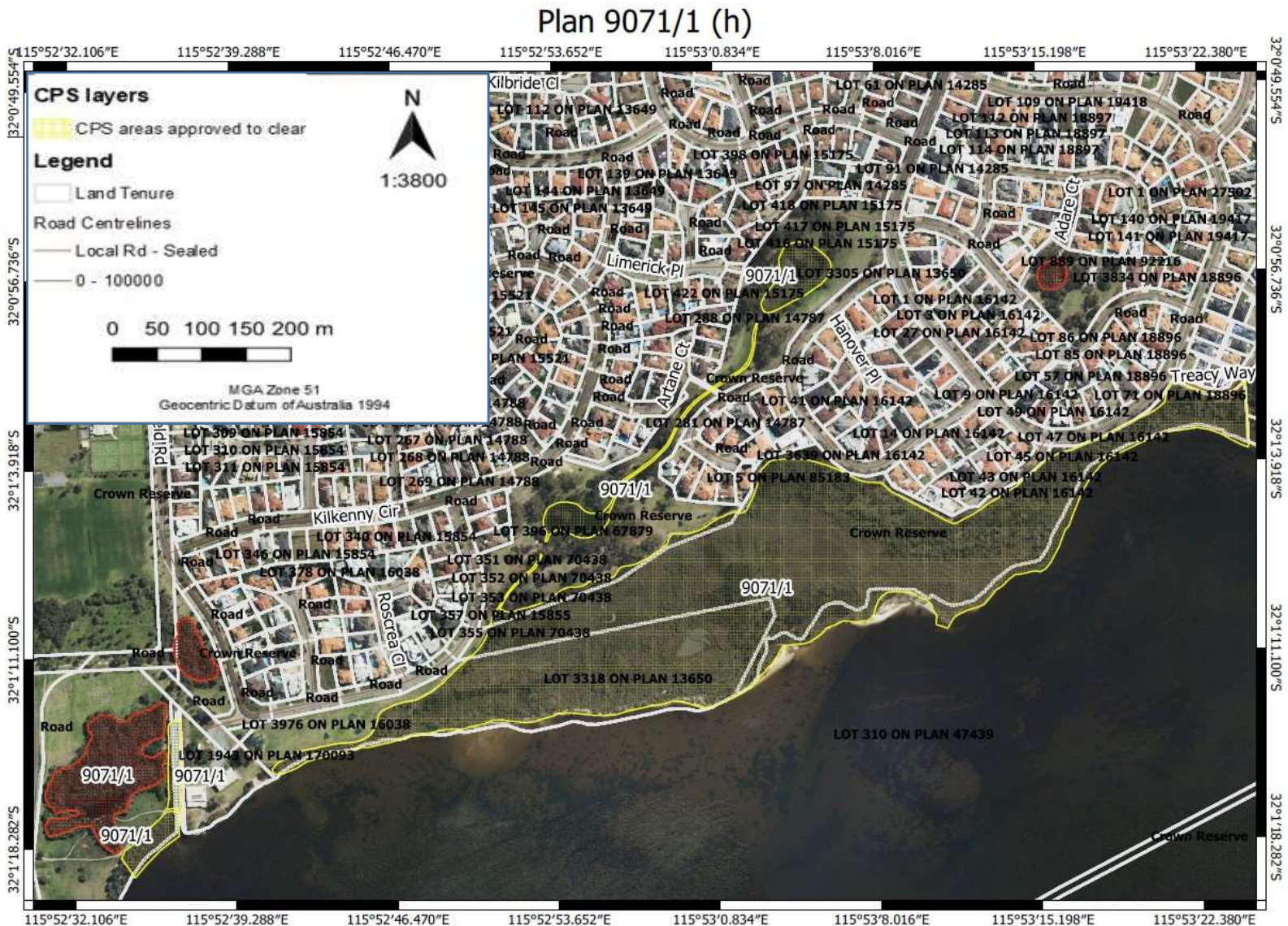


Figure 9 From left to right, Elderfield Wetlands and Andrew Thompson Reserve, Bodkin Park Lakes and Doneraile Reserve Basin. The areas cross-hatched red indicates areas within which specific conditions apply.
CPS 9071/1 27 May 2021

2 Legislative context

The clearing of native vegetation in Western Australia is regulated under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations).

In addition to the matters considered in accordance with section 51O of the EP Act (see Section 1.4), the Delegated Officer has also had regard to the objects and principles under section 4A of the EP Act, particularly:

- the precautionary principle
- the principle of intergenerational equity
- the polluter pays principle
- the principle of the conservation of biological diversity and ecological integrity.

Other legislation of relevance for this assessment include:

- *Biodiversity Conservation Act 2016* (WA) (BC Act)
- *Conservation and Land Management Act 1984* (WA) (CALM Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Soil and Land Conservation Act 1945* (WA)

The key guidance documents which inform this assessment are:

- *A guide to the assessment of applications to clear native vegetation* (DER, 2013)
- *Procedure: Native vegetation clearing permits* (DWER, October 2019)

3 Detailed assessment of application

3.1. Avoidance and mitigation measures

The applicant has proposed three methods of Typha removal to reduce the risk of soil erosion, deterioration in the quality of surface or underground water and impact to adjacent fauna and flora. Methods include:

- Where only small patches of Typha are present, a technique of hand pulling/digging will be employed.
- Where practicable, repeated routine cutting of Typha stalks is an effective means of control that prevents the plant from reaching maturity and developing seed heads. A hedger will be used, when appropriate, to cut the Typha below the water level to stress the plant and decrease the nutrient supply to the roots resulting in the plants death.
- Glyphosate will be applied carefully onto the leaves of the plant at a rate of 1.5 per cent using a manual knapsack.
- Every effort will be made to keep the herbicide out of the water, as much as possible, by applying the Glyphosate when the wind is calm and directing the spray carefully to each individual stalk. Follow up removal of the dead material and installing more appropriate native species will decrease the chance of the species returning after treatment.

3.2. Assessment of impacts on environmental values

In assessing the application, the Delegated Officer has had regard for the site characteristics (see Appendix C) and the extent to which the impacts of the proposed clearing present a risk to biological, conservation, or land and water resource values.

The assessment against the clearing principles (see Appendix D) identified that the impacts of the proposed clearing may present a risk to fauna, flora, conservation areas, and land and water resources. The consideration of these impacts, and the extent to which they can be managed through conditions applied in line with sections 51H and 51I of the EP Act, is set out below.

3.2.1. Biological values (flora) - Clearing Principles (a and c)

Assessment

According to available databases, none of the 17 wetland and aquatic conservation significant flora (see Appendix C.3), are recorded within the application area. A Typha survey conducted on behalf of the applicant (Syrinx, 2020) identified fringing native vegetation associated with a number of water bodies, that could provide suitable habitat for wetland and aquatic conservation significant flora. According to herbarium records, (Western Australian Herbarium, 1998-) none of the 17 species listed in Appendix C.3, were recorded as occurring within stands of Typha. As the proposed clearing will only target Typha, it is unlikely any conservation significant flora will be negatively impacted during removal, due to the nature of the clearing.

The proposed clearing is to reduce the rate of spread and allow natural recruitment of other native plant species in areas where *Typha* has been removed. Areas relatively free of *Typha* will be monitored and controlled to ensure numbers remain low. Dense stands will be controlled by the repeated cutting of *Typha* stalks below the water line. As a last resort, for more dense stands of *Typha*, the applicant proposes to apply chemical treatment, specifically a 1.5 per cent solution of Glyphosate. Glyphosate is a general herbicide and has the potential to impact adjacent fauna and flora, and the short-term and long-term impact on aquatic wildlife from Glyphosate use is not entirely clear (DBCA, 2019). The applicant has advised that every effort will be made to keep the herbicide out of the water, as much as possible, and spraying will only occur when the wind is calm (City of South Perth, 2021). The proposed use of a knapsack will allow a more targeted application of Glyphosate, directing the spray to individual leaf stalks.

Conclusion

Based on the above assessment, the proposed clearing is unlikely to result in a significant loss in biodiversity or impact significant populations of threatened and priority flora. Suitable habitat for species listed in Appendix C.3 is unlikely to be significantly impacted by the proposed clearing.

Conditions

To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- Undertake spraying of Glyphosate during the driest period of the year when the water level is at its lowest and during calm conditions.

3.2.2. Biological values (fauna) - Clearing Principles (b)

Assessment

According to available databases, six conservation significant fauna species associated with water courses, wetlands, and coastal habitats have been recorded within the application area. These include the Wood sandpiper (*Tringa glareola*), Green shank (*Tringa nebularia*), Long-toed stint (*Calidris subminuta*), Red-necked stint (*C. ruficollis*), Crested tern (*Thalasseus bergii*) and the Priority 4 Blue-billed duck (*Oxyura australis*).

The above migratory shore bird species are recorded within the portion of the application area that intersects the Andrew Thompson Reserve (see Section 1, Figure 9). This reserve is a subtropical and temperate coastal saltmarsh threatened ecological community (TEC). The above migratory species, except Crested tern, may use the shallow brackish pools and mud flats occurring within the reserve as foraging habitat. This portion of the application area is currently free of *Typha* (Syrinx, 2020) and is unlikely to become infested as wetland areas are too brackish for *Typha* infestation to be of significant impact. An assessment of the impacts of the proposed clearing within Andrew Thompson Reserve is considered in Section 3.2.3 below.

The Priority 4 Blue-billed duck (*Oxyura australis*), has eight records within a 100-metre radius of Lake Tondut and Lake Douglas (see Section 1, Figure 4 and Appendix F, Figure 14), on the southern foreshore of the Swan River. This species can breed from August to March, mostly between October to January (DBCA 2021). Breeding habitat is typically secluded densely vegetated situations, with the nest constructed in *Typha* beds or other vegetation, in permanent water. Nests are usually constructed from dead *Typha* leaves and sometimes thinly lined with down (Birdlife Australia, 2020a). Currently there is no *Typha* within Lake Tondut and Lake Douglas (Syrinx, 2020). The records for Blue billed duck associated with the two water bodies would indicate that this species is using the lakes as foraging habitat, as no breeding habitat is currently available.

Blue billed duck may utilise other portions of the application area where more suitable breeding habitat occurs, including Doneraile Reserve Basin and Elderfield Wetlands, (See Appendix F, Figure 10 and Figure 13). Therefore, proposed clearing may impact the breeding habitat of this species.

Other shore bird and wetland species, recorded in the local area, likely to use Andrew Thompson Reserve, as foraging habitat include, the migratory species Black-tailed godwit (*Limosa limosa*), Common sandpiper (*Actitis hypoleucos*), the Critically Endangered Eastern curlew (*Numenius madagascariensis*), the Critically Endangered Curlew sandpiper (*Calidris ferruginea*), Glossy ibis (*Plegadis falcinellus*), the Critically Endangered Great knot (*Calidris tenuirostris*), Vulnerable Greater sand plover (*Charadrius leschenaultii*), Grey plover (*Pluvialis squatarola*) little ringed plover (*Charadrius dubius*), the Endangered Lesser sand plover (*Charadrius mongolus*), Marsh sandpiper (*Tringa stagnatilis*), Oriental pratincole (*Glaucopis maldivarum*), Pacific golden plover (*Pluvialis fulva*), Pectoral sandpiper, (*C. melanotos*), the Endangered Red knot (*C. canutus*), Ruff (*Philomachus pugnax*), Sanderling (*C. alba*), Sharp-tailed sandpiper (*C. acuminata*), and Whimbrel (*Numenius phaeopus*). These species also feed in habitats too saline for *Typha* infestation to be of significant impact or do not depend exclusively on foraging in habitats prone to *Typha* infestation.

The Endangered Australian painted snipe (*Rostratula australis*), has been recorded approximately 6 kilometres from the application area. Painted snipe, is usually found in shallow inland wetlands, either freshwater or brackish, that

are either permanently or temporarily filled (DAWE, 2003). This habitat is similar to that found at Andrew Thompson Reserve and Painted snipe may range through the area. However, considering the only record for Painted snipe in the local area is for a single individual at Herdsman Lake, dated 2012, it is unlikely this species is still present in the local area. Also, given the small size of the clearing and the location of the Typha to be removed (see Appendix F, Figure 11), it is unlikely to significantly impact this species.

According to available data bases, 18 records exist in the local area for the Endangered *Botaurus poiciloptilus* (Australasian bittern). This species, favours permanent freshwater wetlands with tall, dense vegetation, particularly *Eleocharis* spp (Spike rushes) and *Typhus* (DBCA 2018). The species is known to breed in Spring-Summer, with egg laying known to occur in September to December (DBCA 2021). The application area is outside the current range of Australasian bittern, however it may potentially visit areas outside of its current range. It is not considered to be resident or breeding at those sites (DBCA 2021).

The Priority 4 *Ixobrychus dubius* (Little bittern) has been recorded within 2.4 kilometres of the application area and has similar habitat requirements to the Australasian bittern, mainly where tall rushes, reeds, Typha, shrub thickets or other dense cover is inundated by at least 30 centimetres of water. It can be found in extensive swamps, but often inhabits small patches of dense wetland vegetation such as Typha along drains or in small urban lakes (Bird life Australia, 2020b). Little bittern can occur as a migrant in south-west Australia from late August to early April, breeding in the north of the state in winter (Bird life Australia, 2020b). Little bittern may visit wetlands on the Swan Coastal Plain, and there is a possibility of the species occurring within the application area, but the probability is low (DBCA 2021).

The Priority 3 Black bittern (*Ixobrychus flavicollis australis*) is also recorded in the local area. In spring, this species builds a nest on branches overhanging water. Habitat includes terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangrove (Birdlife Australia, 2020c). Given that Black bittern are not dependent on Typha habitat for breeding, it is unlikely this species will be impacted significant by the proposed clearing.

According to available databases, 27 records for the Priority 4, Rakali or Water rat (*Hydromys chrysogaster*), occur within the local area. Rakali are amphibious or semiaquatic mammals reaching up to 70 centimetres in length (from nose to end of the tail), feeding largely underwater, on a wide range of prey including large insects, crustaceans, mussels and fishes, and even frogs, lizards, small mammals and water birds. Although dependent on water for foraging, Rakali live on land, in burrows on low banks of rivers, lakes, wetlands, and estuaries including coastal areas. Intact riparian vegetation and associated bank stability is critical to their survival. (DWER, 2021).

Rakali have not been recorded in the application area, however the high number of records indicate that this species may range through the application area, as ranging territory can be up to 4 kilometres of riverbank (DWER, 2021). It is unlikely the proposed clearing will impact this species as Typha does not form a critical component of its habitat.

Conclusion

Based on the above assessment, stands of Typha located at Doneraile Reserve Basin and Elderfield Wetlands may provide breeding habitat and a source of nest building material for Blue billed duck. There is a low probability that Australasian bittern, Little bittern and Black bittern may temporarily utilise the above wetlands as foraging habitat

Andrew Thompson reserve may provide foraging habitat for the Endangered Australian painted snipe and a number of migratory shore birds. The proposed clearing within the reserve is minimal and does not occur within the portion of the reserve utilised by the above species.

Rakali or Water rat may also range through the application area. Typha removal does not form a critical component of the habitat utilised by this species.

For the reasons set out above, it is considered that the impacts of the proposed clearing can be managed by conducting, preclearing site inspections and slow directional clearing.

Conditions

To address the above impacts, the following management measures will be required as conditions on the clearing permit, in areas comprising permanent water and dense stands of Typha:

- Each potential Blue billed duck nesting area identified must be inspected by a fauna specialist for evidence of current breeding, before clearing can occur. If breeding Blue billed duck is detected, clearing cannot occur within that portion of the application area until the chicks have fledged.
- Undertake slow, progressive one directional clearing to allow terrestrial and avian fauna to move into adjacent habitat ahead of the clearing activity.

3.2.3. Biological values (threatened ecological community) - Clearing Principles (d)

Assessment

A portion of the application area comprises the Andrew Thompson Reserve (see Section 1.5, Figure 9). The reserve is mapped as a Subtropical and Temperate Coastal Saltmarsh, listed as a Vulnerable TEC under the EPBC Act and Priority 3 priority ecological community (PEC) by DBCA. The community consists mainly of salt-tolerant vegetation (halophytes) including grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate, and vegetation is generally <0.5m tall with the exception of some reeds and sedges, however Typha is not a component of this vegetation unit (DBCA 2019a). Further inland, the vegetation of the reserve changes to *Melaleuca raphiophylla* and *Eucalyptus rudis* open woodland over *Pteridium esculentum* (see Appendix F, Figure 12). Typha is recorded at two locations within the above woodland, (see Appendix F, Figure 11). The two stands cover a total area of 0.0012 hectares representing 0.01 percent of the reserve. Monitoring and removal of Typha from the reserve is intended to prevent further establishment and spread, preventing Typha stands becoming too large for non-chemical control. Given that Typha is known to colonise and dominate ecosystems, the proposed clearing will be beneficial to this TEC.

Several portions of the application area are mapped as Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region, including:

- Malaleuca Swamp
- Lake Gillon
- Elderfield Wetlands
- Cygnia Cove Lakes

The fringing vegetation of the above water bodies is not consistent with available spatial data. The plant communities described in these areas (Syrinx, 2020) do not resemble any state listed TEC or PEC (see Appendix C for vegetation descriptions and Appendix F, Figures 10, 15, 16, and 17).

Conclusion

Based on the above assessment, the proposed clearing will not result in significant impact to the Subtropical and Temperate Coastal Saltmarsh TEC. Given the nature of the clearing, Typha removal will be beneficial to the maintenance of species composition and structure of this of the reserve. Noting the small size of the Typha stand within the reserve, mechanical removal of Typha will be undertaken, reducing the risk of Glyphosate impacting the TEC.

3.2.4. Environmental value:(land and water resources) - Clearing Principles (f, g and i)

Assessment

The proposed clearing is for the purpose of controlling the occurrence of Typha due to its invasive nature and adverse impacts on wetlands in the absence of management. Given the proposed clearing will target Typha or areas where Typha infestation is anticipated, the proposed clearing is not likely to result in any long-term impact to the ecological values of the riparian vegetation communities and associated wetlands within the application area.

Given the nature of the proposed clearing activities, the most likely land degradation impacts anticipated to result from the proposed clearing would be wind and surface water erosion of the exposed ground. However, the applicant is only proposing to clear small areas at a time (Syrinx 2020), or where practicable, repeated routine cutting of Typha stalks to prevent the plant from reaching maturity and developing seed heads. Dense growth in any small water body particularly those that already contain a good cover of native sedges and rushes (e.g. Doneraile Reservoir Basin and Elderfield Wetlands) should be removed at a minimum, on an annual basis by mechanical cutting and flooding of the cut stems. For larger wetland areas such as Elderfield Wetlands (see section 1.5, Figure 9), the applicant proposes to periodically cut and remove above-ground biomass and Typha populations will be sprayed at the boundary to keep population size under check.

The EnvGeol Sp1 Phase soil type has a high risk of land degradation (see section C5) and is present at Collier Park Lakes (Figure 6) and Lake Gillon (Figure 7). Considering these water bodies are currently free of Typha, and will be monitored regularly, it is expected that only small stands of Typha will be removed, utilising the mechanical clearing methods outlined above.

The removal of Typha has the potential to increase sedimentation and turbidity in wetlands within the application area, thereby possibly impacting surface water quality. However, due to the small scale of the clearing, it is not likely to cause long-term deterioration in the quality of surface water.

Conclusion

The proposed clearing will not significantly impact riparian vegetation and is expected to enhance riparian and wetland habitats, within the application area. Typha removal methods provided by the applicant are considered sufficient to prevent appreciable land degradation. The small scale of the clearing is unlikely to result in the deterioration in the quality of surface or underground water.

3.3. Relevant planning instruments and other matters

The application area falls within the Swan River Development Control area managed by the Department of Biodiversity Conservation and Attractions. The City of South Perth obtained the Works permit (Permit number: P12701) under the *Swan and Canning Rivers Management Act 2006* on 21 December 2020. The permit covers proposed clearing works from 1 January 2020 to 1 January 2026. Authorised works include, monitoring and removal of Typha and revegetation.

The DBCA (2019b) advised that the use of Glyphosate can be contentious near human populations and that the short-term and long-term impact on aquatic wildlife from Glyphosate use is not entirely clear. Within Australia, the regulation of pesticides is undertaken by the Australian Pesticides and Veterinary Medicine Authority. There are legal penalties in place for using pesticides outside of label directions. The applicant is advised to ensure their use of Glyphosate and any other pesticides during this clearing activities complies with all legal requirements concerning the use of these pesticides. Furthermore, applying the Glyphosate when the wind is calm and directing the spray carefully to each individual stalk will mitigate potential risk to adjacent vegetation and fauna.

Appendix A. Additional information provided by applicant

Summary of comments

The applicant submitted additional details of Typha control methods (City of South Perth 2021):

The City of South Perth plans to use the three different methods listed below to control the spread of Typha in City managed reserves.

Pulling/Digging

Where only small patches of Typha are present a technique of hand pulling/digging of Typha will be employed.

Cutting

Where practicable, repeated routine cutting of Typha stalks is an effective means of control that prevents the plant from reaching maturity and developing seed heads.

Manual hand loppers or a petrol powered

Hedger will be used when appropriate to cut the Typha below the water level to stress the plant and decrease the nutrient supply to the roots resulting in the plants death.

Spraying with herbicide

- Spraying herbicide in a wetland will always be a last resort to managing the spread of Typha.
- The successful removal of Typha species requires getting the stalk as well as the root.
- A systemic herbicide will move to the roots through the plant system. Glyphosate will be applied carefully onto the leaves of the plant at a rate of 1.5 % using a manual knapsack.
- Every effort will be made to keep the herbicide out of the water as much as possible by applying the Glyphosate when the wind is calm, and directing the spray carefully to each individual stalk.
- Follow up removal of the dead material and installing more appropriate native species will decrease the chance of the species returning after treatment.

Consideration of comment

Impact of methodology assessed:

Conditions controlling Chemical herbicide added to the permit.

Appendix B. Details of public submissions

Summary of comments	Consideration of comment
Submission 1: Concerns for the invasive nature of the Typha. Submission supports the removal of Typha and comments that the species be completely eradicated.	Typha management methods proposed by applicant will address these concerns.
Submission 2: Submission comments that there is no room for large stands of Typha in the small wetlands of the City of South Perth. Also supporting documentation (Syrinx 2020) states Typha is good for bird species but does not elaborate.	The relationship between Typha and bird species recoded in the local area are reviewed in the Section 3.2.2. Mapping of Typha within the City of South Perth has been conducted by Syrinx (2020).

Appendix C. Site characteristics

C.1. Site characteristics

Characteristic	Details
Local context	The application area comprises a total of 26 targeted areas distributed across various properties managed by the City of South Perth municipality. The proposed clearing will be restricted to the removal of Typha from wetland vegetation including a portion of the Canning River foreshore, associated inlets, and wetlands (see section 1.5, Figure 9) plus a number of manmade lakes within natural remanent vegetation and parkland (See Appendix F for images of the application area). Approximately 90 percent of the native vegetation has been cleared from the local area.
Ecological linkage	The proposed clearing does not include any significant portion of an ecological linkage.
Conservation areas	The clearing area includes the Andrew Thompson Reserve (Section 1.5 Map H) which forms part of the Swan-Canning Estuary, mapped as an important wetland of Australian and is part of the river reserve protected under the <i>Swan and Canning Rivers Management Act 2006</i> . The reserve is the largest remnant of salt marsh within the City of South Perth municipality, and forms part of the Swan Canning Estuary, and the Swan River Development Control area.
Vegetation description	<p>The proposed clearing targets the removal of Typha growing in association natural water courses, and manmade lakes. As a result of Typha occurring in association with manmade water bodies, the distribution of Typha can be inconsistent with mapped vegetation. See Appendix F for examples of vegetation within the application area. Listed below is a summary of mapped vegetation types within the local area that may include Typha as a natural component.</p> <p>Mapped vegetation types (Heddlé <i>et al.</i> 1980), include:</p> <ul style="list-style-type: none"> Vasse Complex 57: Mixture of the closed scrub of <i>Melaleuca</i> species fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca</i> species and open forest of <i>Eucalyptus gomphocephala</i> (tuart) - <i>Eucalyptus marginata</i> (jarrah) - <i>Corymbia calophylla</i> (marri). Will include areas dominated by <i>Tecticornia</i> and <i>Sarcocornia</i> species (Samphire) near Mandurah and south of the Capel River. Karrakatta Complex-Central and South 49: Predominantly open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri) and woodland of <i>Eucalyptus marginata</i> (Jarrah) - <i>Banksia</i> species. <i>Agonis flexuosa</i> (Peppermint) is co-dominant south of the Capel River. Bassendean Complex-Central and South 44: Vegetation ranges from woodland of <i>Eucalyptus marginata</i> (Jarrah) - <i>Allocasuarina fraseriana</i> (Sheoak) - <i>Banksia</i> species to low woodland of <i>Melaleuca</i> species, and sedgelands on the moister sites. This area includes the transition of <i>Eucalyptus marginata</i> (Jarrah) to <i>Eucalyptus todtiana</i> (Pricklybark) in the vicinity of Perth.

Characteristic	Details
	The mapped vegetation within the local area retains approximately 9.7 per cent of the original extent (Government of Western Australia, 2019).
Vegetation condition	<p>A survey of Typha distribution (Syrinx, 2020) indicate that the natural remnants of vegetation within the application area are considered to be in good to excellent (Keighery, 1994) condition.</p> <p>The full Keighery (1994) condition rating scale is provided in Appendix E. Representative photos are available in Appendix F.</p>
Climate and landform	<p>The climate is classified as Mediterranean, with dry, hot summers and cool, wet winters.</p> <ul style="list-style-type: none"> • average rainfall is 762.1 mm pa, with the majority falling between May and August. • average maximum temperature ranges from 18.0 degrees centigrade in winter to 32 degrees centigrade in summer. • the highest recorded maximum being 46.7 degrees centigrade • average minimum temperatures range from 8.0 degrees centigrade in winter to 17.5 degrees centigrade in summer. • the lowest recorded minimum being -1.3 degrees centigrade (BOM 2021). <p>The 26 stands of Typha comprise three landforms including:</p> <ul style="list-style-type: none"> • Vasse System: Poorly drained estuarine flats, of the Swan Coastal Plain. Tidal flat soil, saline wet soil and pale deep sand. Samphire, sedges and paperbark woodland. • Spearwood System: Poorly drained estuarine flats, of the Swan Coastal Plain. Tidal flat soil, saline wet soil and pale deep sand. Samphire, sedges and paperbark woodland. • Bassendean System: Swan Coastal Plain from Busselton to Jurien. Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths.
Soil description	<p>The soil is mapped as:</p> <ul style="list-style-type: none"> • EnvGeol Made Ground Phase: Disturbed landform. • EnvGeol S14 Phase: Sand - pale grey to white, medium-grained sub-angular, quartz and feldspar, well sorted, abundant whole and broken bivalves and gastropod shells, of alluvial origin. • EnvGeol S7 Phase: Sand - pale and olive yellow, medium to coarse-grained, sub-angular to sub-rounded quartz, trace of feldspar, moderately sorted, of residual origin. • EnvGeol S8 Phase: Sand - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin. • EnvGeol Sp1: Phase: Peaty sand- grey to black, fine to medium-grained, moderately sorted quartz sand, slightly peaty, of lacustrine origin. • EnvGeol Cps Phase: Peaty clay, dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin

Characteristic	Details																																																																
	<ul style="list-style-type: none"> EnvGeol C1 Phase: Clay - mid to dark grey, soft, saturated, prominent 0.2 m thick oyster shell bed near surface of alluvial origin. Variable organic content. (DPIRD 2019) 																																																																
Land degradation risk	There is a high amount of variability in the land degradation risk, between the seven soils occurring across the application area. The EnvGeol CPs Phase, soil unit was found to be of high land degradation risk, as 100 percent of the mapped soil unit is susceptible to wind erosion, water erosion, subsurface acidification, water logging, phosphorus export risk, and flood risk. See the table in C.4 for a full analysis of soil risks.																																																																
Waterbodies	<p>The desktop assessment and aerial imagery indicated that the application area included the mapped water bodies tabulated below. Stand size refers to the size of each Typha stand associated with each respective waterbody.</p> <table border="1"> <thead> <tr> <th>Map reference</th> <th>Nearest street address</th> <th>Name/type of water body</th> <th>Stand size (ha)</th> </tr> </thead> <tbody> <tr> <td>Figure 2</td> <td>Millpoint Road</td> <td>Millers Pool, (manmade)</td> <td>0</td> </tr> <tr> <td>Figure 3</td> <td>Millpoint Road</td> <td>Melaleuca Swamp</td> <td>0</td> </tr> <tr> <td>Figure 4</td> <td>Douglas Avenue</td> <td>Lake Tondut (manmade)</td> <td>0</td> </tr> <tr> <td>Figure 4</td> <td>Douglas Avenue</td> <td>Laker Douglas (manmade)</td> <td>0</td> </tr> <tr> <td>Figure 4</td> <td>Hurlingham Road</td> <td>Lake Hurlingham (manmade)</td> <td>0</td> </tr> <tr> <td>Figure 5</td> <td>Henley Street</td> <td>Lake McDougall</td> <td>0</td> </tr> <tr> <td>Figure 6</td> <td>Kent Street</td> <td>Collier Park Lake1 (manmade)</td> <td>0</td> </tr> <tr> <td>Figure 6</td> <td>Kent Street</td> <td>Collier Park Lake2 (manmade)</td> <td>0</td> </tr> <tr> <td>Figure 6</td> <td>Kent Street</td> <td>Collier Park Lake3 (manmade)</td> <td>0</td> </tr> <tr> <td>Figure 7</td> <td>Gillon Street</td> <td>Lake Gillon</td> <td>0.0014</td> </tr> <tr> <td>Figure 8</td> <td>Cygnus Parade</td> <td>Cygnia Cove lakes</td> <td>0.003</td> </tr> <tr> <td>Figure 9</td> <td>Galway Grove</td> <td>Bodkin Park Lakes</td> <td>0</td> </tr> <tr> <td>Figure 9</td> <td>Doneraile Court</td> <td>Doneralie Reserve Basin (manmade)</td> <td>0.0255</td> </tr> <tr> <td>Figure 9</td> <td>Salter Point Parade</td> <td>Elderfield Wetlands</td> <td>0.1573</td> </tr> <tr> <td>Figure 9</td> <td>Fairview Gardens</td> <td>Andrew Thomson Reserve, Salt marsh, forming part of the Swan Canning Estuary</td> <td>0.0012</td> </tr> </tbody> </table>	Map reference	Nearest street address	Name/type of water body	Stand size (ha)	Figure 2	Millpoint Road	Millers Pool, (manmade)	0	Figure 3	Millpoint Road	Melaleuca Swamp	0	Figure 4	Douglas Avenue	Lake Tondut (manmade)	0	Figure 4	Douglas Avenue	Laker Douglas (manmade)	0	Figure 4	Hurlingham Road	Lake Hurlingham (manmade)	0	Figure 5	Henley Street	Lake McDougall	0	Figure 6	Kent Street	Collier Park Lake1 (manmade)	0	Figure 6	Kent Street	Collier Park Lake2 (manmade)	0	Figure 6	Kent Street	Collier Park Lake3 (manmade)	0	Figure 7	Gillon Street	Lake Gillon	0.0014	Figure 8	Cygnus Parade	Cygnia Cove lakes	0.003	Figure 9	Galway Grove	Bodkin Park Lakes	0	Figure 9	Doneraile Court	Doneralie Reserve Basin (manmade)	0.0255	Figure 9	Salter Point Parade	Elderfield Wetlands	0.1573	Figure 9	Fairview Gardens	Andrew Thomson Reserve, Salt marsh, forming part of the Swan Canning Estuary	0.0012
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Hydrogeography	<p>The table below lists stands of Typha that intersect flood plain areas. Refer to section 1.5 for maps.</p> <table border="1"> <thead> <tr> <th>Map reference</th> <th>Name of water body/Nearest street address</th> <th>FPM flood plain area</th> <th>Stand size (ha)</th> </tr> </thead> <tbody> <tr> <td>Figure 2</td> <td>Millers Pool, Millpoint Road</td> <td>(10%) AEP</td> <td>0</td> </tr> <tr> <td>Figure 3</td> <td>Melaleuca Swamp, Millpoint Road</td> <td>(10%) AEP</td> <td>0</td> </tr> <tr> <td>Figure 4</td> <td>Lake Tondut, Douglas Avenue</td> <td>(10%) AEP</td> <td>0</td> </tr> <tr> <td>Figure 4</td> <td>Laker Douglas, Douglas Avenue</td> <td>(10%) AEP</td> <td>0 h</td> </tr> <tr> <td>Figure 4</td> <td>Lake Hurlingham, Hurlingham Road</td> <td>(10%) AEP</td> <td>0</td> </tr> </tbody> </table>	Map reference	Name of water body/Nearest street address	FPM flood plain area	Stand size (ha)	Figure 2	Millers Pool, Millpoint Road	(10%) AEP	0	Figure 3	Melaleuca Swamp, Millpoint Road	(10%) AEP	0	Figure 4	Lake Tondut, Douglas Avenue	(10%) AEP	0	Figure 4	Laker Douglas, Douglas Avenue	(10%) AEP	0 h	Figure 4	Lake Hurlingham, Hurlingham Road	(10%) AEP	0																																								
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Characteristic	Details			
	Figure 8	Cygnia Cove lakes, Cygnus Parade	(1%) AEP	0.0045
	Figure 9	Bodkin Park Lakes, Galway Grove	(1-10%) AEP	0
	Figure 9	Elderfield Wetlands	(1-10%) AEP	1.6
	Figure 9	Andrew Thomson Reserve, Salt marsh, forming part of the Swan Canning Estuary	(10%) AEP	0.0012
FPM-Flood plain Mapping, AEP- Annual exceedance probability The application area falls within a RIWI ground water area (DWER-034)				
Flora	A total of 113 species of conservation significant flora occur within the local area. There are 17 species of conservation significant flora that are known to be associated with wetland habitats and could possibly occur adjacent to Typha stands. Refer to the Flora Analysis table section Appendix C.3 for further flora analysis of the 17 wetland species.			
Ecological communities	Two threatened ecological communities are mapped as occurring in the local area: <ul style="list-style-type: none"> Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region, Endangered under the EPBC Act. Subtropical and temperate coastal saltmarsh, Vulnerable under the EPBC Act 			
Fauna	A total of 84 conservation significant species were recorded in the local area. Of the 84 species, Blue-billed duck (<i>Oxyura australis</i>), Crested tern (<i>Thalasseus bergii</i>), Green shank (<i>Tringa nebularia</i>), and Red-necked stint (<i>Calidris ruficollis</i>) have been recorded within the application area, and further seven recorded in habitats similar to the application area. The aforementioned 12 species are considered further in Section C3.			

C.2. Flora analysis table

With consideration for the site characteristics set out above, relevant datasets (see Appendix G.1), impacts to the following conservation significant flora required further consideration.

Species name	Conservation status	Suitable habitat features ? [Y/N]	Suitable vegetation type? [Y/N]	Suitable soil type? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Are surveys adequate to identify? [Y, N, N/A]
<i>Bolboschoenus fluviatilis</i>	1	Yes	Yes	Yes	6	2	N/A
<i>Carex tereticaulis</i>	3	No	No	Yes	5.7	1	N/A
<i>Eleocharis keigheryi</i>	T	No	No	Yes	6.5	3	N/A
<i>Fabronia hampeana</i> (moss)	2	No	No	Yes	6	2	N/A
<i>Hydrocotyle lemnoides</i>	4	Yes	No	Yes	4	1	N/A
<i>Hydrocotyle striata</i>	1	Yes	No	Yes	3.4	1	N/A
<i>Lepidosperma rostratum</i>	T	No	No	Yes	7	26	N/A
<i>Myriophyllum echinatum</i>	3	Yes	No	Yes	7	2	N/A
<i>Ornduffia submersa</i>	4	Yes	No	Yes	7	4	N/A
<i>Schoenus capillifolius</i>	3	No	No	Yes	1.6	5	N/A
<i>Schoenus benthamii</i>	3	Yes	No	Yes	2	4	N/A
<i>Schoenus loliaceus</i>	2	Yes	No	Yes	9.8	1	N/A
<i>Schoenus natans</i>	4	Yes	No	Yes	3.3	4	N/A
<i>Schoenus pennisetis</i>	3	No	No	Yes	6.3	5	N/A
<i>Schoenus</i> sp. Beaufort (G.J. Keighery 6291)	1	No	No	yes	6.8	1	N/A

Species name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Suitable soil type? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Are surveys adequate to identify? [Y, N, N/A]
<i>Schoenus choenus</i> sp. Waroona (G.J. Keighery 12235)	3	No	No	No	6.4	1	N/A
<i>Tetragia australiensis</i>	T	No	No	No	4.8	1	N/A

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

C.3. Fauna analysis table

With consideration for the site characteristics set out above, relevant datasets (see Appendix H.1), impacts to the following conservation significant fauna required further consideration.

Species name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Are surveys adequate to identify? [Y, N, N/A]
Blue-billed duck (<i>Oxyura australis</i>)	P4	Yes	Yes	0	853	N/A
Crested tern (<i>Thalasseus bergii</i>)	MI	Yes	Yes	0	1	N/A
Green shank (<i>Tringa nebularia</i>)	MI	Yes	Yes	0	188	N/A
Long-toed stint (<i>Calidris subminuta</i>)	MI	Yes	Yes	0	1	N/A
Red-necked stint (<i>Calidris ruficollis</i>)	MI	Yes	Yes	0	130	N/A
Wood sandpiper (<i>Tringa glareola</i>)	MI	Yes	Yes	0	1	N/A
Grey plover (<i>Pluvialis squatarola</i>)	MI	Yes	Yes	0.5	143	N/A
Water-rat, rakali (<i>Hydromys chrysogaster</i>)	P4	Yes	Yes	1.2	27	N/A
Great knot (<i>Calidris tenuirostris</i>)	CR	Yes	Yes	1.6	31	N/A
Australasian bittern (<i>Botaurus poiciloptilus</i>)	EN	Yes	Yes	1.6	18	N/A
Black bittern (<i>Ixobrychus flavicollis australis</i>)	P2	Yes	Yes	1.6	4	N/A
Greater sand plover (<i>Charadrius leschenaultii</i>)	VU	Yes	Yes	3	3	N/A
Black-tailed godwit (<i>Limosa limosa</i>)	MI	Yes	Yes	2	32	N/A
Red knot (<i>Calidris canutus</i>)	EN	Yes	Yes	2	20	N/A
Little bittern (<i>Ixobrychus dubius</i>)	P4	Yes	Yes	2.4	3	N/A
Curler sandpiper (<i>Calidris ferruginea</i>)	CR	Yes	Yes	3	53	N/A
Marsh sandpiper (<i>Tringa stagnatilis</i>)	MI	Yes	Yes	3	8	N/A
Black-tailed godwit (<i>Limosa limosa</i>)	MI	Yes	Yes	3	8	N/A
Lesser Sand Plover (<i>Charadrius mongolus</i>)	EN	Yes	Yes	3	1	N/A
Glossy ibis (<i>Plegadis falcinellus</i>)	MI	Yes	Yes	3.4	189	N/A
hooded plover (<i>Thinornis rubricollis</i>)	P4	Yes	Yes	4.8	4	N/A
Sharp-tailed sandpiper (<i>Calidris acuminata</i>)	MI	Yes	Yes	5	27	N/A
Eastern curlew (<i>Numenius madagascariensis</i>)	CR	Yes	Yes	5	2	N/A
Pectoral sandpiper, (<i>Calidris melanotos</i>)	MI	Yes	Yes	4	5	N/A
Pacific golden plover (<i>Pluvialis fulva</i>)	MI	Yes	Yes	5	5	N/A
Lesser sand Plover (<i>Charadrius mongolus</i>)	EN	Yes	Yes	3	1	N/A
Whimbrel (<i>Numenius phaeopus</i>)	MI	Yes	Yes	5.2	1	M/A
Australian painted snipe (<i>Rostratula australis</i>)	EN	No	No	6	1	N/A
Carter's freshwater mussel (<i>Westralunio carteri</i>)	VU	Yes	N/A	6.5	8	N/A
Ruff (<i>Philomachus pugnax</i>)	Mi	Yes	Yes	7	2	N/A
Sanderling (<i>Calidris alba</i>)	MI	Yes	Yes	7	4	N/A
Little ringed plover (<i>Charadrius dubius</i>)	MI	Yes	Yes	7.3	2	N/A
Oriental pratincole (<i>Glareola maldivarum</i>)	MI	Yes	Yes	7.3	6	N/A

Species name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Are surveys adequate to identify? [Y, N, N/A]
Common sandpiper (<i>Actitis hypoleucos</i>)	MI	Yes	Yes	7.7	4	N/A

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

C.4. Ecological community analysis table

Community name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Suitable soil type? [Y/N]	Distance of closest record to application area (km)	Are surveys adequate to identify? [Y, N, N/A]
Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region.	EN	No	No	Yes	0	N/A
Subtropical and Temperate Coastal Saltmarsh	VU	Yes	Yes	Yes	0	N/A

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

C.5. Land degradation risk table

Soil System	EnvGeol Made Ground Phase	EnvGeol S14 Phase	EnvGeol S7 Phase	EnvGeol S8 Phase	EnvGeol Sp1 Phase	EnvGeol Cps Phase	EnvGeol C1 Phase
Wind erosion	0	35	99	65	100	20	0
Water erosion	0	0	0	0	100	0	0
Surface Salinity	0	0	0	0	0	0	0
Subsurface Acidification	0	95	0	100	100	0	0
Water logging	0	0	0	5	100	100	0
Phosphorus export risk	0	95	10	50	100	95	0
Flood risk	0	0	0	0	100	0	0

Appendix D. Assessment against the clearing principles

Assessment against the clearing principles	Variance level	Is further consideration required?
Environmental value: biological values		
<p>Principle (a): "Native vegetation should not be cleared if it comprises a high level of biodiversity."</p> <p>Assessment: The proposed clearing will target stands of Typha. This species is capable of aggressive invasions that can transform ecosystems unless it is actively managed (Western Australian Herbarium, 2019). Without management, Typha can develop quickly into a monoculture (Figure 10) and cover an entire water body. Given the application area, comprises predominantly of Typha and its tendency to colonise ecosystems, it is not anticipated that the proposed clearing will significantly impact fauna habitat or conservation significant assemblages of plants. The application area may contain suitable habitat and soils for a number of conservation significant fauna and flora species.</p>	Not likely to be at variance	Yes Refer to Section 3.2.1, above.

Assessment against the clearing principles	Variance level	Is further consideration required?
<p><u>Principle (b):</u> <i>“Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna.”</i></p> <p><u>Assessment:</u> The area proposed to be cleared may contain foraging, and, breeding, habitat for conservation significant fauna.</p>	May be at variance	Yes <i>Refer to Section 3.2.2, above.</i>
<p><u>Principle (c):</u> <i>“Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.”</i></p> <p><u>Assessment:</u> The application area may contain suitable habitat for the, Threatened flora species, <i>Eleocharis keigheryi</i>, and <i>Lepidosperma rostratum</i>. If present, it is unlikely that these species will be impacted by the proposed clearing.</p>	Not likely to be at variance	Yes <i>Refer to Section 3.2.1, above.</i>
<p><u>Principle (d):</u> <i>“Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.”</i></p> <p><u>Assessment:</u> According to available spatial data, the area proposed to be cleared contains two TECs, Subtropical and Temperate Coastal Saltmarsh and. Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region.</p>	May be at variance	Yes <i>Refer to Section 3.2.3, above.</i>
Environmental value: significant remnant vegetation and conservation areas		
<p><u>Principle (e):</u> <i>“Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.”</i></p> <p><u>Assessment:</u> The extent of the mapped remnant native vegetation in the local area represents 9.7 percent of its, original extent. This is inconsistent with the national objectives and targets for biodiversity conservation in Australia. The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present pre-European settlement, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001).Considering the targeted nature of Typha removal, the proposed clearing is unlikely to further degrade any vegetation remnant of native vegetation in an area that has been extensively cleared.</p>	Not at variance	No
<p><u>Principle (h):</u> <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.”</i></p> <p><u>Assessment:</u> A portion of the application area falls within Andrew Thomson Reserve (Figure 9). Given the purpose of the proposed clearing is to create and improve wetland habitats (Syrinx, 2020), it is not likely to have an impact on the environmental values of the reserve.</p>	Not likely to be at variance	Yes <i>Refer to Section 3.2.3, above.</i>
Environmental value: land and water resources		
<p><u>Principle (f):</u> <i>“Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.”</i></p> <p><u>Assessment:</u> Typha forms a natural component of native wetland and watercourse vegetation. However, Typha can dominate wetland ecosystems. Given the nature of the proposed clearing, it is unlikely to significantly impact wetlands or watercourses.</p>	At variance	Yes <i>Refer to Section 3.2.4, above.</i>
<p><u>Principle (g):</u> <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.”</i></p>	May be at variance	Yes <i>Refer to Section 3.2.4, above.</i>

Assessment against the clearing principles	Variance level	Is further consideration required?
<p>Assessment: The mapped soils are generally not susceptible to wind/water erosion, nutrient export, or salinity. The soil unit EnvGeol S14 Phase is recorded having a high potential for Phosphorus export (95 percent of mapped soil unit). The soil unit EnvGeol Sp1 Phase is recorded as having a high potential for wind/water erosion, and nutrient export. Typha control methods proposed by the applicant (Applicant 2021) will include slashing the plants below the water line and chemical control, which is not likely to have an appreciable impact on land degradation.</p>		
<p>Principle (i): <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.”</i></p> <p>Assessment: The removal of Typha may increase water turbidity.</p>	May be at variance	Yes <i>Refer to Section 3.2.4, above.</i>
<p>Principle (j): <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.”</i></p> <p>Assessment: In addition to improving wetland habitats, the purpose of the proposed clearing is to improve water flow, by monitoring and removing dense stands of Typha (See Appendix F, Figure 10). Therefore, the proposed clearing is unlikely to contribute to waterlogging.</p>	Not at variance	No

Appendix E. Vegetation condition rating scale

Vegetation condition is a rating given to a defined area of vegetation to categorise and rank disturbance related to human activities. The rating refers to the degree of change in the vegetation structure, density and species present in relation to undisturbed vegetation of the same type. The degree of disturbance impacts upon the vegetation's ability to regenerate. Disturbance at a site can be a cumulative effect from a number of interacting disturbance types.

Considering its location, the scale below was used to measure the condition of the vegetation proposed to be cleared. This scale has been extracted from, Keighery, B.J. (1994) *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc). Nedlands, Western Australia.

Measuring vegetation condition for the South West and Interzone Botanical Province (Keighery, 1994)

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

Appendix F. Biological survey information excerpts / photographs

All images by Syrinx (2020)



Figure 10 Examples of Typha infestation at Elderfield Wetlands.



Figure 11 Distribution of Typha within Andrew Thompson Reserve (yellow arrows).



Figure 12 Andrew Thompson Reserve showing remnant vegetation *Juncus kraussii* rushes with *Casuarina obesa* trees (a); *Melaleuca raphiophylla* and *Eucalyptus rudis* with *Pteridium esculentum* (b); and small areas of *Typha* infestation at the end of Bodkin Park drain (c) and eastern section (d).



Figure 13 *Typha* infestation at Doneraile Reserve Basin.



Figure 14 Lake Tondut, fringing vegetation.



Figure 15 Example of Vegetation at Melaleuca Swamp.



Figure 16 Examples of fringing vegetation and small occurrences of Typha at Gillion Lake.



Figure 17 Example of vegetation at Cygnia Cove Lakes.

Appendix G. Sources of information

G.1. GIS databases

Publicly available GIS Databases used (sourced from www.data.wa.gov.au):

- 10 Metre Contours (DPIRD-073)
- Aboriginal Heritage Places (DPLH-001)
- Aboriginal Heritage Places (DPLH-001)
- Cadastre (LGATE-218)
- Cadastre Address (LGATE-002)
- Contours (DPIRD-073)
- DBCA – Lands of Interest (DBCA-012)
- DBCA Legislated Lands and Waters (DBCA-011)
- Directory of Important Wetlands in Australia – Western Australia (DBCA-045)
- Environmentally Sensitive Areas (DWER-046)
- Flood Risk (DPIRD-007)
- Groundwater Salinity Statewide (DWER-026)
- Hydrography – Inland Waters – Waterlines
- Hydrological Zones of Western Australia (DPIRD-069)
- IBRA Vegetation Statistics
- Imagery
- Local Planning Scheme – Zones and Reserves (DPLH-071)
- Native Title (ILUA) (LGATE-067)
- Offsets Register – Offsets (DWER-078)
- Pre-European Vegetation Statistics
- Public Drinking Water Source Areas (DWER-033)
- Ramsar Sites (DBCA-010)
- Regional Parks (DBCA-026)
- Remnant Vegetation, All Areas
- RIWI Act, Groundwater Areas (DWER-034)
- RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)
- Soil Landscape Land Quality – Flood Risk (DPIRD-007)
- Soil Landscape Land Quality – Phosphorus Export Risk (DPIRD-010)
- Soil Landscape Land Quality – Subsurface Acidification Risk (DPIRD-011)
- Soil Landscape Land Quality – Water Erosion Risk (DPIRD-013)
- Soil Landscape Land Quality – Water Repellence Risk (DPIRD-014)
- Soil Landscape Land Quality – Waterlogging Risk (DPIRD-015)
- Soil Landscape Land Quality – Wind Erosion Risk (DPIRD-016)
- Soil Landscape Mapping – Best Available
- Soil Landscape Mapping – Systems
- Wheatbelt Wetlands Stage 1 (DBCA-021)

Restricted GIS Databases used:

- ICMS (Incident Complaints Management System) – Points and Polygons
- Threatened Flora (TPFL)
- Threatened Flora (WAHerb)
- Threatened Fauna
- Threatened Ecological Communities and Priority Ecological Communities
- Threatened Ecological Communities and Priority Ecological Communities (Buffers)

G.2. References

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Syrinx (2020) *Typha distribution in City of South Perth nature reserves and parks*. Consultant report prepared for the City of South Perth.

Western Australian Herbarium (1998-). *FloraBase - the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions, Western Australia. <https://florabase.dpaw.wa.gov.au/> (Accessed 23 February 2021)



Property	Locality
Lot 100 on Plan 5947	South Perth
Lot 100 on Diagram 71837	Como
Lot 101 on Plan 5947	South Perth
Lot 102 on Plan 5947	South Perth
Lot 103 on Plan 5947	South Perth
Lot 104 on Plan 5947	South Perth
Lot 105 on Plan 5947	South Perth
Lot 11835 on Deposited Plan 240379 (Crown Reserve R 34565)	South Perth
Lot 16 on Plan 3285	South Perth
Lot 1943 on Deposited Plan 170093 (Crown Reserve R 27449)	Salter Point
Lot 198 on Plan 1620	South Perth
Lot 199 on Plan 1620	South Perth
Lot 207 on Plan 5950	South Perth
Lot 208 on Plan 5950	South Perth
Lot 209 on Plan 5950	South Perth
Lot 210 on Plan 5950	South Perth
Lot 300 on Deposited Plan 44440 (Crown Reserve R 23967)	Salter Point
Lot 301 on Deposited Plan 44440	Salter Point
Lot 310 on Deposited Plan 47439 (Crown Reserve R 48327)	Salter Point, Waterford
Lot 3305 on Plan 13650	Waterford
Lot 3306 on Plan 13650 (Crown Reserve R 37723)	Waterford
Lot 3318 on Plan 13650 (Crown Reserve R 37712)	Waterford
Lot 3834 on Plan 18896 (Crown Reserve R 42768)	Waterford
Lot 3858 on Deposited Plan 218457 (Crown Reserve R 38794)	Como
Lot 389 on Plan 15472 (Crown Reserve R 37712)	Waterford
Lot 3976 on Plan 16038 (Crown Reserve R 37712)	Waterford
Lot 4000 on Deposited Plan 44883 (Crown Reserve R 48530)	Waterford
Lot 4001 on Deposited Plan 70746 (Crown Reserve R 52637)	Waterford
Lot 4690 on Deposited Plan 27529 (Crown Reserve R 46565)	Karawara
Lot 5000 on Deposited Plan 70746	Waterford
Lot 920 on Deposited Plan 214831 (Crown Reserve R 33804)	South Perth
Waterford Avenue road reserve (PIN 1146737)	Waterford
Nenagh Grove road reserve (PIN 1146739)	Waterford
Treacy Way road reserve (PIN 11416772)	Waterford
Clydesdale Street road reserve (PIN 11569968)	Como
Douglas Avenue road reserve (PIN 11579579)	South Perth
Unnamed Road Reserve (PIN 11580656 and 11614054)	Waterford
Cygnus Parade road reserve (PIN 12028271)	Waterford