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Department for Environment and Water

Baseline Waterbird Monitoring of Lake Hawdon North

Monitoring Results 2023 and 2024

Synthesis of Monitoring 2021 to 2024

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Nature Glenelg Trust

Report to the South Australian Government Department for Environment and Water

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Cover photo

Australian painted snipe (*Rostratula australis*), Lake Hawdon North, 27th December 2023 (photo Abel Zevenboom).

Disclaimer

Respect and Reconciliation

Aboriginal people are the First Peoples and Nations of South Australia. The Coorong, connected waters and surrounding lands have sustained unique First Nations cultures since time immemorial.

The *Healthy Coorong, Healthy Basin* program acknowledges the range of First Nations' rights, interests and obligations for the Coorong and connected waterways and the cultural connections that exist between Ngarrindjeri Nations and First Nations of the South East peoples across the region and seeks to support their equitable engagement.

Aboriginal peoples' spiritual, social, cultural and economic practices come from their lands and waters, and they continue to maintain their cultural heritage, economies, languages and laws which are of ongoing importance.

The Department for Environment and Water (DEW) and Landscapes SA work across the State with Aboriginal South Australians to conserve and sustain Country. Through this work we seek to improve the relationship between Aboriginal and non-Aboriginal Australians and build respect based on mutual understanding and acceptance of each other.

Acknowledgements

Fieldwork for the waterbird census was conducted in collaboration with Friends of Shorebirds South East (FoSSE), DEW and the Limestone Coast Landscape Board (LCLB).

In November 2023 the census was supported by FoSSE members Jeff Campbell, Sarah Campbell, Holly Prest, Vicki Natt, John Mullins, Cath Bell, Emma Blythman and Maureen Christie and Limestone Coast Landscape Board (LCLB) officer Mark de Jong.

In November 2024 the census was supported by FoSSE members Jeff Campbell and Holly Prest, LCLB officer Mark de Jong and NGT ecologist Greg Kerr.

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Abbreviations

CSL	Coorong South Lagoon
DEM	Digital Elevation Model
DEW	South Australian Government Department for Environment and Heritage
FoSSE	Friends of Shorebirds South East
HCHB	Healthy Coorong, Healthy Basin program
LCLB	Limestone Coast Landscape Board
LHN	Lake Hawdon North
LHS	Lake Hawdon South
mAHD	meters Australia Height Datum (elevation relative to mean sea level)
OGW	On-Ground Works project (of the HCHB)
RBR	Regional Bird Refugia component (of the HCHB OGW)
WSEL	Water Surface Elevation

1. Introduction

1.1. Healthy Coorong, Healthy Basin

The Coorong, and Lakes Alexandrina and Albert Wetland is located at the terminus of the Murray-Darling Basin (MDB) System in South Australia. It is a system of shallow lakes, lagoons and wetlands covering over 140,000 hectares that is extremely diverse and an important refuge for migratory and non-migratory waterbirds in the Murray Darling Basin. In 1985 the Coorong, and Lakes Alexandrina and Albert Wetland was declared a Ramsar Wetland of International Importance, largely due to its role in supporting a diverse and abundant waterbird community. The site is also subject to a number of international migratory bird agreements including the Japan Australia Migratory Bird Agreement, the China Australia Migratory Bird Agreement and the Republic of Korea Migratory Bird Agreement and is an Icon Site of the Murray-Darling Basin Living Murray Initiative.

It is well documented (e.g. Brookes et al. 2018) that the Coorong and Lower Lakes has undergone ecological decline, which has been exacerbated by unsustainable water extractions in the MDB and the Millennium Drought. The *Healthy Coorong, Healthy Basin* (HCHB) program proposes to implement works to support the long-term health of the Coorong, with a focus on the Coorong South Lagoon (CSL). The program is being delivered by the South Australian Government Department for Environment and Water (DEW) and is jointly funded by the Australian and South Australian Governments.

The HCHB program will be achieved through six projects, including the On-Ground Works (OGW) project. The OGW project is proposing to implement short to medium term on-ground works to support the mitigation of threats to key Coorong biota while longer term options are being investigated. The OGW project includes the Regional Bird Refugia (RBR) component, which aims to improve the availability and quality of habitat for seven target migratory and non-migratory shorebirds at priority wetlands in the Lower Lakes and South East of South Australia to provide regional refugia while long-term solutions for the Coorong are developed and implemented. The seven target shorebird species are:

- sharp-tailed sandpiper;
- curlew sandpiper;
- red-necked stint;
- common greenshank;
- banded stilt;
- red-necked avocet; and
- red-capped plover.

A multi criteria decision analysis (MCDA) was undertaken to evaluate the potential of 23 wetlands in the South East region to provide habitat for key species of waterbirds disadvantaged by deteriorating conditions in the southern Coorong (Hunt et al. 2019). Lake Hawdon North (LHN) was one of two South East wetlands that received the highest MCDA score. A feasibility assessment completed in July 2020 (Taylor 2020) indicated the availability of habitat for the target species could be greatly increased by restoring hydrology and removing shrubland vegetation that has invaded the lakebed in recent decades. This shrubland is unsuitable habitat for the target species and has established on former open mudflats (Taylor 2014) that previously would have provided ideal shorebird habitat. Assuming habitat for the target species consists of open mudflats inundated from 0 (damp) to 10 cm depth, Taylor (2020) found that restoration (shrubland removal combined with restored hydrology) could increase the carrying capacity of LHN for target species by 531%.

Following the 2020 feasibility assessment, further investigations were undertaken examining various aspects of the proposed restoration including:

- detailed design of infrastructure;
- the ideal method to remove shrubland vegetation;
- approvals;
- Traditional Owner perspectives;
- stakeholder and broader community engagement; and
- downstream environmental water requirements.

Construction of the Lake Hawdon North regulator commenced in October 2024 and was completed in May 2025. Habitat restoration works, involving the prescribed burning and mechanical clearance of shrubland vegetation from the lakebed, were well advanced as of June 2025.

The ecological objectives of the restoration of Lake Hawdon North have been defined as (Taylor et al. 2022b):

- specifically within LHN, to:

  Objective A. improve the availability and quality of foraging habitat (open pan) for the seven HCHB target shorebird species, which are at risk from deteriorating conditions in the southern Coorong;

  Objective B. increase the area of open pan/open water aquatic habitat, maintain the area of *Machaerina arthrophylla* and *Gahnia filum* sedgelands and reduce the area of *Melaleuca halmaturorum* shrublands;

  Objective C. do no harm, i.e. at the very least maintain identified existing ecological values, in particular the highly significant native fish community of the Lake Hawdon system, which includes diadromous species and covers both LHN and adjoining Lake Hawdon South Conservation Park;

- More broadly, to:
  - not adversely impact the health of the downstream Robe Lakes; and
  - provide additional complementary foraging habitat to act as a 'buffer' against worsening conditions in the CSL, particularly during drier periods when waterbirds rely heavily on coastal wetlands.

Nature Glenelg Trust, in collaboration with the Department for Environment and Water, has developed a baseline ecological monitoring program (Taylor et al. 2022b) to enable the ecological outcomes of restoration to be measured and assessed against those project objectives specific to LHN. The elements of the monitoring program and their relationship to the ecological objectives of the restoration project are as follows:

Objective A

- Shorebirds and other waterbirds: quantify the abundance of the seven HCHB target shorebird species and other waterbirds across LHN to establish a pre-restoration baseline and to guide future surveys.
- Shorebird food resources: quantify the diversity and abundance of macroinvertebrate food resources for shorebirds in the sediments of both Lake Hawdon North and Lake Hawdon South to establish a pre-restoration baseline and a comparison between the two sites.

Objective B

- Vegetation transects: establish transects that describe the pre-restoration vegetation of LHN and enable future changes arising through restoration to be observed and monitored.
- *Melaleuca halmaturorum* recruitment: continue previously established monitoring of the abundance and size distribution of this invasive native species to provide an indication of the effectiveness of management, primarily grazing and hydrology, at preventing its proliferation within LHN.

Objective C

- Fish: undertake fish monitoring of existing and new monitoring locations throughout the Lake Hawdon system and compare results to previous data to provide a detailed understanding of the diversity, abundance and distribution of fish species and the demography of key threatened species.
- Bush Birds: improve understanding of the diversity and abundance of bush birds in the areas of *Melaleuca halmaturorum* shrubland proposed for clearance to provide a basis for the restoration project to minimise impacts to fauna.

In 2021 comprehensive baseline ecological monitoring was undertaken (Taylor et al. 2022b) to document the status of Lake Hawdon North in its current, unrestored condition. This included a baseline waterbird census of the entire wetland in early November 2021. The baseline census was repeated in 2022 (see Taylor et al. 2022a), 2023 and 2024. The 2023 and 2024 baseline waterbird censuses are the subject of this report, which also provides a synthesis of all four baseline censuses undertaken to date.

2. Methods

2.1. Baseline Waterbird Census

The third baseline waterbird census was conducted over two days on 14th and 15th November 2023 and the fourth on 16th and 17th October 2024. The timing of the 2024 census was brought forward due to dry conditions, with Lake Hawdon North anticipated to be completely dry by November, the month that the three previous censuses were undertaken. Teams consisted of two to three members, with at least one experienced shorebird and waterbird surveyor in each team. Teams included representatives from NGT, Friends of Shorebirds South East (FoSSE) and LCLB. Team members are listed in Table 1.

Table 1. Baseline waterbird census team members in 2023 and 2024.

2023	2024
Abel Zevenboom (NGT)	Ben Taylor (NGT)
Ben Taylor (NGT)	Jeff Campbell (FoSSE)
Bryan Haywood (NGT)	Greg Kerr (NGT)
Jonathan Tuck (NGT)	Holly Prest (FoSSE)
Cath Bell (FoSSE)	Mark de Jong (LCLB)
Emma Blythman (FoSSE)	
Jeff Campbell (FoSSE)	
Mark de Jong (LCLB)	

2023	2024
Sarah Campbell (FoSSE)	
Holly Prest (FoSSE)	
John Mullins (FoSSE)	
Vicki Natt (FoSSE)	

The survey area was assessed on foot, with vehicle access around the margins of the wetland arranged prior with adjoining landholders. Teams were equipped with binoculars and spotting scopes. Call identification was also used to detect some species.

The survey area consisted of the mapped extents (DEW "LANDSCAPE_Wetlands" layer) of LHN, comprising wetland polygons S0109028 and S0108576, as well as an adjacent wetland to the immediate north, wetland S0108587 (Figure 1). This adjacent wetland was included in the survey area because it is hydraulically connected to LHN when the water surface elevation (WSEL) exceeds approximately 4.15 mAHD, which is within the proposed regulated WSEL range (3.60 – 4.30 mAHD) for LHN.

The survey area was superimposed with a grid of 220 square cells, each 400 × 400 m (16 ha) in size (Figure 1). Cells were aligned with Drain L to avoid the logistical difficulties of cells straddling both sides of the drain. Cell boundaries were identifiable to surveyors on the ground using the AvenzaMaps® application on mobile phones, enabling bird counts per cell to be made. Areas within cells but outside of the target wetland polygons (i.e. adjoining paddocks) were outside of the survey area and were not counted. Drain L itself was counted as part of cells in the row D-15 to P-15 immediately south of the drain.

Mudflat and open water habitats in each cell were assessed and all birds within these habitats counted. This included both inundated and damp mudflats. Parts of Lake Hawdon North that were determined *a priori* to be dry were not surveyed in 2023 or 2024 as the 2021 census found waterbirds were absent from dry areas, with the exception of very small numbers of red-capped plover. Other habitat types were not systematically counted, however birds observed within these habitats (shrublands, grasslands (mostly dominated by introduced pasture grasses), *Gahnia filum* sedgelands, *Machaerina arthrophylla* sedgelands) were opportunistically counted.

Birds in flight were counted but if they entered or exited the cell being counted the direction of movement was noted for later cross checking to avoid double-counting.

The depth of water in each cell was measured in an open location (where the DEM is more accurate compared to densely vegetated areas) and the location recorded. These data were used in combination with the DEM to map the overall extent of surface water within LHN at the time of the survey. Because the WSEL was not consistent across the survey area it was necessary to sub-divide the DEM within LHN and adjust the WSEL within sub-units, to align with field observations.

Weather conditions in Robe (15 km to the west of LHN) on 14th November 2023 were partly cloudy with a maximum temperature of 17.9°C and 13 km/hr sou-south westerly winds at 3.00 pm. On 15th November 2023 conditions were overcast, maximum temperature 15.9°C with 7 km/hr sou-south westerly winds at 3.00 pm. On 16th October 2024 conditions were overcast, maximum temperature 26.0°C with 11 km/hr sou-south easterly winds at 3.00 pm. On 17th October 2024 conditions were overcast, maximum temperature 21.1°C with 6 km/hr north westerly winds at 3.00 pm.

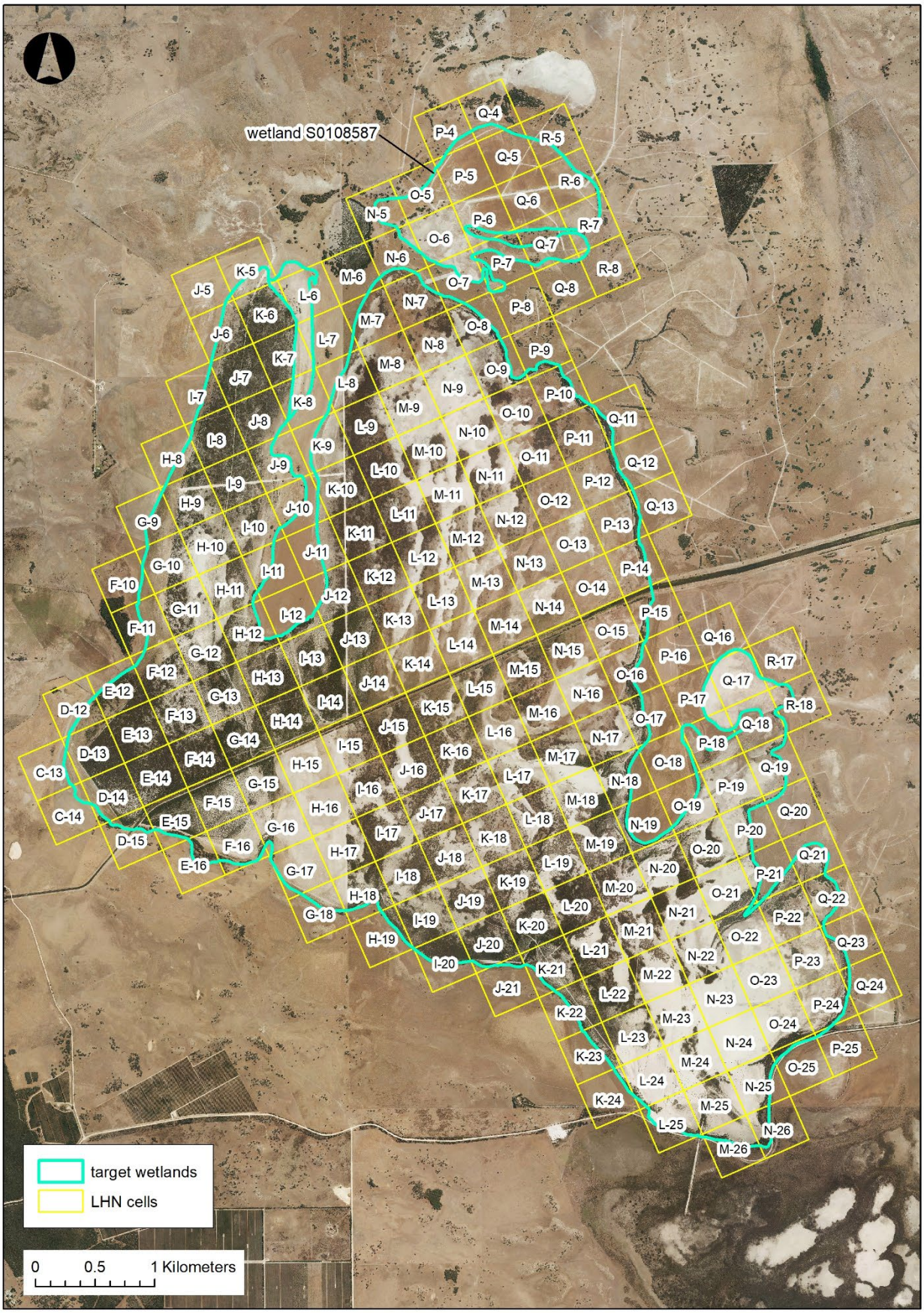

Figure 1. Lake Hawdon North survey area (target wetlands) and overlying grid of 220 cells.

To complement the census of Lake Hawdon North, a count of Lake Hawdon South (LHS) was undertaken on 16th October 2024. This count repeated counts undertaken in 1999 by Stewart et al. (2001) and regularly (although not annually) since 2002 by FoSSE. The area surveyed covers 440 ha and is the area of open water/mudflat that initially receives inflows from the Bray Drain (Figure 2). The survey area was divided into three sub-areas, north, central and south, with teams counting different sub-areas. Sub-area boundaries were identifiable to surveyors on the ground using the AvenzaMaps® application on mobile phones. All other aspects of the methodology were as per Lake Hawdon North.

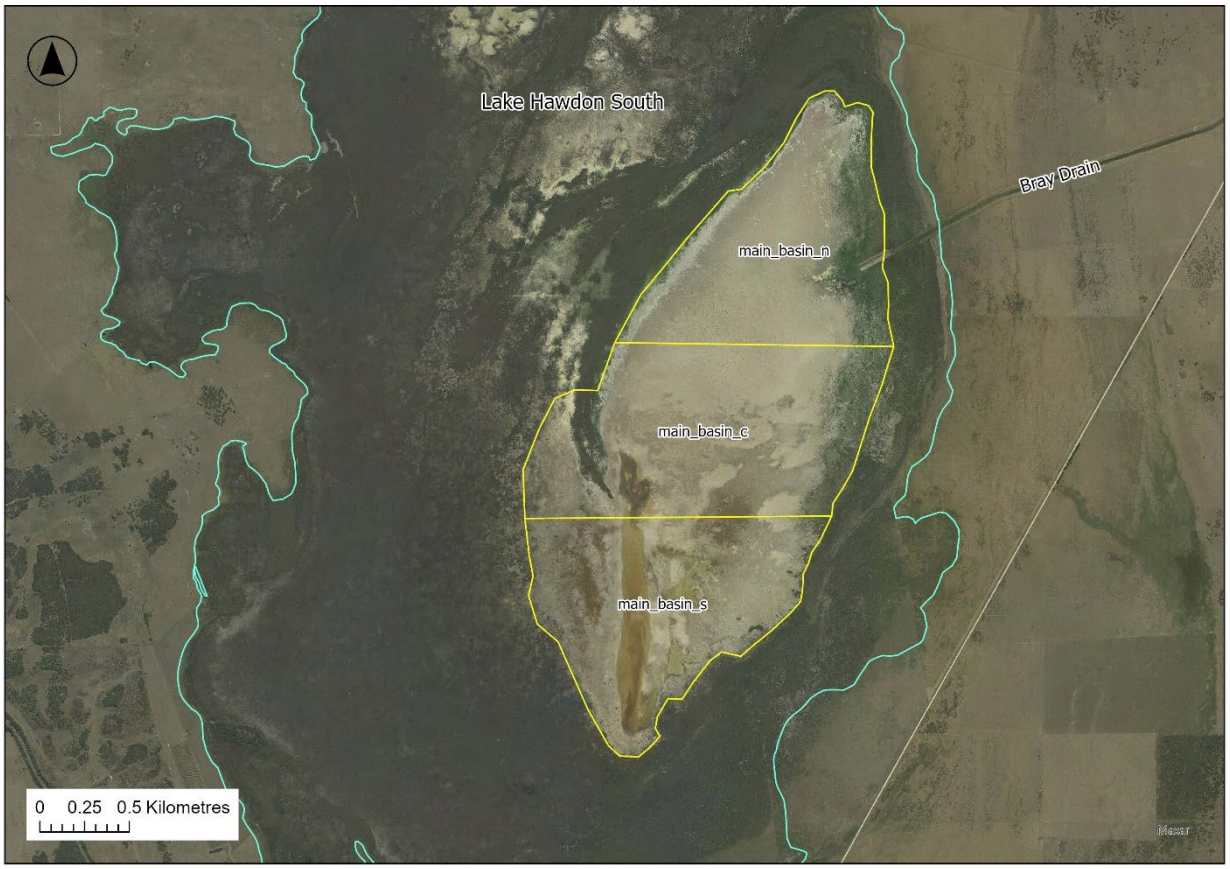

Figure 2. Lake Hawdon South survey area (yellow polygons).

2.2. Estimation of Target Shorebird Habitat Extent, 2021 – 2024

The Restoration Feasibility Assessment of Lake Hawdon North (Taylor 2020) defined target shorebird foraging habitat as open pan inundated to a depth of 0 - 10 cm. To estimate the extent of target shorebird foraging habitat present for each of the four baseline censuses conducted to date, the following procedure was followed:

1. The extent of inundation on the census date, determined from field observations and the DEM, was drawn as polygons in GIS.
2. Areas of vegetation that do not support shorebird foraging (shrubland and sedgeland) were subtracted from those polygons. For this purpose the high resolution vegetation mapping undertaken in 2021 (Lynker Analytics 2021) was used as follows:

Lynker Analytics (2021) vegetation class	Broad vegetation category
Schoenus nitens herbland	open pan (included)
bare mudflat	
Myriophyllum sp. aquatic herbland	
Ruppia sp. aquatic herbland	
deep water	
Machearina arthrophylla sedgeland	sedgeland (subtracted)
Juncus kraussii sedgeland	
pasture grass	
Gahnia filum sedgeland ± *M. halmaturorum*	shrubland (subtracted)
Melaleuca halmaturorum shrubland (recent)	
Melaleuca halmaturorum shrubland (mature)	

3. A correction factor was applied to convert the total areas determined in the previous two steps to areas of 0 - 10 cm depth (i.e. to subtract the area with depth >10 cm). This correction factor was determined by Taylor (2020) to be

$$y = 0.6265x + 12.489$$

where x is the total area inundated and y is the area inundated 0-10 cm. This relationship is accurate provided x is less than 1000 ha.

3. Results

3.1. Water Levels

In October 2024, of the 220 cells within the survey area, only 6 cells were partially or completely inundated at the time of the survey (excluding Drain L, Figure 2). In November 2023, 76 cells were partially or completely inundated at the time of the survey (excluding Drain L, Figure 3). For comparison, these numbers were 97 cells in November 2022 (Figure 5) and 76 cells in November 2021 (Figure 6).

The 2 m regional DEM is not accurate for the survey area within Lake Hawdon South so the extent of inundation was estimated using Sentinel-2 satellite imagery obtained 2 days prior to the survey (Geoscience Australia 2025) combined with on-ground observations (Figure 7).

Table 2. Number of grid cells partially or completely inundated at the time of survey (excluding Drain L) for each of the four survey events to date.

Survey Date	Grid cells partially or completely inundated
November 2021	76
November 2022	97
November 2023	76
October 2024	6

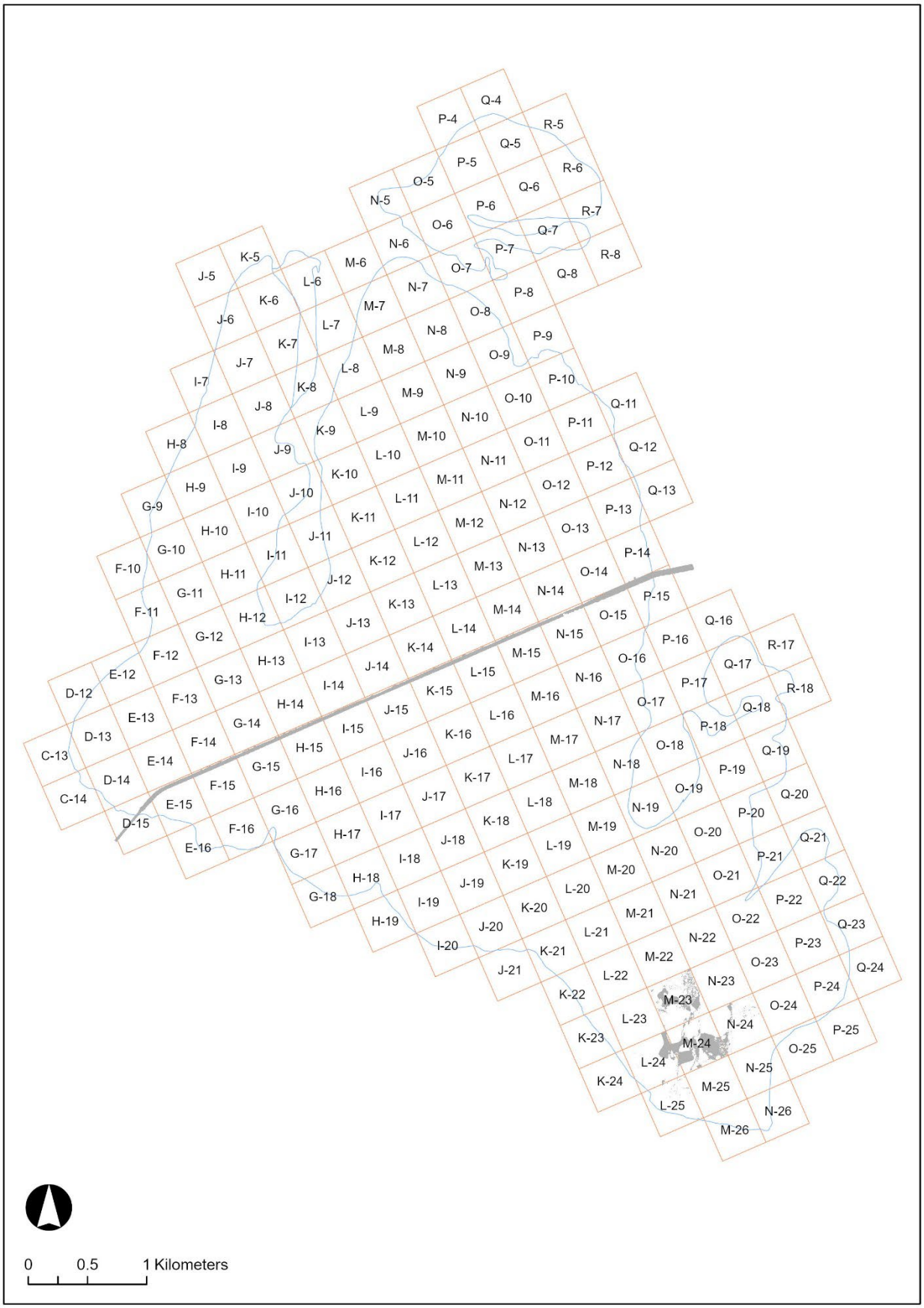

Figure 3. Estimated extent of inundation of the survey area on 16-17th October 2024.

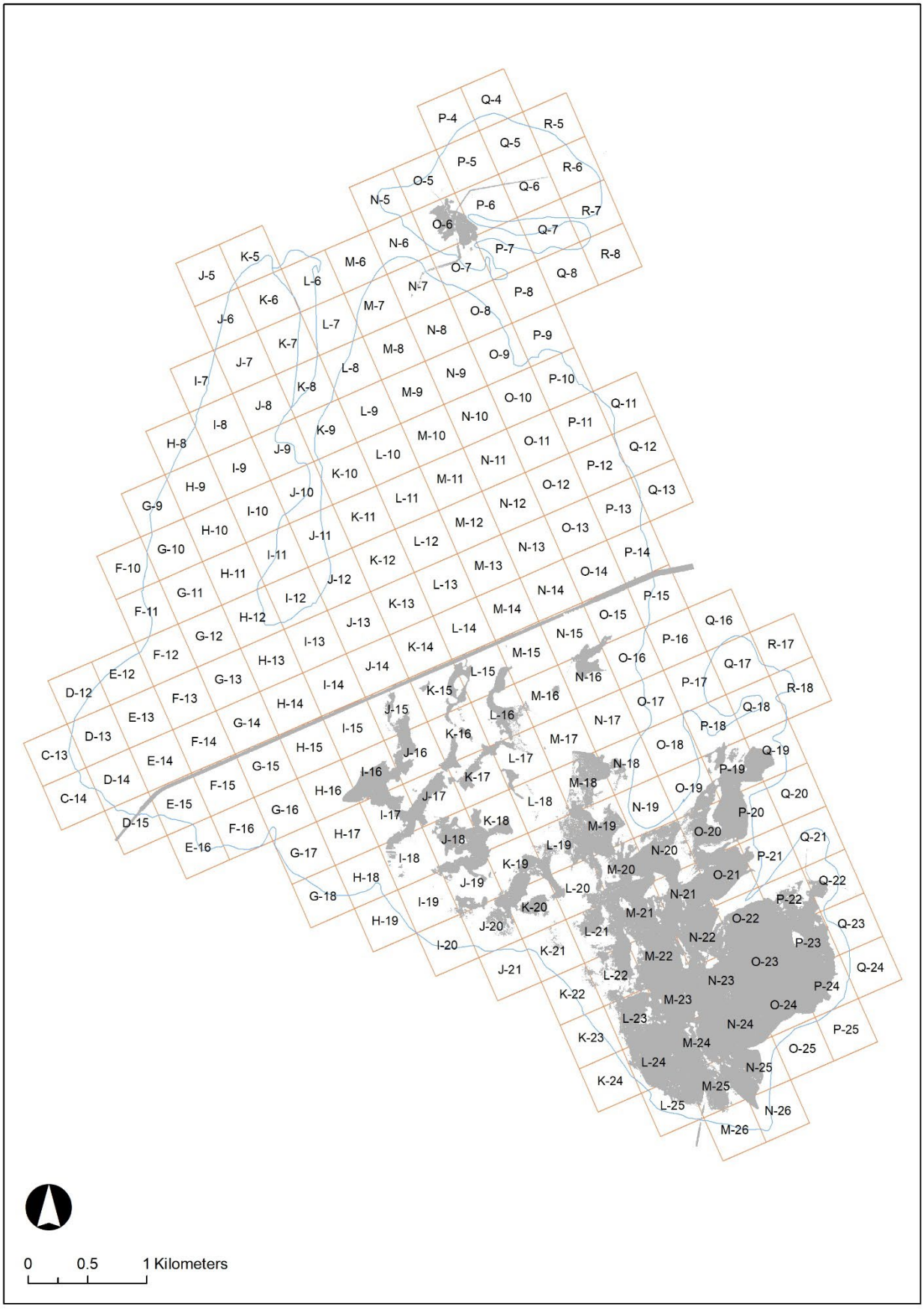

Figure 4. Estimated extent of inundation of the survey area on 14-15th November 2023.

Figure 5. Estimated extent of inundation of the survey area on 8-9th November 2022.

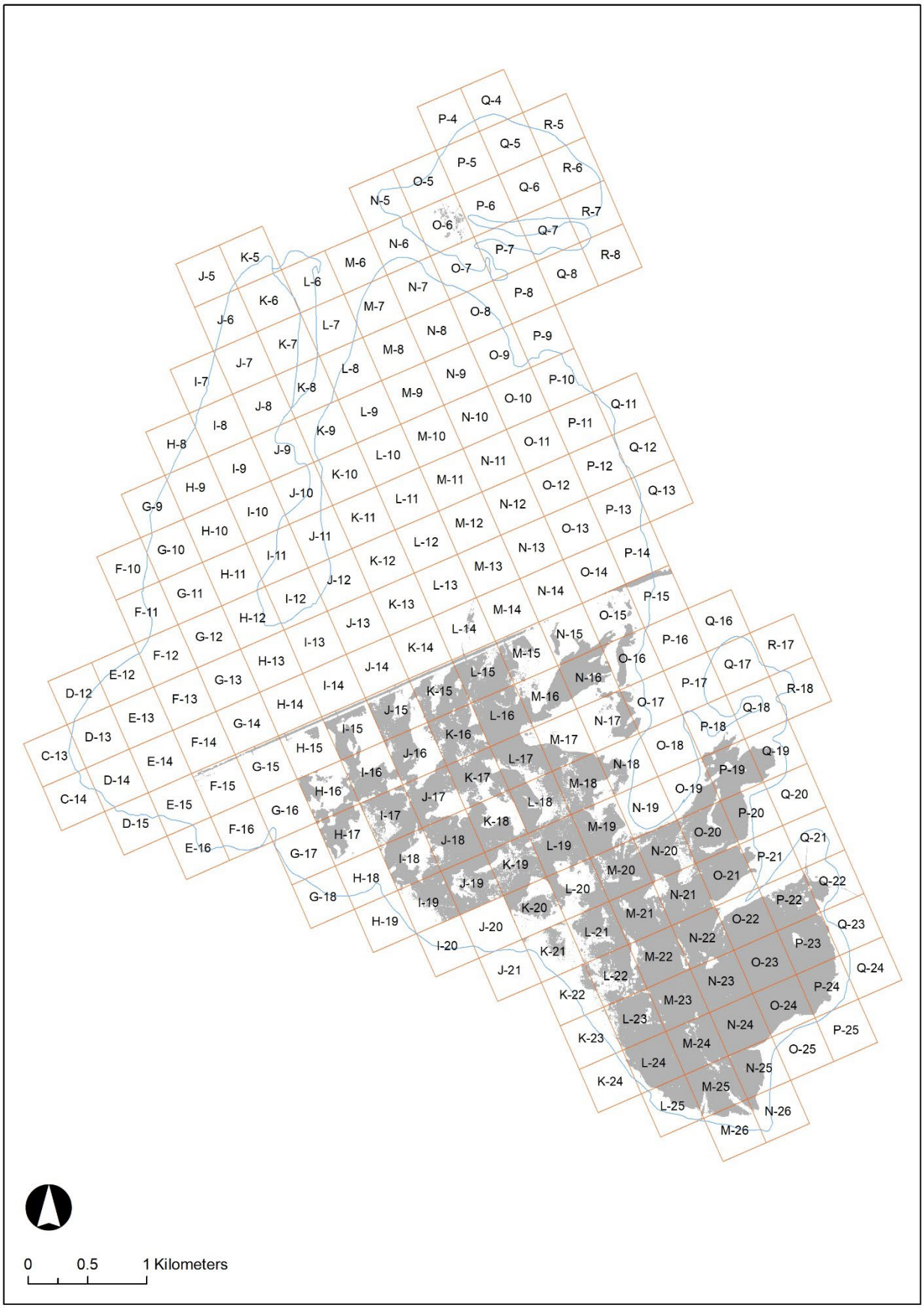

Figure 6. Estimated extent of inundation of the survey area on 10-11th November 2021.

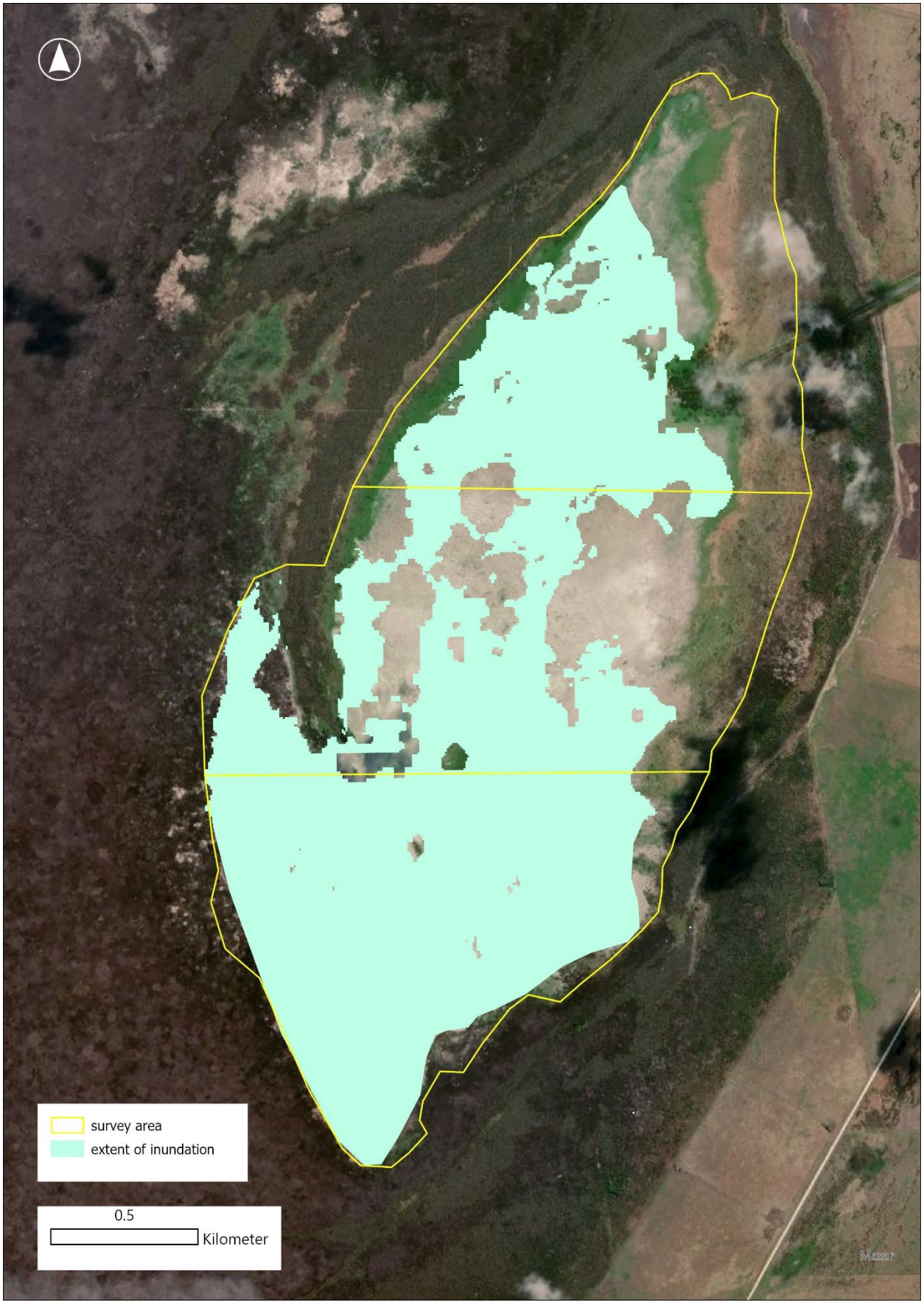

Figure 7. Estimated extent of inundation (blue area) within the survey area of Lake Hawdon South on 16th October 2024 (source: Geoscience Australia 2025).

3.2. Bird Abundance

As for the previous baseline censuses of LHN, the 2023 and 2024 baseline censuses recorded bird species in two categories:

- Species of open water and open pan habitat for which confident counts were obtained for the entire survey area. Total counts for these species are presented in Table 3 and counts for each cell are presented in Appendices A and B for 2023 and 2024 respectively.
- Species recorded opportunistically. While these species were counted when observed, total numbers counted are not representative of the entire survey area because these species favour dense shrubland and *Gahnia filum* and *Machaerina arthrophylla* sedgeland vegetation that was not systematically surveyed for the census. For these species, counts for each cell are presented in Appendices A and B and total counts are presented in Appendix C.

In November 2023 a total of 45 species of open water and mudflat habitat were recorded, including 13 species not recorded in either of the previous baseline censuses. Two of the seven target shorebird species, curlew sandpiper and red-necked avocet, were recorded in the census for the first time, albeit in very low abundance. Other notable species of open water and mudflat habitat recorded in the census for the first time included freckled duck (*Stictonetta naevosa*), Pacific golden plover (*Pluvialis fulva*), fairy tern (*Sternula nereis*), intermediate egret (*Ardea intermedia*) and glossy ibis (*Plegadis falcinellus*). In October 2024 a total of 18 species of open water and mudflat habitat were recorded, all of which had been recorded in previous baseline censuses.

The total number of species of open water and mudflat habitat counted over the four years of the census is 48 following the 2024 count and includes six of the seven HCHB target species (Table 3).

In November 2023 the total abundance of waterbirds of open water and mudflat habitat was markedly higher than for either of the previous two baseline censuses; 31,108 compared to 1,916 in 2022 and 10,200 in 2021. Grey teal were by far the most abundant species at 20,608 (66% of total abundance) and the most widely distributed (47 cells). Grey teal and other waterfowl were particularly abundant in the mining tenement where mining activities have lowered the bed of the wetland, resulting in deeper water (5 – 20 cm). Other notable abundances were sharp-tailed sandpiper (3685, 36 cells) and black-winged stilt (1697, 41 cells).

In October 2024 the total abundance of waterbirds of open water and mudflat habitat was the lowest of the four baseline censuses, reflecting the very small area inundated compared to previous years.

Table 3. Total counts for bird species of open water and mudflat habitat systematically counted for the Lake Hawdon North baseline census, 2021 – 2024. HCHB target species are indicated (bold).

Common Name	**Total**			
	Nov 2021	**Nov 2022**	**Nov 2023**	**Oct 2024**
Australasian grebe	0	0	1	0
Australasian shoveler	22	0	1	0
Australian pelican	0	16	0	0
Australian shelduck	2786	1191	37	33
Australian white ibis	11	1	12	0
banded lapwing	5	0	2	6
black swan	159	54	121	13
black-winged stilt	1313	0	1697	0
Caspian tern	1	0	0	0
cattle egret	2	0	0	0
chestnut teal	116	4	39	139

Common Name	Total			
	Nov 2021	Nov 2022	Nov 2023	Oct 2024
common greenshank	**47**	**49**	**34**	**0**
curlew sandpiper	**0**	**0**	**5**	**0**
dusky moorhen	0	5	1	1
fairy tern	0	0	3	0
freckled duck	0	0	150	0
glossy ibis	0	0	3	0
great cormorant	2	0	4	0
great egret	2	1	46	0
grey teal	1394	7	20608	851
hardhead	6	0	62	1
hoary-headed grebe	11	0	148	13
intermediate egret	0	0	4	0
little black cormorant	0	0	2	4
little egret	27	7	7	0
little pied cormorant	0	0	9	0
marsh sandpiper	0	1	1	0
masked lapwing	153	200	126	51
musk duck	5	4	3	0
Pacific black duck	330	46	180	62
Pacific golden plover	0	0	3	0
pied cormorant	0	1	2	0
pink-eared duck	2	0	463	0
red-capped plover	**140**	**36**	**123**	**53**
red-kneed dotterel	0	0	181	15
red-necked avocet	**0**	**0**	**14**	**0**
red-necked stint	**331**	**16**	**286**	**65**
royal spoonbill	1	0	18	0
sharp-tailed sandpiper	**674**	**21**	**3685**	**15**
silver gull	702	155	168	10
straw-necked ibis	1	0	9	0
unidentified duck sp.	0	18	1400	19
unidentified egret sp.	0	2	2	0
unidentified wader sp.	0	31	134	0
whiskered tern	1834	0	849	0
white-faced heron	123	50	329	7
white-necked heron	0	0	115	0
yellow-billed spoonbill	0	0	21	0
TOTAL	**10200**	**1916**	**31108**	**1358**

In November 2023 a total of 40 species were recorded opportunistically, including 10 not recorded in 2021 or 2022; Australasian bittern, Australian painted snipe, Australian spotted crake, Ballion's crake, blue-winged parrot, peregrine falcon, an unidentified species of raptor (family Accipitridae), a parrot of the genus *Neophema*, an unidentified quail and an unidentified rail. The total number of waterbird species

recorded opportunistically for the census is 62 following the 2023 survey. The most widely distributed species was black-tailed native-hen (44 cells) followed by little grassbird (14 cells), white-fronted chat (14 cells) and Australian spotted crake (13 cells).

In October 2024 all species observed, including those recorded opportunistically, had been recorded previously in Lake Hawdon North.

The total abundance of birds observed within the survey area in Lake Hawdon South in October 2024 are presented in Table 4. This count can be considered comprehensive for all species observed because the survey area is entirely open pan habitat and there is no basis to separate systematically and opportunistically counted species. These data are compared to counts of the same area undertaken in previous years by FoSSE in Section 3.5 below.

Table 4. Total counts for bird species within the survey area of the Lake Hawdon South in October 2024. HCHB target species are indicated (bold).

Common Name	Total
	Oct 2024
Australasian shoveler	88
Australian shelduck	327
Australian white ibis	36
banded lapwing	2
black falcon	1
black swan	500
black-shouldered kite	1
black-tailed native-hen	20
black-winged stilt	179
chestnut teal	8
common greenshank	**42**
Eurasian skylark	1
grey teal	11348
little grassbird	1
marsh sandpiper	1
masked lapwing	83
Nankeen kestrel	1
pectoral sandpiper	1
pink-eared duck	58
red-capped plover	**55**
red-necked stint	**1228**
royal spoonbill	8
sharp-tailed sandpiper	**4858**
silver gull	37
swamp harrier	6
wedge-tailed eagle	2
whiskered tern	1511
whistling kite	1
white-faced heron	17
white-fronted chat	21

3.3. Target Shorebird Distribution

Six of the seven HCHB target species were recorded in 2023 and three in 2024, with only banded stilt not yet recorded in any baseline census. In addition to the seven target species, other migratory shorebirds that have been recorded over the four years of the census, in very low numbers, are marsh sandpiper, Pacific golden plover and Latham's snipe. The combined total abundance of HCHB target species in 2023 was 4,147, markedly higher than 2022 (122) and 2021 (1192). This difference reflects the high numbers of sharp-tailed sandpiper recorded in 2023. In 2024 the combined total abundance of HCHB target species was 133 and all were present within 6 cells in the mining tenement that have been deepened by mining activities and still held water despite the extremely dry conditions.

The combined abundance and distribution of the HCHB target shorebird species recorded in the 2023 census is shown in Figure 8. Single species abundance and distribution maps for each of the six target species recorded are provided in Figure 9 to Figure 14.

The combined abundance and distribution of the HCHB target shorebird species recorded in the 2024 census is shown in Figure 15. Single species abundance and distribution maps for each of the six target species recorded are provided in Figure 16 to Figure 18.

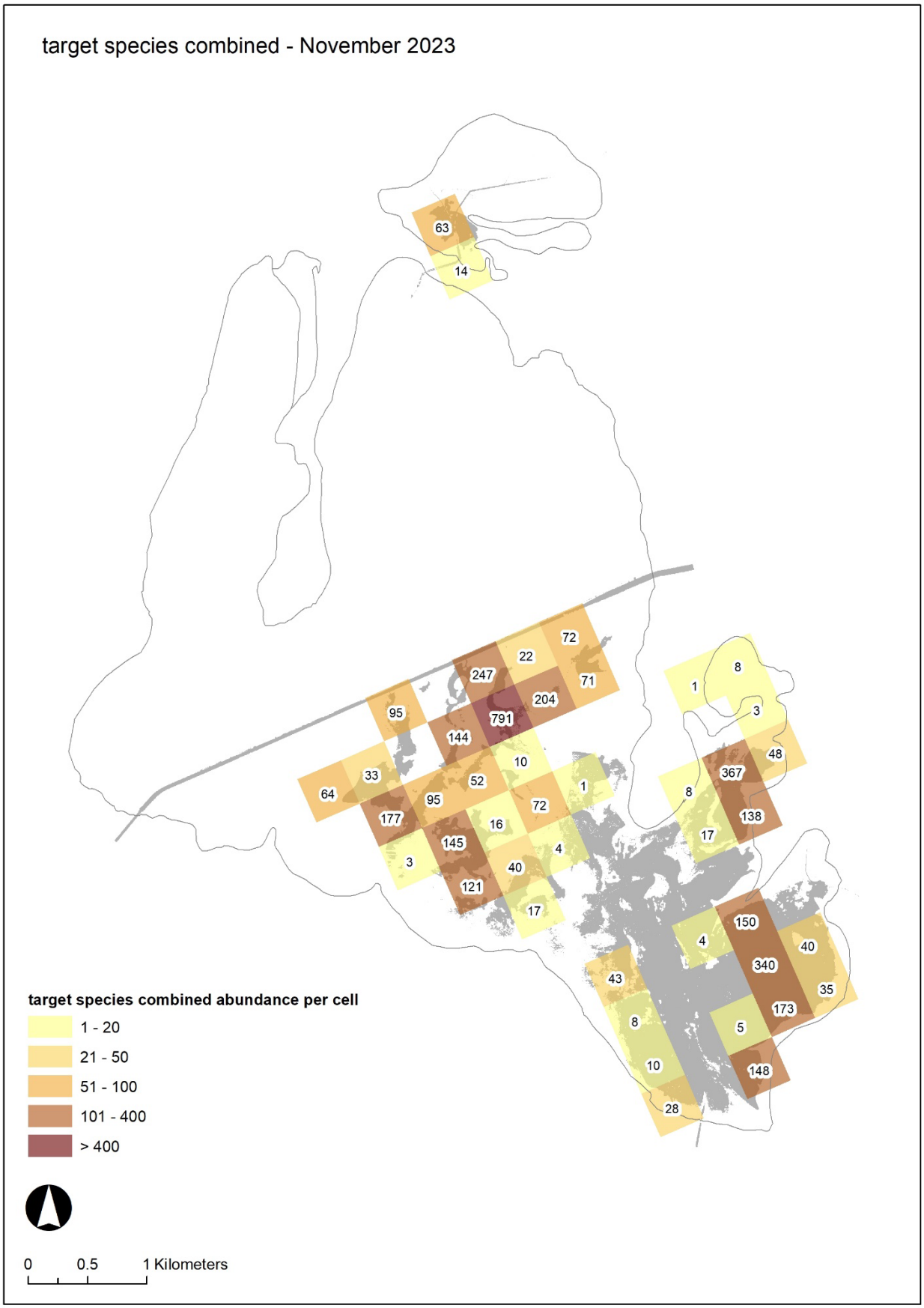

Figure 8. Distribution and abundance of HCHB RBR target shorebirds (combined) at LHN, 14-15 November 2023. Extent of inundation is also indicated.

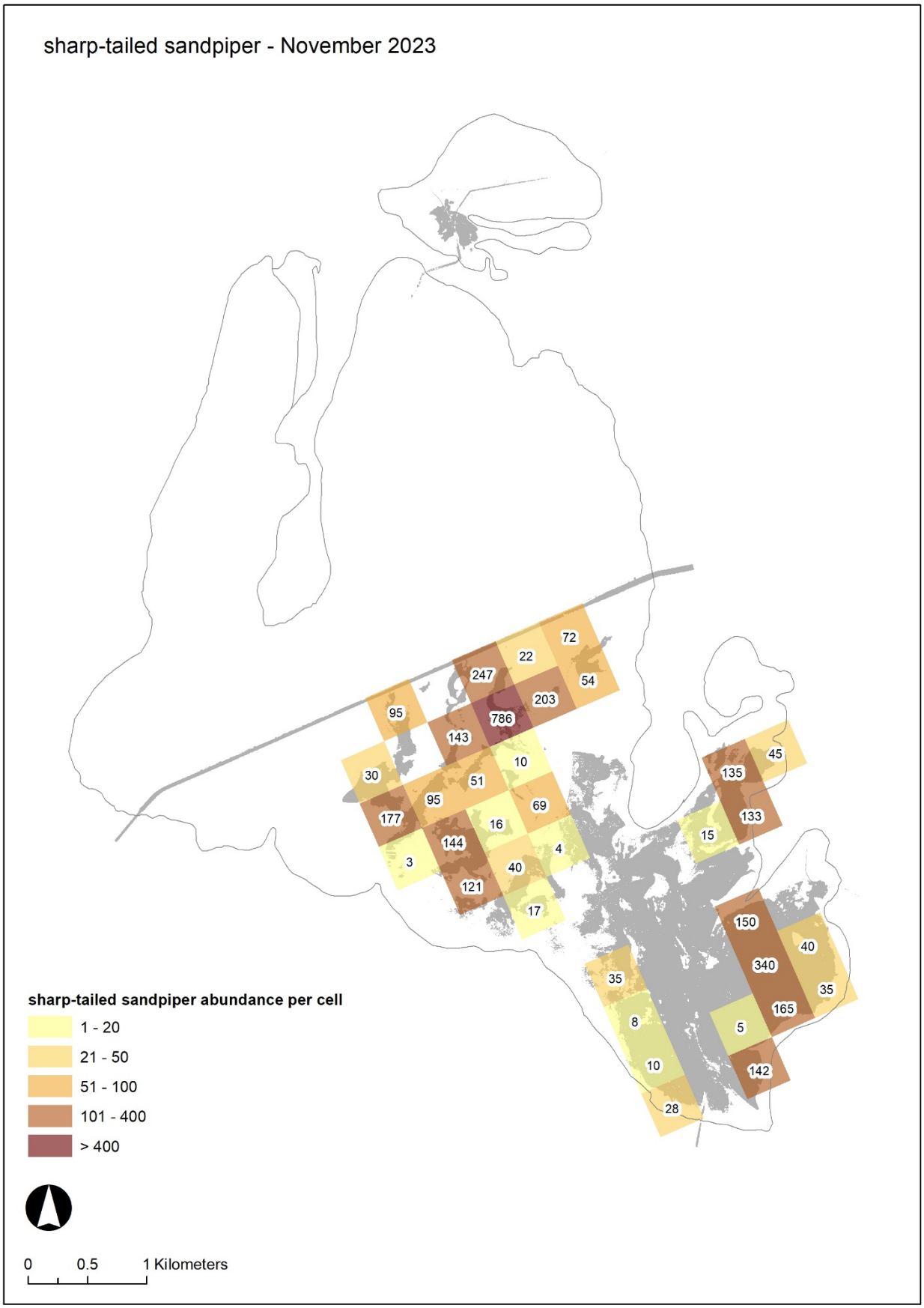

Figure 9. Distribution and abundance of sharp-tailed sandpiper at LHN, 14-15 November 2023. Extent of inundation is also indicated.

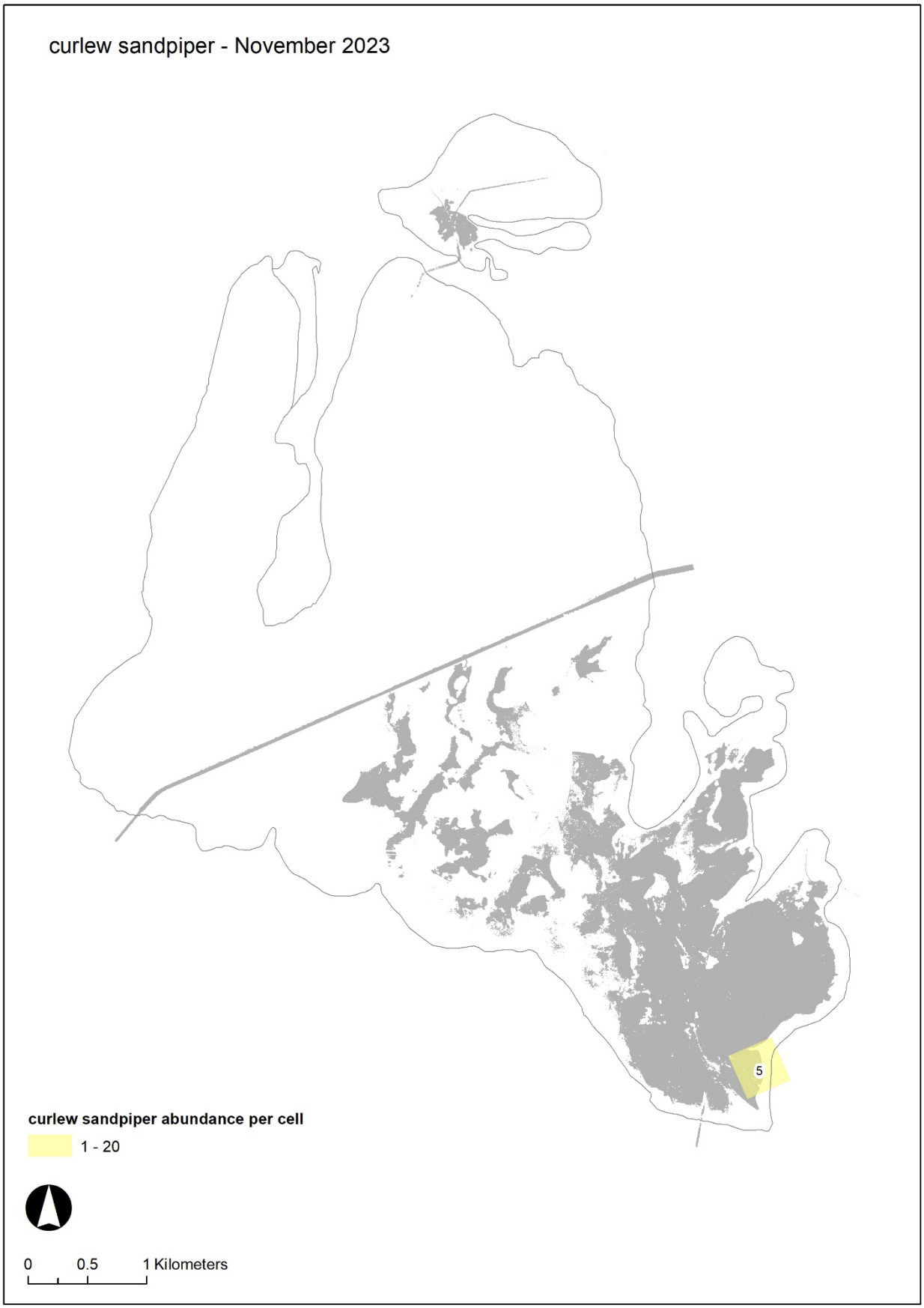

Figure 10. Distribution and abundance of curlew sandpiper at LHN, 14-15 November 2023. Extent of inundation is also indicated.

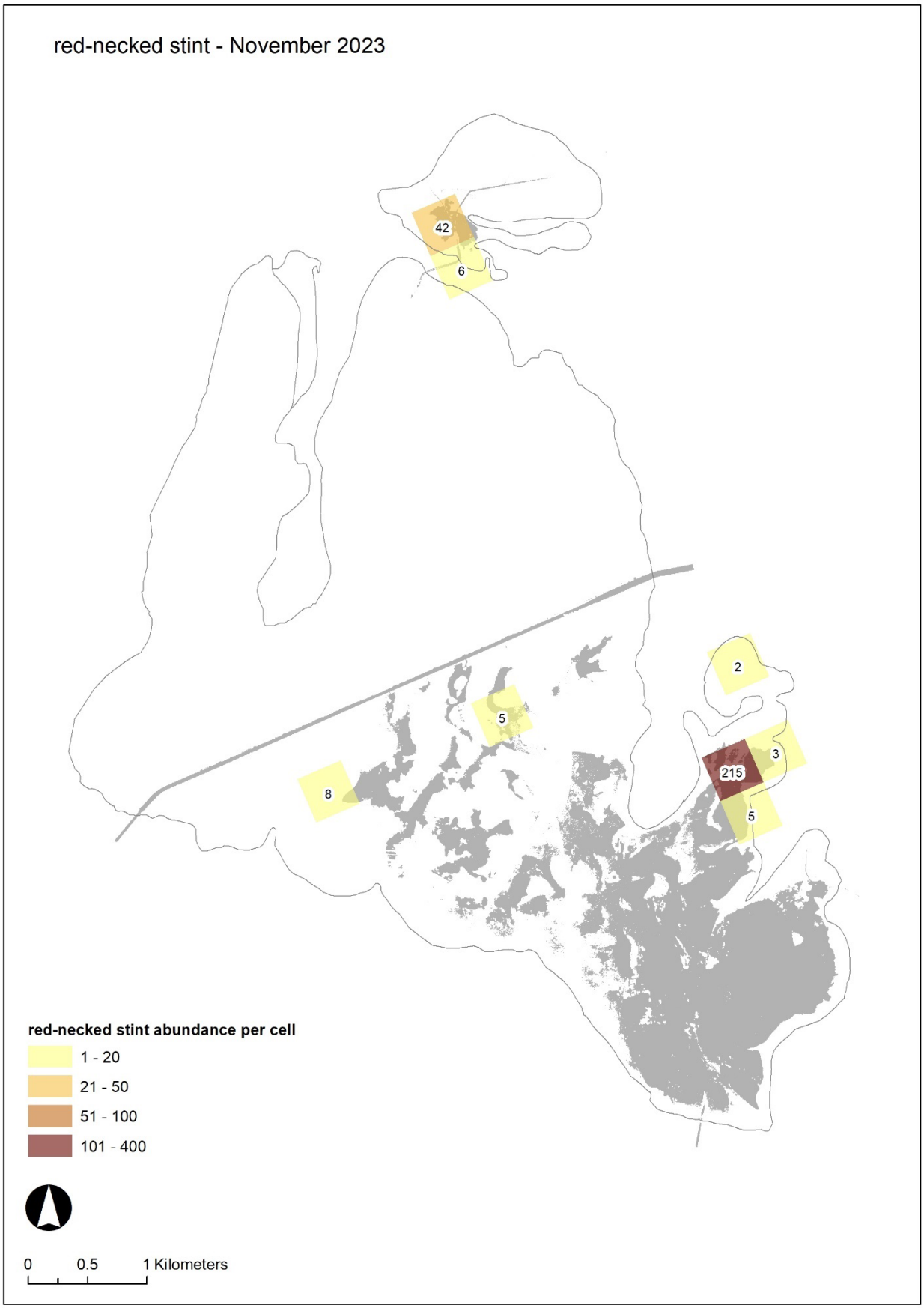

Figure 11. Distribution and abundance of red-necked stint at LHN, 14-15 November 2023. Extent of inundation is also indicated.

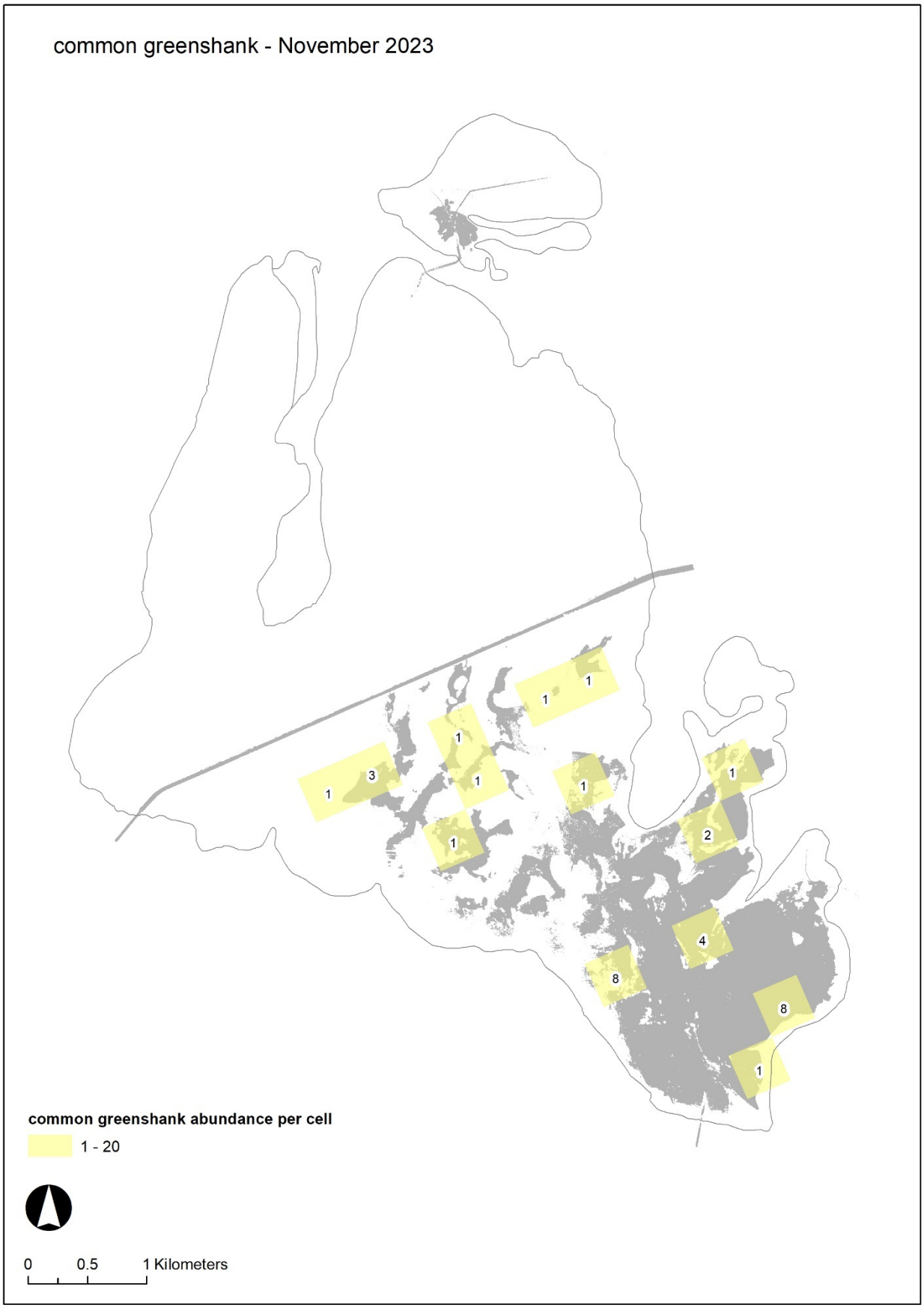

Figure 12. Distribution and abundance of common greenshank at LHN, 14-15 November 2023. Extent of inundation is also indicated.

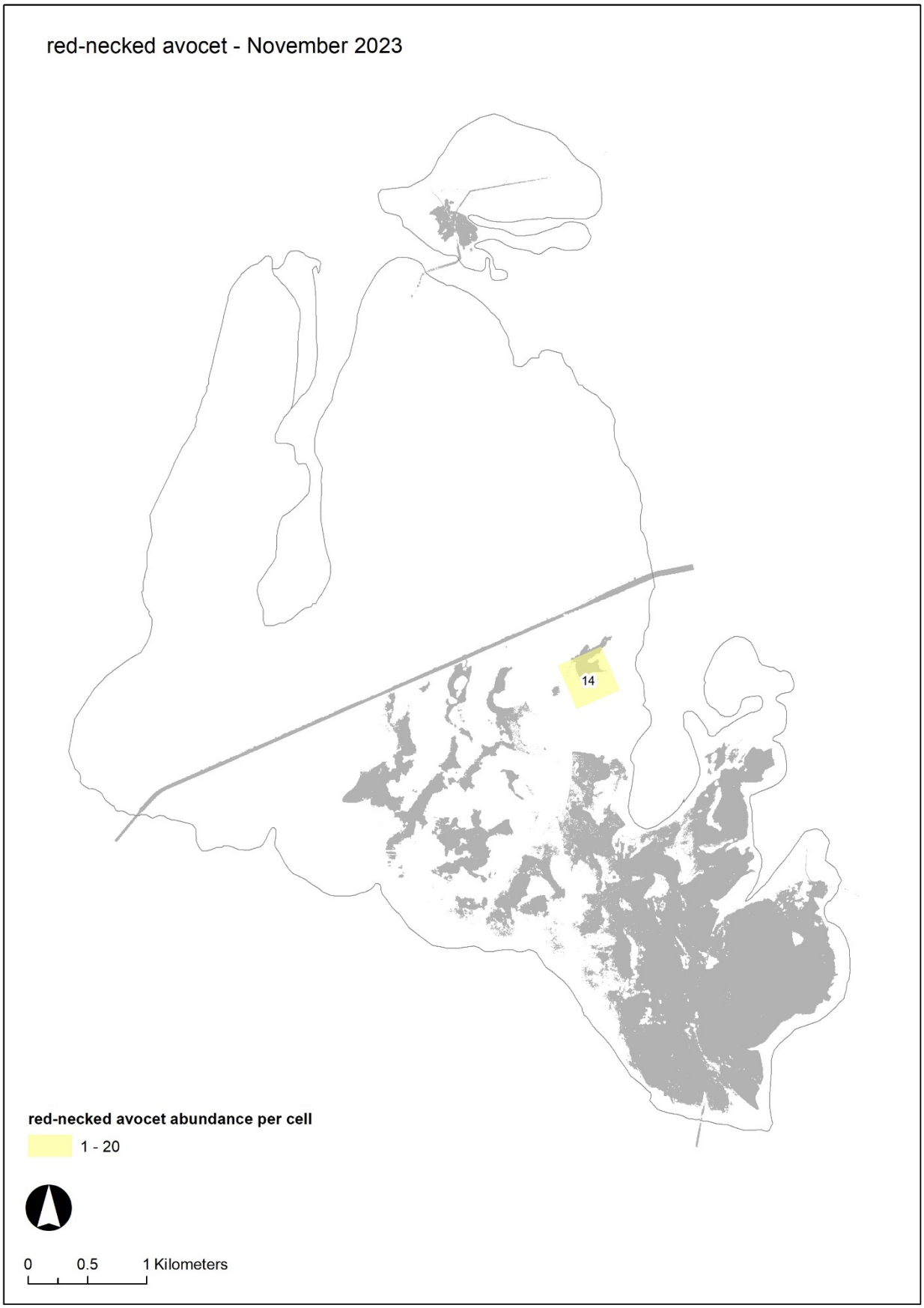

Figure 13. Distribution and abundance of red-necked avocet at LHN, 14-15 November 2023. Extent of inundation is also indicated.

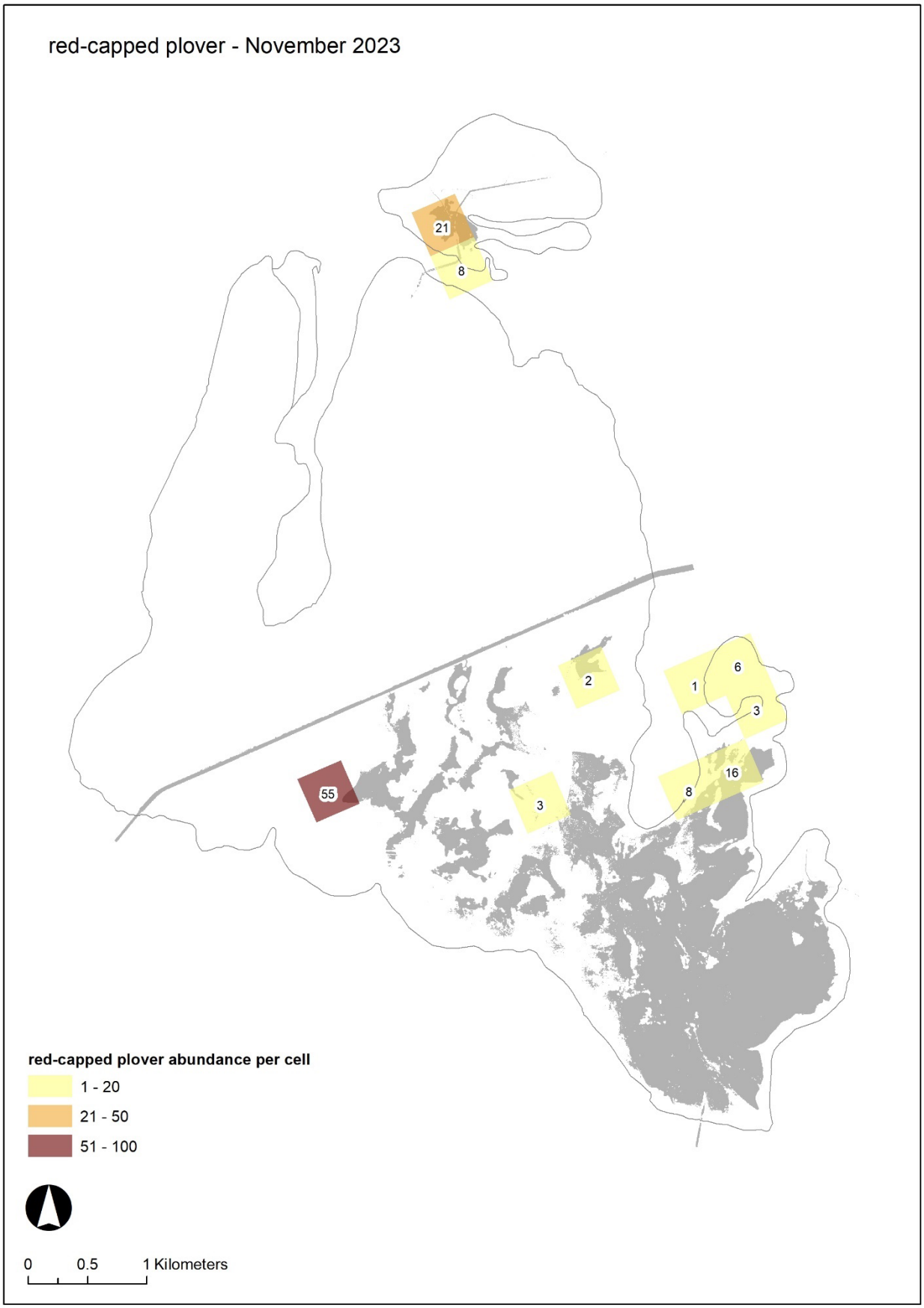

Figure 14. Distribution and abundance of red-capped plover at LHN, 14-15 November 2023. Extent of inundation is also indicated.

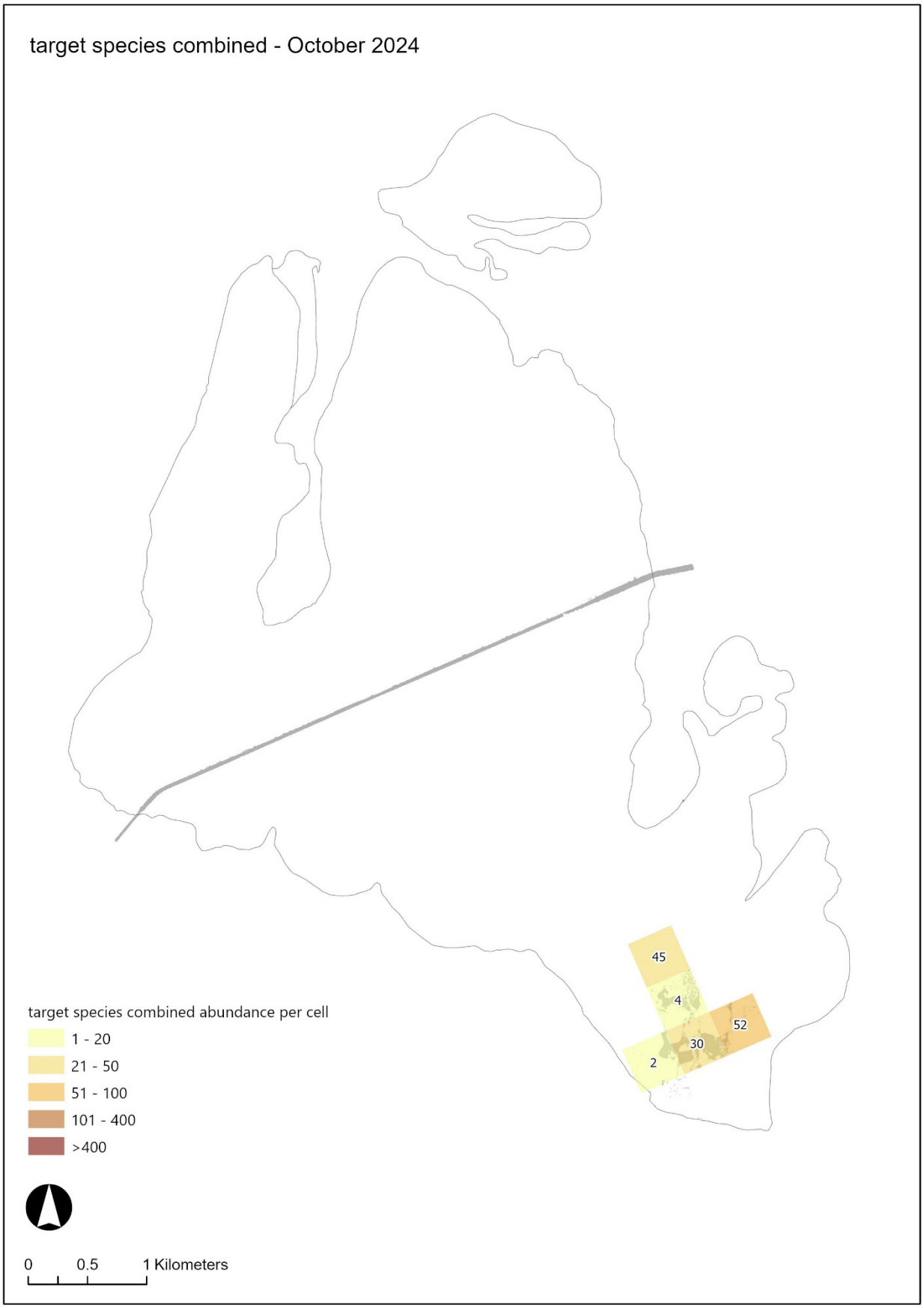

Figure 15. Distribution and abundance of HCHB RBR target shorebirds (combined) at LHN, 16-17 October 2024. Extent of inundation is also indicated.

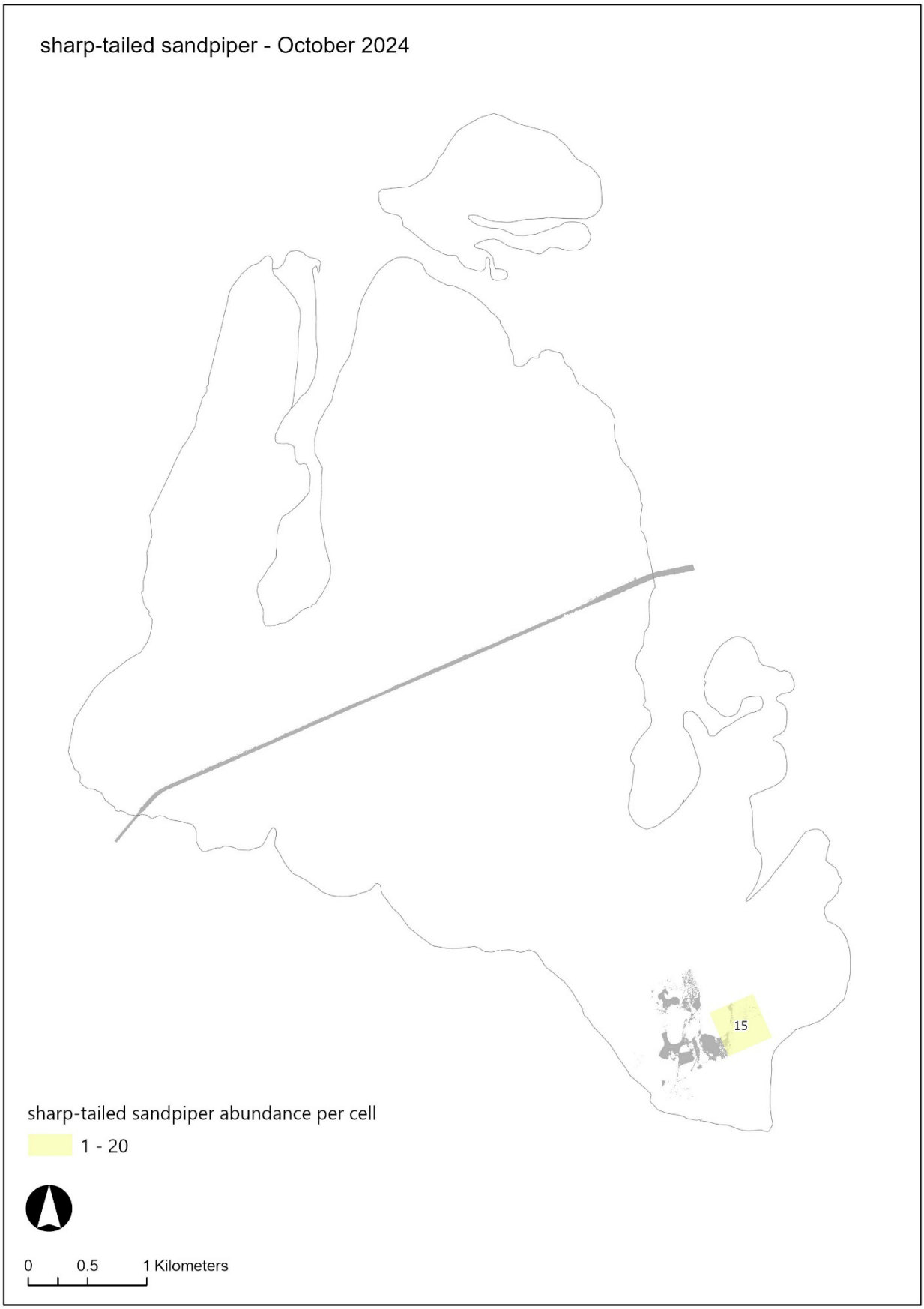

Figure 16. Distribution and abundance of sharp-tailed sandpiper at LHN, 16-17 October 2024. Extent of inundation is also indicated.

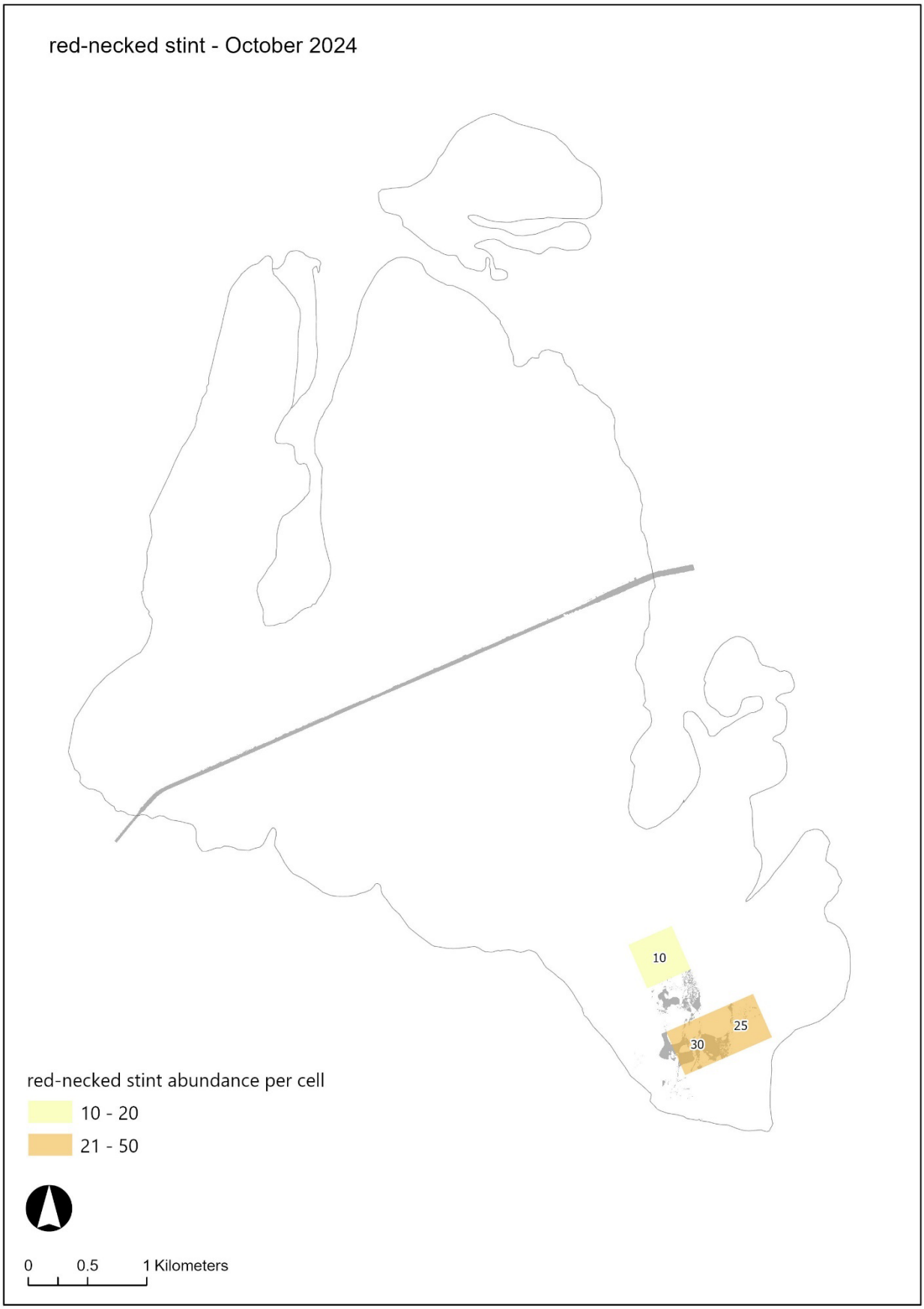

Figure 17. Distribution and abundance of red-necked stint at LHN, 16-17 October 2024. Extent of inundation is also indicated.

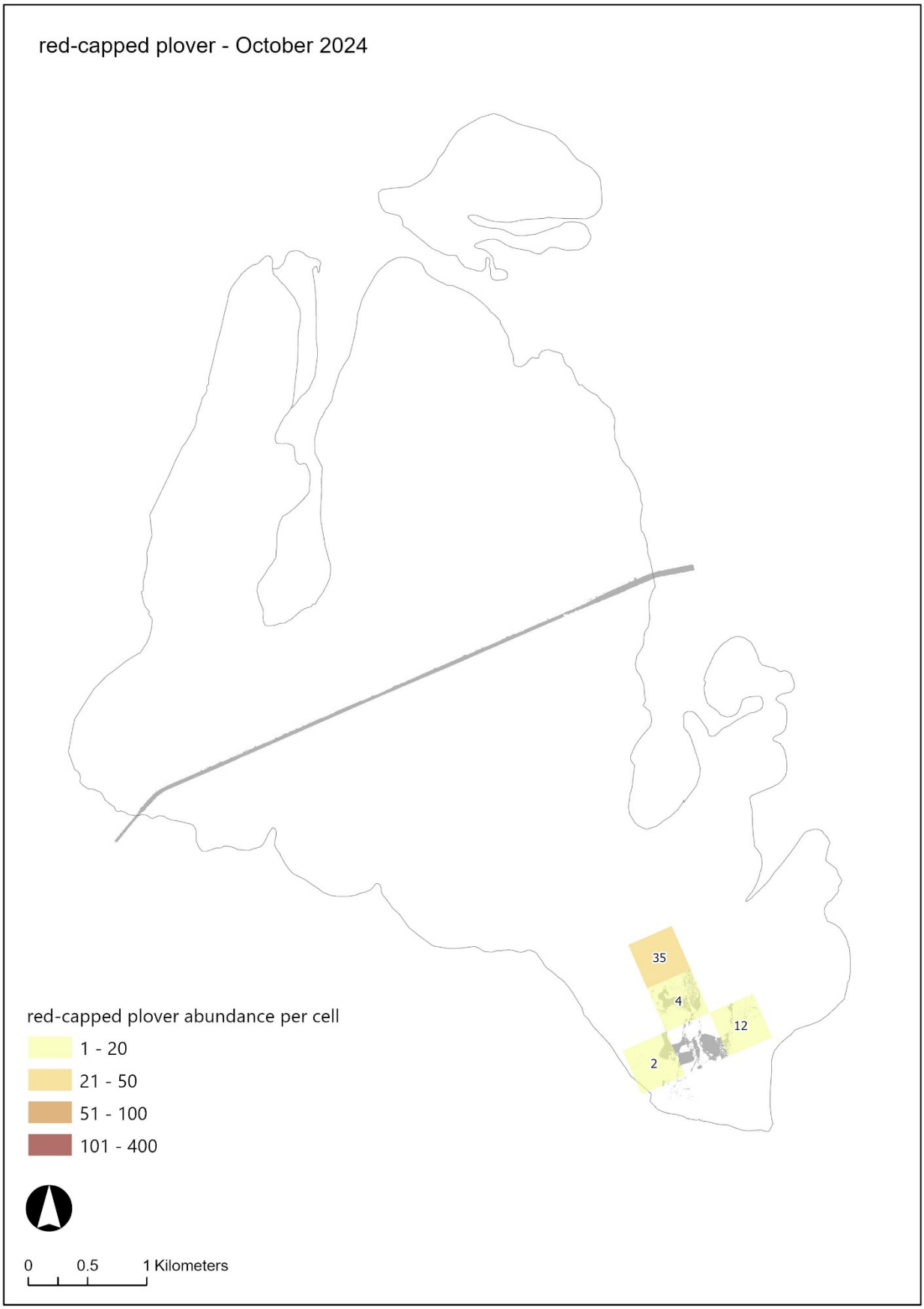

Figure 18. Distribution and abundance of red-capped plover at LHN, 16-17 October 2024. Extent of inundation is also indicated.

3.4. Target Shorebird Density Within Suitable Habitat

Results for the three steps in the calculation of suitable shorebird habitat within LHN in 2021-2024 and LHS in 2024 are shown in Table 5. These values have been used to determine the density of the HCHB target species within suitable habitat (Table 6). Table 7 compares the 2024 target species density within the survey area in Lake Hawdon South to densities determined for previous years based on FoSSE counts. The information presented in Table 7 was taken from Taylor (2020) but has been updated to include Lake Hawdon South counts for the years 2021, 2023 and 2024.

Table 5. Determination of area of suitable shorebird habitat in LHN in 2021-2024 and LHS in 2024.

Monitoring Event	Total extent of inundation (ha)	Minus area with unsuitable vegetation	Minus area with depth >10 cm
LHN 2021	752.8	423.5	277.8
LHN 2022	836.1	541.8	351.9
LHN 2023	511.7	327	217.3
LHN 2024	28.3	24	24
LHS (survey area) 2024	253.1	253.1	171

Table 6. Density of target species within suitable habitat in LHN in 2021-2024 and LHS in 2024

Monitoring Event	Area of suitable habitat (ha)	Target species abundance	Target species density within suitable habitat (bird/ha)
LHN 2021	277.8	1192	4.29
LHN 2022	351.9	154*	0.44
LHN 2023	217.3	4286*	19.72
LHN 2024	24	133	5.54
LHS (survey area) 2024	171	6185	36.2

*assumes “unidentified waders” are target species.

Table 7. Estimated area of suitable habitat, total abundance and total density of target species, Lake Hawdon South, 2004-2024.

Year	Survey date	WOfS date	Inundated extent (ha) of survey area	Estimated extent with depth 0 – 10 cm	Target species abundance	Target species density within suitable habitat (birds/ha)
2004	30/01/2004	15/01/2004	211.6	145.1	450	3.1
2005	17/01/2005	25/01/2005	142	101.5	7172	70.66
2006	2/02/2006	5/02/2006	1.7	1.7	33	19.41

Year	Survey date	WOfS date	Inundated extent (ha) of survey area	Estimated extent with depth 0 – 10 cm	Target species abundance	Target species density within suitable habitat (birds/ha)
2009	5/02/2009	13/02/2009	10.8	10.8	38	3.52
2010	27/01/2010	31/01/2010	119.5	87.4	7917	90.58
2017	15/02/2017	11/02/2017	331.2	219.9	4573	20.66
2019	20/01/2019	24/01/2019	329.7	219	16842	76.9
2020	5/02/2020	4/02/2020	233.8	159	1034	6.5
2021	25/02/2021	14/02/2021	38.8	36.8	557	15.13
2023	15/02/2023	20/02/2023	26.7	26.7	230	8.61
2024	16/10/2024	14/10/2024	253.1	171.1	7084	41.4

4. Discussion

4.1. Monitoring Results 2023 and 2024

The 2023 and 2024 Lake Hawdon North waterbird monitoring brings the total number of baseline (pre-restoration) censuses to four, across the four years 2021 – 2024. The 2023 census was noteworthy for recording by far the highest total abundance of systematically counted species to date. This result was largely due to the high count of 20,608 grey teal, recorded mostly within the mining tenement area, where deeper water caused by mining activities favours waterfowl over wading birds. However, the highest abundance of HCHB target shorebirds was also recorded in 2023 (4,147), including six of the seven target species, with the count dominated by sharp-tailed sandpiper (3,685). The dominance of sharp-tailed sandpiper is consistent with past shorebird counts of the Lake Hawdon complex, mostly in Lake Hawdon South by FoSSE (see Taylor 2020).

The 2024 census was noteworthy for the extremely dry conditions that required the timing of the survey to be brought forward to mid-October; all previous baseline monitoring had been undertaken in early to mid-November. The area of suitable habitat within Lake Hawdon North was limited to 24 ha and the total abundance of HCHB target shorebirds was low (133) and included just three target species. More habitat was available in Lake Hawdon South at the time (171 ha) and more HCHB target shorebirds were present (6,183).

4.2. Synthesis of Monitoring 2021 to 2024

Predictions of the carrying capacity of Lake Hawdon North for the HCHB target species under a restored scenario were based on the assumption that peak densities of these species observed in Lake Hawdon South would be achieved in Lake Hawdon North (Taylor 2020). Peak densities observed in Lake Hawdon South of 70.7, 90.6 and 76.9 birds/ha in 2005, 2010 and 2019 respectively were averaged to determine the predicted peak density of 79.4 bird/ha in Lake Hawdon North. Monitoring of the Lake Hawdon complex undertaken since 2020 allows the following questions to be answered:

1. does the peak density in Lake Hawdon South need updating in the light of recent monitoring?
2. have the densities observed in Lake Hawdon North to date matched the predicted peak density?

The answer to question 1 is no; the densities of target species within the survey area of Lake Hawdon South in 2021, 2023 and 2024 were below the peak densities observed in 2005, 2010 and 2019. Therefore, the predicted peak density for Lake Hawdon North of 79.4 birds/ha remains valid based on the assumptions of the restoration feasibility assessment (Taylor 2020).

In relation to question 2, the densities of the target species observed in Lake Hawdon North during the baseline (pre-restoration) phase of monitoring ranged from 0.4 to 19.7 birds/ha, well below the predicted peak density of 79.4 birds/ha. There are at least three factors potentially influencing this result, either singly or in combination.

Firstly, the timing of the four baseline Lake Hawdon North waterbird monitoring surveys, mid-October to mid-November, was relatively early in the migratory shorebird season (mid-October to mid-March), necessarily so because the lake was typically dry by mid-December prior to hydrological restoration. There is generally greater shorebird habitat availability at a regional scale early in the season, including nearby in Lake Hawdon South, so the higher densities would be less likely to occur. It is noteworthy that the peak densities in Lake Hawdon South in 2005, 2010 and 2019 were all observed in mid to late January when Lake Hawdon North was very likely completely dry. By extending the duration of inundation within Lake Hawdon North, to mid-March in an average year (DEW 2021), restoration will provide habitat for target species much later in the shorebird season, meaning overall regional habitat availability will be far more limited and therefore higher bird densities in available habitat can be anticipated. At the local scale, restoration is anticipated to cause the inundation of Lake Hawdon North to persist later into the shorebird season than Lake Hawdon South, the opposite of what typically occurred prior to restoration but closer to what likely occurred historically (Taylor et al. 2025). This is likely to result in shorebirds moving from throughout the Lake Hawdon complex into the remaining habitat within Lake Hawdon North, potentially resulting in higher densities than have been observed to date.

Secondly, food resources for target species may be less plentiful in Lake Hawdon North compared to Lake Hawdon South. The one baseline monitoring event of benthic macroinvertebrates undertaken in spring 2021 found that both the diversity and abundance were higher in Lake Hawdon South than in Lake Hawdon North and the two sites had quite different communities (Taylor et al. 2022b). The monitoring locations within each wetland had markedly different hydrology. The Lake Hawdon South samples were collected within the waterbird monitoring area (Figure 2), which is typically inundated from mid-winter until mid-February. The Lake Hawdon North samples were collected from the western side of the lake, south of Drain L, in an area that is typically dry by mid-November. The water depths observed during macroinvertebrate monitoring reflect this difference (Taylor et al. 2022b). The much briefer duration of inundation at the Lake Hawdon North sampling location may have contributed to the reduced abundance and diversity of macroinvertebrates sampled. The sediment in Lake Hawdon North was more compact, likely making it more difficult for invertebrates to colonise (Taylor et al. 2022b). Processes such as bioturbation, by which organisms soften lakebed sediments, may increase with increased duration of inundation. Longer inundation is also likely to increase the biomass of submerged aquatic vegetation that is left stranded in shallow water or damp sediments when water levels recede, boosting overall productivity as this material is consumed by invertebrates that are in turn a food source for shorebirds. The seeds and other propagules of some submerged aquatic plants are also consumed by some HCHB target shorebirds directly (Paton 2010). In short, it likely that the availability of shorebird food resources within Lake Hawdon North will increase in response to restoration and likely lead to an increase in the peak density (and peak abundance) or target shorebird species. This highlights the need for ongoing monitoring of shorebird food resources (see Section 4.3).

A third possible explanation for the relatively low shorebird densities observed in Lake Hawdon North to date is that factors affecting waterbird movements at a continental scale influenced the results. The very low waterbird count and density in 2022 (Table 6), despite the largest area of suitable habitat of all four baseline survey's being present in Lake Hawdon North at the time, is informative. The 2022 survey coincided with an unusually high extent of waterbird habitat in the Murray-Darling Basin following record high rainfall and it is likely that waterbirds that would typically be at Lake Hawdon in late spring were

instead taking advantage of food resources in the interior of the continent. This effect may have also been at play in the other baseline survey years, although less pronounced. Notably there were no peak shorebird densities observed in Lake Hawdon South during the period 2021 to 2024.

4.3. Recommendations

The completion of the Lake Hawdon North regulator in May 2025 and near-completion of habitat restoration works means that the baseline (pre-restoration) phase is now complete and bird abundance henceforth will be influenced by these restorative works. The bathymetry of the lake is such that the area inundated 0 – 10 cm deep, the ideal foraging depth for the HCHB target species (combined), is at its maximum when the WSEL is 4.05 mAHD (Figure 19). Habitat restoration works will make much of this area available to the target species and other waders.

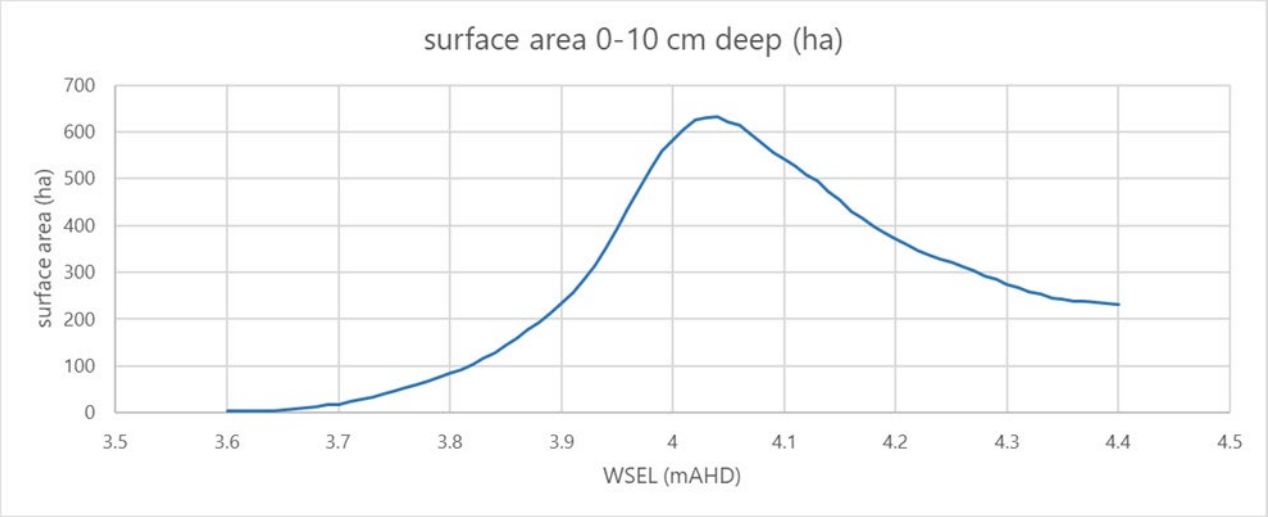

Figure 19. Relationship between WSEL and surface area 0-10 cm deep for Lake Hawdon North.

Modelling indicates that regulator operations will, under average conditions, result in a WSEL of 4.05 mAHD in early November (DEW 2021). This timing matches the timing of baseline monitoring in 2021-2023. Therefore, continuing annual monitoring at this time would enable a comparison of pre- and post-restoration bird abundance that is controlled for time of year.

However, as discussed above, peak densities of target species, and of wading birds in general, are more likely to occur later in the season, when habitat availability at the regional scale is more limited. Peak density is an important measure of the outcomes of restoration at Lake Hawdon North.

Monitoring of Lake Hawdon South, at the same time as Lake Hawdon North, should continue as an integral part of the monitoring program given:

a) the likelihood of bird movement between the two lakes, particularly as their period of inundation becomes more closely aligned;

b) the monitoring of Lake Hawdon South extends back to 1999, providing a valuable data set, and

c) its international significance for shorebirds, e.g. sharp-tailed sandpiper.

Past monitoring of Lake Hawdon South has typically been undertaken in late January / early February and peak densities have been observed at this time. There is therefore a case for waterbird monitoring of the entire Lake Hawdon complex to be undertaken at this time, which controls for time of year in Lake Hawdon South and is more likely to detect peak densities in both North and South than monitoring undertaken in early November. Modelling indicates a likely WSEL of 3.75 mAHD in Lake Hawdon North in

early February in an average year (DEW 2021), corresponding to an area of approximately 50 ha inundated 0 – 10 cm deep (noting that earlier modelling (see Taylor 2020) predicted a WSEL of 3.90 mAHD at this time, corresponding to an area of approximately 240 ha inundated 0 – 10 cm deep).

It is recommended that waterbird monitoring be undertaken in both LHS and LHN twice annually:

- in early November to allow direct comparison with baseline (pre-restoration) monitoring in LHN, controlled for time of year and coinciding with maximum habitat availability for target species in LHN; and
- in late January / early February to allow direct comparison with past monitoring of LHS (extending back to 1999) and more likely to coincide with peak density of HCHB target species, and waders generally, across the Lake Hawdon complex.

Note that the timing of these monitoring events is based on modelling that assumes average conditions. The timing of all monitoring will need to be responsive to actual water levels and may need to depart from the above timing recommendations.

Four years of baseline waterbird monitoring in LHN, and monitoring in LHS extending back to 1999, have shown that waterbird abundance can vary greatly between years and is not strongly correlated with habitat availability. Continental scale factors appear to influence waterbird abundance in the Lake Hawdon complex. Comparing habitat availability pre- and post-restoration is a simple measure of restoration outcomes that is independent of water bird abundance. For the HCHB target species this is the change to the area of open pan habitat inundated 0 – 10 cm across the period mid-October to mid-March. This will be achieved through water level monitoring and vegetation mapping, both included in the overall monitoring program (Taylor et al. 2025). However, habitat quality, another key measure of restoration outcomes that is independent of waterbird abundance, requires the examination of additional parameters. The “shorebird food resources” component of the monitoring program (Taylor et al. 2022b) provides a measure of habitat quality for which pre-restoration data is available for Lake Hawdon North and a control site in Lake Hawdon South. It is recommended that shorebird food resources monitoring be implemented annually to measure any trajectory of change to this important ecological parameter in response to the restoration of Lake Hawdon North.

While the focus of the restoration of Lake Hawdon North has been the HCHB target species and other waders, cryptic waterbirds and passerines of sedgeland habitats are another group worthy of attention throughout the Lake Hawdon complex. The four years of baseline waterbird monitoring have opportunistically detected several important species formerly unknown in Lake Hawdon North. This list includes Australian painted snipe (*Rostratula australis*) (nationally endangered, state endangered), Latham's Snipe (*Gallinago hardwickii*) (nationally vulnerable, migratory, state rare), Australasian bittern (*Botaurus poiciloptilus*) (globally vulnerable, nationally endangered, state endangered) and Baillon's Crake (*Zapornia pusilla palustris*). Cryptic species previously recorded include southern emu-wren (*Stipiturus malachurus polionotum*) (state rare) and there are species not yet recorded that may be present such as Lewin’s rail (*Lewinia pectoralis*) (state vulnerable). The maintenance and improved condition of the sedgeland habitat favoured by these and other cryptic species is a focus of management at Lake Hawdon North (Taylor et al. 2025), yet little is known about their populations, habitat use, breeding, response to fire and response to grazing across the site. The inclusion of cryptic bird monitoring would be a valuable addition to the overall monitoring program for the Lake Hawdon complex. Developing technologies such as acoustic surveillance with automated call recognition (Kulich 2024) could be investigated.

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APPENDIX A – Bird Abundance Counts for each survey cell, November 2023

			Counts per cell																																						
common name	Total	Cells present	C-13	C-14	D-12	D-13	D-14	D-15	E-12	E-13	E-14	E-15	E-16	F-10	F-11	F-12	F-13	F-14	F-15	F-16	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	G-17	G-18	H-8	H-9	H-10	H-11	H-12	H-13	H-14	H-15
Species for which confident counts for entire survey area were obtained																																									
Australasian Grebe	1	1																																								
Australasian shoveler	1	1																																								
Australian pelican	0	0																																								
Australian shelduck	37	9																																								
Australian white ibis	12	3																																								
banded lapwing	2	1																																								
black swan	121	11						5																																		
black-winged stilt	1697	41																																								
Caspian tern	0	0																																								
cattle egret	0	0																																								
chestnut teal	39	4																																								
common greenshank	34	14																																								
curlew sandpiper	5	1																																								
dusky moorhen	1	1																																								
fairy tern	3	1																																								
freckled duck	150	1																																								
glossy ibis	3	1																																								
great cormorant	4	3																																								
great egret	46	16																																								
grey teal	20608	47										14																														
hardhead	62	4																																								
hoary-headed grebe	148	12										1																														
intermediate egret	4	2																																								
little black cormorant	2	2										1																														
little egret	7	6						1																																		
little pied cormorant	9	6						1																																		
marsh sandpiper	1	1																																								
masked lapwing	126	31																																								
musk duck	3	2																																								
Pacific black duck	180	13																																								
Pacific golden plover	3	1																																								
pied cormorant	2	1										2																														
pink-eared duck	463	7																																								
red-capped plover	123	10																																								
red-kneed dotterel	181	16																																								
red-necked avocet	14	1																																								
red-necked stint	286	8																																								
royal spoonbill	18	5																																								
sharp-tailed sandpiper	3685	36																																								
silver gull	168	13																																								
straw-necked ibis	9	1																																								
unidentified duck sp.	1400	1																																								
unidentified egret sp.	2	2																																								
unidentified wader sp.	134	3																																								
whiskered tern	849	40																																								
white-faced heron	329	41																																								
white-necked heron	115	24																																								
yellow-billed spoonbill	21	8																																								

			Counts per cell																																				
common name	Total	Cells present	H-16	H-17	H-18	H-19	I-7	I-8	I-9	I-10	I-11	I-12	I-13	I-14	I-15	I-16	I-17	I-18	I-19 damp	I-20	J-5	J-6	J-7	J-8	J-9	J-10	J-11	J-12	J-13	J-14	J-15	J-16	J-17	J-18	J-19	J-20	J-21	K-5	K-6	K-7
Species for which confident counts for entire survey area were obtained																																							
Australasian Grebe	1	1																																					
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Australian pelican	0	0																																					
Australian shelduck	37	9																																					
Australian white ibis	12	3																																					
banded lapwing	2	1																																					
black swan	121	11																																					
black-winged stilt	1697	41	18													48	51														65		48	43						
Caspian tern	0	0																																					
cattle egret	0	0																																					
chestnut teal	39	4																																					
common greenshank	34	14	1													3																		1					
curlew sandpiper	5	1																																					
dusky moorhen	1	1																																					
fairy tern	3	1																																					
freckled duck	150	1																																					
glossy ibis	3	1																																3					
great cormorant	4	3																																					
great egret	46	16														8																							
grey teal	20608	47														9															80	100	4	140					
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red-capped plover	123	10	55																																				
red-kneed dotterel	181	16																														11	1	8						
red-necked avocet	14	1																																					
red-necked stint	286	8	8																																				
royal spoonbill	18	5														1	1																						
sharp-tailed sandpiper	3685	36														30	177	3													95		95	144	121				
silver gull	168	13	1	1																																			
straw-necked ibis	9	1																																					
unidentified duck sp.	1400	1																																					
unidentified egret sp.	2	2																																					
unidentified wader sp.	134	3														130																							
whiskered tern	849	40	4													45	36	2	43												1			94	31	4			
white-faced heron	329	41	4													35	32														15	7	12	13	3	11			
white-necked heron	115	24														6	10		1												3		11	8	1				
yellow-billed spoonbill	21	8															5																						

			Counts per cell																																									
common name	Total	Cells present	K-8	K-9	K-10	K-11	K-12	K-13	K-14	K-15	K-16	K-17	K-18	K-19	K-20	K-21	K-22	K-23	K-24	L-6	L-7	L-8	L-9	L-10	L-11	L-12	L-13	L-14	L-15	L-16	L-17	L-18	L-19	L-20	L-21	L-22	L-23	L-24	L-25	M-6
Species for which confident counts for entire survey area were obtained																																											
Australasian Grebe	1	1																											1														
Australasian shoveler	1	1																												1													
Australian pelican	0	0																																										
Australian shelduck	37	9																6											1	3														
Australian white ibis	12	3												1																			1										
banded lapwing	2	1																																									
black swan	121	11																											2	2								16				
black-winged stilt	1697	41								3	12	69	38	6															91	120	42		17			40		2				
Caspian tern	0	0																																									
cattle egret	0	0																																									
chestnut teal	39	4																													2											
common greenshank	34	14									1	1																								8						
curlew sandpiper	5	1																																								
dusky moorhen	1	1																																								
fairy tern	3	1																																								
freckled duck	150	1																																								
glossy ibis	3	1																																								
great cormorant	4	3																																								
great egret	46	16																											1				2			1						
grey teal	20608	47								43	1	90	14																108	1800	341	4				1		5				
hardhead	62	4																												26													
hoary-headed grebe	148	12																																				8				
intermediate egret	4	2																																								
little black cormorant	2	2																																								
little egret	7	6																																				1				
little pied cormorant	9	6																																				2				
marsh sandpiper	1	1																																								
masked lapwing	126	31						5	13	4	15	2	4						2											2							1				
musk duck	3	2																																				2				
Pacific black duck	180	13																																			25		1		
Pacific golden plover	3	1																																								
pied cormorant	2	1																																								
pink-eared duck	463	7																																								
red-capped plover	123	10																														3										
red-kneed dotterel	181	16											4																			11	1							1		
red-necked avocet	14	1																																								
red-necked stint	286	8																												5												
royal spoonbill	18	5																																								
sharp-tailed sandpiper	3685	36									143	51	16	40	17														247	786	10	69	4			35	8	10	28		
silver gull	168	13								2	1																		1									1				
straw-necked ibis	9	1																																								
unidentified duck sp.	1400	1																																								
unidentified egret sp.	2	2										1																														
unidentified wader sp.	134	3								1																																
whiskered tern	849	40									3	1	14	12	10															5	10	10	46	6			2				
white-faced heron	329	41									2	3	1	10	71												1				1	3	9			2	1	6	2		
white-necked heron	115	24								2		2	3	2	23															1	1	2	24	4							
yellow-billed spoonbill	21	8																															1								

			Counts per cell																																			
common name	Total	Cells present	M-7	M-8	M-9	M-10	M-11	M-12	M-13	M-14	M-15	M-16	M-17	M-18	M-19	M-20	M-21	M-22	M-23	M-24	M-25	M-26	N-5	N-6	N-7	N-8	N-9	N-10	N-11	N-12	N-13	N-14	N-15	N-16	N-17	N-18	N-19	N-20	N-21	N-22
Species for which confident counts for entire survey area were obtained																																								
Australasian Grebe	1	1																																						
Australasian shoveler	1	1																																						
Australian pelican	0	0																																						
Australian shelduck	37	9													12	2																		2						
Australian white ibis	12	3																																						
banded lapwing	2	1																																						
black swan	121	11																2				1												24						
black-winged stilt	1697	41									15	157	75	14	1			6		3												24	137		1		12	37	65
Caspian tern	0	0																																						
cattle egret	0	0																																						
chestnut teal	39	4																																						
common greenshank	34	14										1		1																				1						4
curlew sandpiper	5	1																																						
dusky moorhen	1	1									1																													
fairy tern	3	1																																						
freckled duck	150	1																																						
glossy ibis	3	1																																						
great cormorant	4	3									1																													
great egret	46	16									2			17	3	2		1	1		1																3		
grey teal	20608	47									14	285	1776	70	2	2		10	1		1												8	1150		1		32	225	450
hardhead	62	4																																6						
hoary-headed grebe	148	12									12					14		2																						
intermediate egret	4	2													2																									
little black cormorant	2	2									1																													
little egret	7	6													1			1																						
little pied cormorant	9	6												1				1																						
marsh sandpiper	1	1										1																												
masked lapwing	126	31							1		2																				8	1								2
musk duck	3	2																																						
Pacific black duck	180	13									8			1				2		10													8	11						
Pacific golden plover	3	1																																						
pied cormorant	2	1																																						
pink-eared duck	463	7																																255						
red-capped plover	123	10																																2						
red-kneed dotterel	181	16																			7																			
red-necked avocet	14	1																																14						
red-necked stint	286	8																																						
royal spoonbill	18	5									8		2																											
sharp-tailed sandpiper	3685	36									22	203																					72	54						
silver gull	168	13											9	145	1			1		1																				
straw-necked ibis	9	1																																						
unidentified duck sp.	1400	1																																						
unidentified egret sp.	2	2																																		1				
unidentified wader sp.	134	3									3																													
whiskered tern	849	40										4	164	10	11	25	17	30		1	2										80				2		2		25
white-faced heron	329	41									4	2		7	5	10	8	5	1		3									20					2				3
white-necked heron	115	24										1	2	1		3	2	1													1								
yellow-billed spoonbill	21	8									2		6		1			1																2						

			Counts per cell																																					
common name	Total	Cells present	N-23	N-24	N-25	N-26	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	O-22	O-23	O-24	O-25	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16
Species for which confident counts for entire survey area were obtained																																								
Australasian Grebe	1	1																																						
Australasian shoveler	1	1																																						
Australian pelican	0	0																																						
Australian shelduck	37	9			2																																			
Australian white ibis	12	3	10																																					
banded lapwing	2	1						2																																
black swan	121	11																								2														
black-winged stilt	1697	41		11																		29		70	80	12														
Caspian tern	0	0																																						
cattle egret	0	0																																						
chestnut teal	39	4		15																					20															
common greenshank	34	14			1																	2				8														
curlew sandpiper	5	1			5																																			
dusky moorhen	1	1																																						
fairy tern	3	1																							3															
freckled duck	150	1																							150															
glossy ibis	3	1																																						
great cormorant	4	3		1													2																							
great egret	46	16	1																																				1	
grey teal	20608	47		30	714																10	115		3375	2120	1830												14	
hardhead	62	4	25																																				5	
hoary-headed grebe	148	12	15	4													7								34	34													2	
intermediate egret	4	2		2																																				
little black cormorant	2	2																																						
little egret	7	6																								2														
little pied cormorant	9	6		1																																			3	
marsh sandpiper	1	1																																						
masked lapwing	126	31	2		2		1		2					22		2										7				2										
musk duck	3	2		1																																				
Pacific black duck	180	13	87						1								6																						3	
Pacific golden plover	3	1																											3											
pied cormorant	2	1																																						
pink-eared duck	463	7		2																				60	96	10														
red-capped plover	123	10						21	8												8																			
red-kneed dotterel	181	16		6	65	1															4	5																		
red-necked avocet	14	1																																						
red-necked stint	286	8						42	6																															
royal spoonbill	18	5	6																																					
sharp-tailed sandpiper	3685	36		5	142																	15		150	340	165														
silver gull	168	13	2																							2														
straw-necked ibis	9	1																							9															
unidentified duck sp.	1400	1																																						
unidentified egret sp.	2	2																																						
unidentified wader sp.	134	3																																						
whiskered tern	849	40	16	5	4																	2				42														
white-faced heron	329	41	1	7					1															3		1														
white-necked heron	115	24																																						
yellow-billed spoonbill	21	8	3																																					

			Counts per cell																														
common name	Total	Cells present	P-17	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25	Q-4	Q-5	Q-6	Q-7	Q-8	Q-11	Q-12	Q-13	Q-16	Q-17	Q-18	Q-19	Q-20	Q-21	Q-22	Q-23	Q-24	R-5	R-6	R-7	R-8	R-17	R-18
Species for which confident counts for entire survey area were obtained																																	
Australasian Grebe	1	1																															
Australasian shoveler	1	1																															
Australian pelican	0	0																															
Australian shelduck	37	9							8														1										
Australian white ibis	12	3																															
banded lapwing	2	1																															
black swan	121	11							61	2													4										
black-winged stilt	1697	41			8	16		50	55	65													41										
Caspian tern	0	0																															
cattle egret	0	0																															
chestnut teal	39	4																					2										
common greenshank	34	14			1																												
curlew sandpiper	5	1																															
dusky moorhen	1	1																															
fairy tern	3	1																															
freckled duck	150	1																															
glossy ibis	3	1																															
great cormorant	4	3																															
great egret	46	16							1	1																							
grey teal	20608	47			55	29	50	2000	2400	530													525				30						
hardhead	62	4																															
hoary-headed grebe	148	12								15																							
intermediate egret	4	2																															
little black cormorant	2	2																															
little egret	7	6																															
little pied cormorant	9	6																															
marsh sandpiper	1	1																															
masked lapwing	126	31			2					5										2		2											
musk duck	3	2																															
Pacific black duck	180	13							17																								
Pacific golden plover	3	1																															
pied cormorant	2	1																															
pink-eared duck	463	7							15	25																							
red-capped plover	123	10	1		16																6	3											
red-kneed dotterel	181	16			9	46																	1										
red-necked avocet	14	1																															
red-necked stint	286	8			215	5															2		3										
royal spoonbill	18	5																															
sharp-tailed sandpiper	3685	36			135	133			40	35													45										
silver gull	168	13																															
straw-necked ibis	9	1																															
unidentified duck sp.	1400	1								1400																							
unidentified egret sp.	2	2																															
unidentified wader sp.	134	3																															
whiskered tern	849	40			27	1																											
white-faced heron	329	41					1																1										
white-necked heron	115	24																															
yellow-billed spoonbill	21	8																															

Note: species listed in red were recorded in the baseline census for the first time in November 2023.

			Counts per cell																																				
common name	Total	Cells	C-13	C-14	D-12	D-13	D-14	D-15	E-12	E-13	E-14	E-15	E-16	F-10	F-11	F-12	F-13	F-14	F-15	F-16	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	G-17	G-18	H-8	H-9	H-10	H-11	H-12	H-13	H-14	H-15
		present																																					
Species counted opportunistically - counts not representative of entire survey area																																						
Australasian bittern	1	1																																				
Australasian pipit	2	2																																				
Australian hobby	0	0																																				
Australian magpie	7	2																																				
Australian painted snipe	1	1																																				
Australian raven	0	0																																				
Australian reed warbler	0	0																																				
Australian spotted crake	23	13																																				
Ballion's crake	2	1																																				
beautiful firetail	1	1																																				
black-tailed native-hen	2514	44																																				
blue-winged parrot	2	1																																				
brown falcon	1	1																																				
brown songlark	0	0																																				
brown thornbill	0	0																																				
collared sparrowhawk	0	0																																				
common blackbird	0	0																																				
common bronzewing	0	0																																				
common skylark	15	6																																				
common starling	0	0																																				
crested pigeon	4	1																																				
eastern yellow robin	0	0																																				
emu	1	1																																				
European goldfinch	0	0																																				
forest raven	0	0																																				
galah	2	1																																				
golden whistler	1	1																																				
golden-headed cisticola	13	8																																				
grey butcherbird	0	0																																				
grey currawong	0	0																																				
grey faintail	2	2																																				
grey shrike-thrush	5	5																																				
Horsefield's bronze-cuckoo	0	0																																				
Latham's snipe	4	4																																				
little grassbird	18	14																																				
little raven	11	1																																				
magpie-lark	5	3																																				
Nankeen kestrel	1	1																																				
peregrine falcon	1	1																																				
purple swamphen	0	0																																				
raven sp.	55	3																																				
silvereye	1	1																																				
singing honeyeater	0	0																																				
southern emu-wren	2	1																																				
spiny-cheeked honeyeater	2	2																																				
striated fieldwren	2	2																																				
stubble quail	0	0																																				
superb fairy-wren	8	4																																				
swamp harrier	7	6																																				
tree martin	0	0																																				
wedge-tailed eagle	1	1																																				
welcome swallow	4	3																																				
white-browed babbler	0	0																																				
white-browed scrubwren	3	2																																				
white-fronted chat	49	14																																				
willie wagtail	0	0																																				
yellow-faced honeyeater	0	0																																				
yellow-rumped thornbill	3	1																																				
unidentified bird of prey (fa	1	1																																				
unidentified parrot sp. (gen	6	2																																				
unidentified quail sp.	2	1																																				
unidentified rail sp.	2	2																																				

			Counts per cell																																						
common name	Total	Cells	H-16	H-17	H-18	H-19	I-7	I-8	I-9	I-10	I-11	I-12	I-13	I-14	I-15	I-16	I-17	I-18	I-19	I-20	J-5	J-6	J-7	J-8	J-9	J-10	J-11	J-12	J-13	J-14	J-15	J-16	J-17	J-18	J-19	J-20	J-21	K-5	K-6	K-7
		present																	damp																						
Species counted opportunistically - counts not representative of entire survey area																																									
Australasian bittern	1	1																																							
Australasian pipit	2	2																																							
Australian hobby	0	0																																							
Australian magpie	7	2																																							
Australian painted snipe	1	1																																							
Australian raven	0	0																																							
Australian reed warbler	0	0																																							
Australian spotted crake	23	13																																							
Ballion's crake	2	1																																							
beautiful firetail	1	1																																							
black-tailed native-hen	2514	44																												180	78	12	40		136	12				
blue-winged parrot	2	1																																							
brown falcon	1	1																																							
brown songlark	0	0																																							
brown thornbill	0	0																																							
collared sparrowhawk	0	0																																							
common blackbird	0	0																																							
common bronzewing	0	0																																							
common skylark	15	6																													3										
common starling	0	0																																							
crested pigeon	4	1																																							
eastern yellow robin	0	0																																							
emu	1	1																																							
European goldfinch	0	0																																							
forest raven	0	0																																							
galah	2	1																																							
golden whistler	1	1																																							
golden-headed cisticola	13	8																													2			1	1						
grey butcherbird	0	0																																							
grey currawong	0	0																																							
grey faintail	2	2																																							
grey shrike-thrush	5	5																																		1					
Horsefield's bronze-cuckoo	0	0																																							
Latham's snipe	4	4																													1										
little grassbird	18	14																																1							
little raven	11	1																																							
magpie-lark	5	3																																							
Nankeen kestrel	1	1																																							
peregrine falcon	1	1																																							
purple swamphen	0	0																																							
raven sp.	55	3																																							
silvereye	1	1																																							
singing honeyeater	0	0																																							
southern emu-wren	2	1																																							
spiny-cheeked honeyeater	2	2																	1																						
striated fieldwren	2	2																																	1	1					
stubble quail	0	0																																							
superb fairy-wren	8	4																																							
swamp harrier	7	6														1																2		1							
tree martin	0	0																																							
wedge-tailed eagle	1	1																																							
welcome swallow	4	3																																1							
white-browed babbler	0	0																																							
white-browed scrubwren	3	2																																							
white-fronted chat	49	14	4																2																		6				
willie wagtail	0	0																																							
yellow-faced honeyeater	0	0																																							
yellow-rumped thornbill	3	1																																							
unidentified bird of prey (fa	1	1																																							
unidentified parrot sp. (gen	6	2															1																								
unidentified quail sp.	2	1																																							
unidentified rail sp.	2	2															1																								

			Counts per cell																																						
common name	Total	Cells	K-8	K-9	K-10	K-11	K-12	K-13	K-14	K-15	K-16	K-17	K-18	K-19	K-20	K-21	K-22	K-23	K-24	L-6	L-7	L-8	L-9	L-10	L-11	L-12	L-13	L-14	L-15	L-16	L-17	L-18	L-19	L-20	L-21	L-22	L-23	L-24	L-25	M-6
		present																																							
Species counted opportunistically - counts not representative of entire survey area																																								
Australasian bittern	1	1																																							
Australasian pipit	2	2																																							
Australian hobby	0	0																																							
Australian magpie	7	2																									1														
Australian painted snipe	1	1																																							
Australian raven	0	0																																							
Australian reed warbler	0	0																																							
Australian spotted crake	23	13																														1	1		2	2	2	1		
Ballion's crake	2	1																																							
beautiful firetail	1	1																																							
black-tailed native-hen	2514	44						40		83		61	173				15										115		39	85	64	34			4	6	8		16	
blue-winged parrot	2	1														2																									
brown falcon	1	1																																		1					
brown songlark	0	0																																							
brown thornbill	0	0																																							
collared sparrowhawk	0	0																																							
common blackbird	0	0																																							
common bronzewing	0	0																																							
common skylark	15	6								3		4	1																												
common starling	0	0																																							
crested pigeon	4	1																																							
eastern yellow robin	0	0																																							
emu	1	1																											1												
European goldfinch	0	0																																							
forest raven	0	0																																							
galah	2	1																												2										
golden whistler	1	1																																							
golden-headed cisticola	13	8								2																				1	1									
grey butcherbird	0	0																																							
grey currawong	0	0																																							
grey fantail	2	2													1																										
grey shrike-thrush	5	5													1																										
Horsefield's bronze-cuckoo	0	0																																							
Latham's snipe	4	4								1								1																							
little grassbird	18	14											3																		1		1		1					
little raven	11	1																																							
magpie-lark	5	3						2					2	1																											
Nankeen kestrel	1	1																												1										
peregrine falcon	1	1																																							
purple swamphen	0	0																																							
raven sp.	55	3																									1													
silvereye	1	1																																							
singing honeyeater	0	0																																							
southern emu-wren	2	1																2																							
spiny-cheeked honeyeater	2	2																																							
striated fieldwren	2	2																																							
stubble quail	0	0																																							
superb fairy-wren	8	4																																							
swamp harrier	7	6										1	1																	1										
tree martin	0	0																																							
wedge-tailed eagle	1	1																																							
welcome swallow	4	3																																							
white-browed babbler	0	0																																							
white-browed scrubwren	3	2																																							
white-fronted chat	49	14						2	11					9																											
willie wagtail	0	0																																							
yellow-faced honeyeater	0	0																																							
yellow-rumped thornbill	3	1																																							
unidentified bird of prey (fa	1	1								1																															
unidentified parrot sp. (gen	6	2																																5							
unidentified quail sp.	2	1								2																															
unidentified rail sp.	2	2																															1								

			Counts per cell																																					
common name	Total	Cells	M-7	M-8	M-9	M-10	M-11	M-12	M-13	M-14	M-15	M-16	M-17	M-18	M-19	M-20	M-21	M-22	M-23	M-24	M-25	M-26	N-5	N-6	N-7	N-8	N-9	N-10	N-11	N-12	N-13	N-14	N-15	N-16	N-17	N-18	N-19	N-20	N-21	N-22
		present																																						
Species counted opportunistically - counts not representative of entire survey area																																								
Australasian bittern	1	1																	1																					
Australasian pipit	2	2																																						
Australian hobby	0	0																																						
Australian magpie	7	2																															6							
Australian painted snipe	1	1																			1																			
Australian raven	0	0																																						
Australian reed warbler	0	0																																						
Australian spotted crake	23	13																1			5																		2	
Ballion's crake	2	1													2																									
beautiful firetail	1	1																		1																				
black-tailed native-hen	2514	44							80	105		290	98			20															100		89		11	3			5	1
blue-winged parrot	2	1																																						
brown falcon	1	1																																						
brown songlark	0	0																																						
brown thornbill	0	0																																						
collared sparrowhawk	0	0																																						
common blackbird	0	0																																						
common bronzewing	0	0																																						
common skylark	15	6							1																															
common starling	0	0																																						
crested pigeon	4	1																																						
eastern yellow robin	0	0																																						
emu	1	1																																						
European goldfinch	0	0																																						
forest raven	0	0																																						
galah	2	1																																						
golden whistler	1	1												1																										
golden-headed cisticola	13	8									3				2																									
grey butcherbird	0	0																																						
grey currawong	0	0																																						
grey faintail	2	2																																	1					
grey shrike-thrush	5	5									1																								1					
Horsefield's bronze-cuckoo	0	0																																						
Latham's snipe	4	4									1																													
little grassbird	18	14									1			2	1	2					1														1					
little raven	11	1																																						
magpie-lark	5	3																																						
Nankeen kestrel	1	1																																						
peregrine falcon	1	1																																	1					
purple swamphen	0	0																																						
raven sp.	55	3																												50		4							
silvereye	1	1																																		1				
singing honeyeater	0	0																																						
southern emu-wren	2	1																																						
spiny-cheeked honeyeater	2	2																																						
striated fieldwren	2	2																																						
stubble quail	0	0																																						
superb fairy-wren	8	4									2				1																			4		1				
swamp harrier	7	6																																						
tree martin	0	0																																						
wedge-tailed eagle	1	1																																						
welcome swallow	4	3													1																									
white-browed babbler	0	0																																						
white-browed scrubwren	3	2																																		1				
white-fronted chat	49	14													1																									
willie wagtail	0	0																																						
yellow-faced honeyeater	0	0																																						
yellow-rumped thornbill	3	1									3																													
unidentified bird of prey (fa	1	1																																						
unidentified parrot sp. (gen	6	2																																						
unidentified quail sp.	2	1																																						
unidentified rail sp.	2	2																																						

			Counts per cell																																							
common name	Total	Cells	N-23	N-24	N-25	N-26	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	O-22	O-23	O-24	O-25	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16
		present																																							
Species counted opportunistically - counts not representative of entire survey area																																									
Australasian bittern	1	1																																							
Australasian pipit	2	2														1																									
Australian hobby	0	0																																							
Australian magpie	7	2																																							
Australian painted snipe	1	1																																							
Australian raven	0	0																																							
Australian reed warbler	0	0																																							
Australian spotted crake	23	13			2												1																							1	
Ballion's crake	2	1																																							
beautiful firetail	1	1																																							
black-tailed native-hen	2514	44		1	39	1															65		2	80																
blue-winged parrot	2	1																																							
brown falcon	1	1																																							
brown songlark	0	0																																							
brown thornbill	0	0																																							
collared sparrowhawk	0	0																																							
common blackbird	0	0																																							
common bronzewing	0	0																																							
common skylark	15	6													3																										
common starling	0	0																																							
crested pigeon	4	1							4																																
eastern yellow robin	0	0																																							
emu	1	1																																							
European goldfinch	0	0																																							
forest raven	0	0																																							
galah	2	1																																							
golden whistler	1	1																																							
golden-headed cisticola	13	8																																							
grey butcherbird	0	0																																							
grey currawong	0	0																																							
grey faintail	2	2																																							
grey shrike-thrush	5	5							1																																
Horsefield's bronze-cuckoo	0	0																																							
Latham's snipe	4	4																																							
little grassbird	18	14		1																		1																		1	
little raven	11	1																																							
magpie-lark	5	3																																							
Nankeen kestrel	1	1																																							
peregrine falcon	1	1																																							
purple swamphen	0	0																																							
raven sp.	55	3																																							
silvereye	1	1																																							
singing honeyeater	0	0																																							
southern emu-wren	2	1																																							
spiny-cheeked honeyeater	2	2																																							
striated fieldwren	2	2																																							
stubble quail	0	0																																							
superb fairy-wren	8	4																																							
swamp harrier	7	6																																							
tree martin	0	0																																							
wedge-tailed eagle	1	1							1																																
welcome swallow	4	3															2																								
white-browed babbler	0	0																																							
white-browed scrubwren	3	2																																							
white-fronted chat	49	14							2							3					4																				
willie wagtail	0	0																																							
yellow-faced honeyeater	0	0																																							
yellow-rumped thornbill	3	1																																							
unidentified bird of prey (fa	1	1																																							
unidentified parrot sp. (gen	6	2																																							
unidentified quail sp.	2	1																																							
unidentified rail sp.	2	2																																							

			Counts per cell																																
common name	Total	Cells	P-17	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25	Q-4	Q-5	Q-6	Q-7	Q-8	Q-11	Q-12	Q-13	Q-16	Q-17	Q-18	Q-19	Q-20	Q-21	Q-22	Q-23	Q-24	R-5	R-6	R-7	R-8	R-17	R-18
		present																																	
Species counted opportunistically - counts not representative of entire survey area																																			
Australasian bittern	1	1																																	
Australasian pipit	2	2		1																															
Australian hobby	0	0																																	
Australian magpie	7	2																																	
Australian painted snipe	1	1																																	
Australian raven	0	0																																	
Australian reed warbler	0	0																																	
Australian spotted crake	23	13				2																													
Ballion's crake	2	1																																	
beautiful firetail	1	1																																	
black-tailed native-hen	2514	44			9	3		125	32	40												29	85												
blue-winged parrot	2	1																																	
brown falcon	1	1																																	
brown songlark	0	0																																	
brown thornbill	0	0																																	
collared sparrowhawk	0	0																																	
common blackbird	0	0																																	
common bronzewing	0	0																																	
common skylark	15	6																																	
common starling	0	0																																	
crested pigeon	4	1																																	
eastern yellow robin	0	0																																	
emu	1	1																																	
European goldfinch	0	0																																	
forest raven	0	0																																	
galah	2	1																																	
golden whistler	1	1																																	
golden-headed cisticola	13	8																																	
grey butcherbird	0	0																																	
grey currawong	0	0																																	
grey fantail	2	2																																	
grey shrike-thrush	5	5																																	
Horsefield's bronze-cuckoo	0	0																																	
Latham's snipe	4	4																																	
little grassbird	18	14																																	
little raven	11	1																				11													
magpie-lark	5	3																																	
Nankeen kestrel	1	1																																	
peregrine falcon	1	1																																	
purple swamphen	0	0																																	
raven sp.	55	3																																	
silvereye	1	1																																	
singing honeyeater	0	0																																	
southern emu-wren	2	1																																	
spiny-cheeked honeyeater	2	2																				1													
striated fieldwren	2	2																																	
stubble quail	0	0																																	
superb fairy-wren	8	4																																	
swamp harrier	7	6																																	
tree martin	0	0																																	
wedge-tailed eagle	1	1																																	
welcome swallow	4	3																																	
white-browed babbler	0	0																																	
white-browed scrubwren	3	2																				2													
white-fronted chat	49	14			1	1																2	1												
willie wagtail	0	0																																	
yellow-faced honeyeater	0	0																																	
yellow-rumped thornbill	3	1																																	
unidentified bird of prey (fa	1	1																																	
unidentified parrot sp. (gen	6	2																																	
unidentified quail sp.	2	1																																	
unidentified rail sp.	2	2																																	

APPENDIX B - Bird Abundance Counts for each survey cell, October 2024

			Counts per cell																			
common name	Total	Cells pre	D-15	E-15	F-15	G-15	H-15	I-15	J-15	K-15	L-15	L-24	L-25	M-15	M-22	M-23	M-24	N-15	N-24	O-15	P-15
depth (cm)		0					dry														
Species for which confident counts for entire survey area were obtained																					
Australasian Grebe	0	0																			
Australasian shoveler	0	0																			
Australian pelican	0	0																			
Australian shelduck	33	3										9		16					8		
Australian white ibis	0	0																			
banded lapwing	6	1					6														
black swan	13	2															2		11		
black-winged stilt/pied stilt	0	0																			
Caspian tern	0	0																			
cattle egret	0	0																			
chestnut teal	139	6	2	12	60								2			3	60				
common greenshank	0	0																			
curlew sandpiper	0	0																			
dusky moorhen	1	1	1																		
fairy tern	0	0																			
freckled duck	0	0																			
glossy ibis	0	0																			
great cormorant	0	0																			
great egret	0	0																			
grey teal	851	11		40	40	2		1					96	3	7	240	5		415		2
hardhead	1	1		1																	
hoary-headed grebe	13	3	3	1															9		
intermediate egret	0	0																			
little black cormorant	4	1	4																		
little egret	0	0																			
little pied cormorant	0	0																			
marsh sandpiper	0	0																			
masked lapwing	51	5								2			4			9	29		7		
musk duck	0	0																			
Pacific black duck	62	4	14	2	38		8														
Pacific golden plover	0	0																			
pied cormorant	0	0																			
pink-eared duck	0	0																			
red-capped plover	53	4										2			35	4			12		
red-kneed dotterel	15	1										15									
red-necked avocet	0	0																			
red-necked stint	65	3													10		30		25		
royal spoonbill	0	0																			
sharp-tailed sandpiper	15	1																	15		
silver gull	10	2															2		8		
straw-necked ibis	0	0																			
unidentified duck sp.	19	2		17						2											
unidentified egret sp.	0	0																			
unidentified wader sp.	0	0																			
whiskered tern	0	0																			
white-faced heron	7	3						2			1									4	
white-necked heron	0	0																			
yellow-billed spoonbill	0	0																			

Note: only cells in which birds were recorded in October 2024 are listed.

			Counts per cell																		
common name	Total	Cells pre	D-15	E-15	F-15	G-15	H-15	I-15	J-15	K-15	L-15	L-24	L-25	M-15	M-22	M-23	M-24	N-15	N-24	O-15	P-15
depth (cm)		0					dry														
Species counted opportunistically - counts not representative of entire survey area																					
Australasian bittern	0	0																			
Australasian pipit	0	0																			
Australian hobby	1	1																1			
Australian magpie	3	2						2										1			
Australian painted snipe	0	0																			
Australian raven	0	0																			
Australian reed warbler	12	4												1				3		5	3
Australian spotted crake	0	0																			
Ballion's crake	0	0																			
beautiful firetail	3	2			2	1															
black-tailed native-hen	25	2														24					1
blue-winged parrot	0	0																			
brown falcon	0	0																			
brown songlark	2	2								1								1			
brown thornbill	3	1				3															
collared sparrowhawk	0	0																			
common blackbird	4	3			2	1					1										
common bronzewing	0	0																			
common skylark	7	3								1				5				1			
common starling	0	0																			
crested pigeon	0	0																			
eastern yellow robin	0	0																			
emu	0	0																			
European goldfinch	0	0																			
forest raven	0	0																			
galah	0	0																			
golden whistler	1	1				1															
golden-headed cisticola	1	1												1							
grey butcherbird	0	0																			
grey currawong	0	0																			
grey faintail	2	2	1											1							
grey shrike-thrush	3	3												1						1	1
Horsefield's bronze-cuckoo	0	0																			
Latham's snipe	0	0																			
little grassbird	16	8					1	1	3		2			2				4		2	1
little raven	0	0																			
magpie-lark	0	0																			
Nankeen kestrel	0	0																			
peregrine falcon	1	1									1										
purple swamphen	5	3	1															1			3
raven sp.	0	0																			
silvereye	0	0																			
singing honeyeater	0	0																			
southern emu-wren	0	0																			
spiny-cheeked honeyeater	0	0																			
striated fieldwren	0	0																			
stubble quail	1	1												1							
superb fairy-wren	12	4	3		3									4						2	
swamp harrier	1	1																		1	
tree martin	0	0																			
wedge-tailed eagle	0	0																			
welcome swallow	0	0																			
white-browed babbler	0	0																			
white-browed scrubwren	5	2	4						1												
white-fronted chat	4	2								2		2									
willie wagtail	0	0																			
yellow-faced honeyeater	0	0																			
yellow-rumped thornbill	0	0																			
unidentified bird of prey (fa	0	0																			
unidentified parrot sp. (gen	0	0																			
unidentified quail sp.	0	0																			
unidentified rail sp.	1	1																1			

APPENDIX C – Birds Counted Opportunistically

Counts are not representative of the entire survey area because these species favour dense shrubland and *Gahnia filum* and *Machaerina arthrophylla* sedgeland that was not systematically surveyed. List includes all species recorded opportunistically in 2021, 2022, 2023 or 2024.

Common Name	2023 Total	2024 Total
Australasian bittern	1	0
Australasian pipit	2	0
Australian hobby	0	1
Australian magpie	7	3
Australian painted snipe	1	0
Australian raven	0	0
Australian reed warbler	0	12
Australian spotted crake	23	0
Baillon's crake	2	0
beautiful firetail	1	3
black-tailed native-hen	2514	25
blue-winged parrot	2	0
brown falcon	1	0
brown songlark	0	2
brown thornbill	0	3
collared sparrowhawk	0	0
common blackbird	0	4
common bronzewing	0	0
common skylark	15	7
common starling	0	0
crested pigeon	4	0
eastern yellow robin	0	0
emu	1	0
European goldfinch	0	0
forest raven	0	0
galah	2	0
golden whistler	1	1
golden-headed cisticola	13	1
grey butcherbird	0	0
grey currawong	0	0
grey fantail	2	2
grey shrike-thrush	5	3
Horsefield's bronze-cuckoo	0	0
Latham's snipe	4	0
little grassbird	18	16
little raven	11	0
magpie-lark	5	0
Nankeen kestrel	1	0
peregrine falcon	1	1
purple swamphen	0	5
raven sp.	55	0
silvereye	1	0
singing honeyeater	0	0
southern emu-wren	2	0
spiny-cheeked honeyeater	2	0
striated fieldwren	2	0
stubble quail	0	1

Common Name	2023 Total	2024 Total
superb fairy-wren	8	12
swamp harrier	7	1
tree martin	0	0
wedge-tailed eagle	1	0
welcome swallow	4	0
white-browed babbler	0	0
white-browed scrubwren	3	5
white-fronted chat	49	4
willie wagtail	0	0
yellow-faced honeyeater	0	0
yellow-rumped thornbill	3	0
unidentified bird of prey (family Accipitridae)	1	0
unidentified parrot sp. (genus Neophema)	6	0
unidentified quail sp.	2	0
unidentified rail sp.	2	1