

# Managing groundwater on the Dampier Peninsula

New information about groundwater resources



The Department of Water has recently collected new information about the groundwater resources of the Dampier Peninsula. Water users and managers can use this

information to support water licence applications. Government will use the information to manage groundwater resources.

## The study

The Royalties for Regions Dampier Peninsula groundwater study was made possible through strong working relationships with traditional owners and other groundwater users. Through the study:

- we completed 4326 kms of aerial electromagnetic survey
- drilled 35 bores
- undertook ecological field work at 35 sites, and
- sampled water from surface water bodies, rain, aquifers and soil and plant tissue.

We now have a good understanding of the physical characteristics of the Broome Sandstone aquifer, including depth to groundwater, saturated thickness, location of the seawater interface and groundwater-dependent ecosystems. We have synthesised this information to identify areas where groundwater development could have fewer constraints and created a 'water opportunities map'.



## Water opportunities map

The water opportunities map is a simple tool accessible to all groundwater stakeholders on the Dampier Peninsula. The colour-coding provides a guide to where water abstraction can progress relatively simply.

The highest water opportunity areas are where groundwater is:

- within 80 m of the surface, fresh and semi-artesian with no groundwater-dependent ecosystems, threatened ecological communities or existing users present
- greater than 80 m below the surface with no groundwater-dependent ecosystems, threatened ecological communities or existing users present.

The lowest water opportunities are in areas where fresh groundwater and seawater have mixed, and where groundwater-dependent ecosystems, threatened ecological communities and existing users are present.

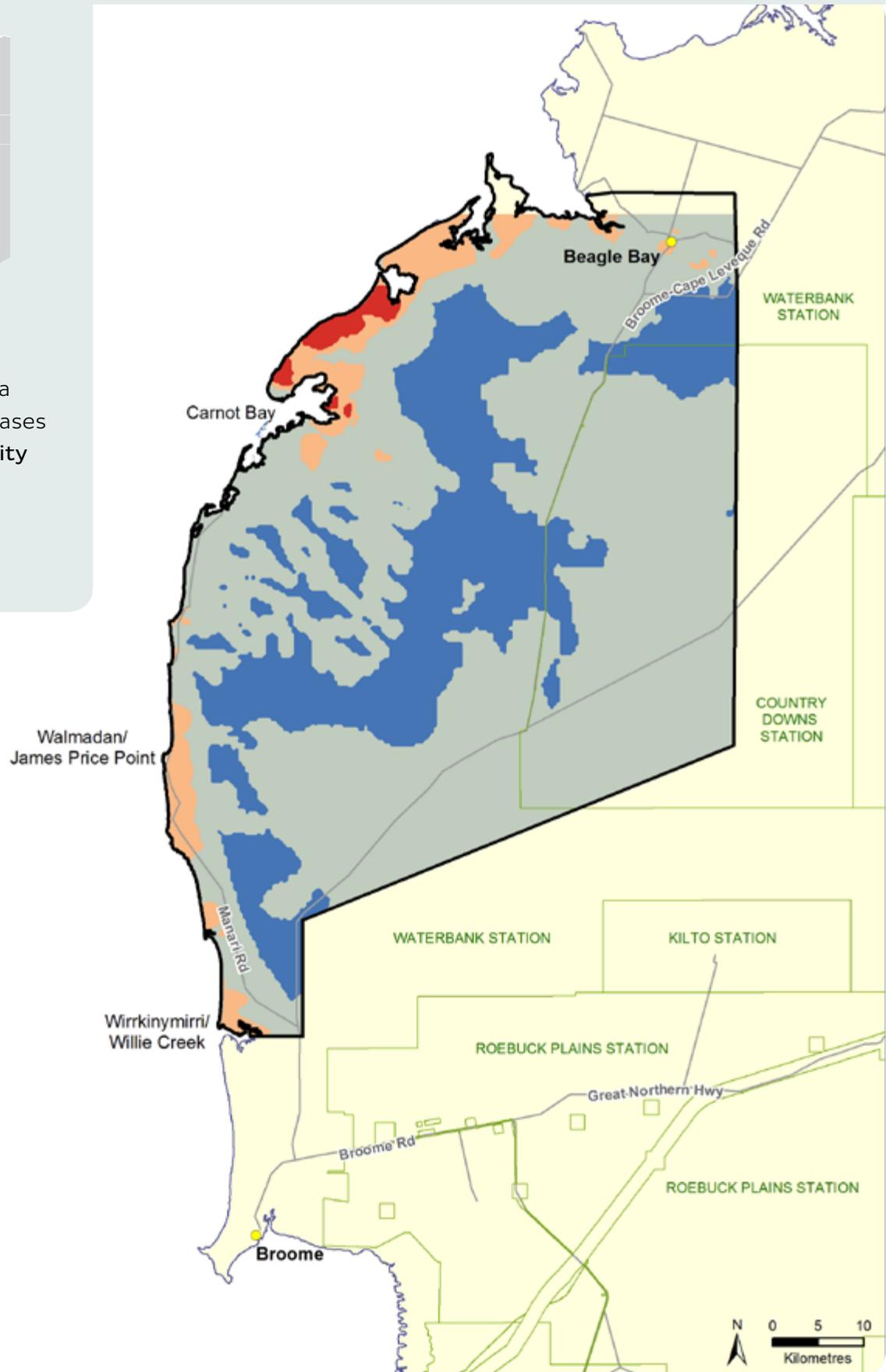
The map provides a regional overview of water opportunities. In most cases further hydrogeological and ecological investigations would be required to support any specific proposal that requires groundwater.

# Water opportunities map for the Dampier Peninsula study area



## Legend

- Project area
- Pastoral Leases
- Water opportunity**
  - High
  - Medium
  - Low
  - Restricted





## Key findings from the study

### **Groundwater in the Broome Sandstone aquifer**

The Broome Sandstone aquifer covers the whole study area and is fresh and generally unconfined. It is typically within 20 m of the surface near the coast and is more than 80 m below the surface over much of the inland extent of the aquifer. The Broome Sandstone aquifer is around 100 m thick in the centre of the peninsula, thickens to more than 500 m in the north and thins where the confining layer is present.

### **Newly discovered confined aquifer**

The Department of Water has identified a new aquifer on the Dampier Peninsula underneath the Broome Sandstone aquifer and confining layer. It is fresh, has sub-artesian pressure where we drilled, and is possibly artesian further south where the aquifer becomes shallower. Our understanding of this aquifer relies heavily on aerial electromagnetic survey, which suggest that the aquifer spans over 930 km<sup>2</sup>, and is generally over 100 m thick.

# Depth to groundwater and location of confining layer for the Dampier Peninsula study area



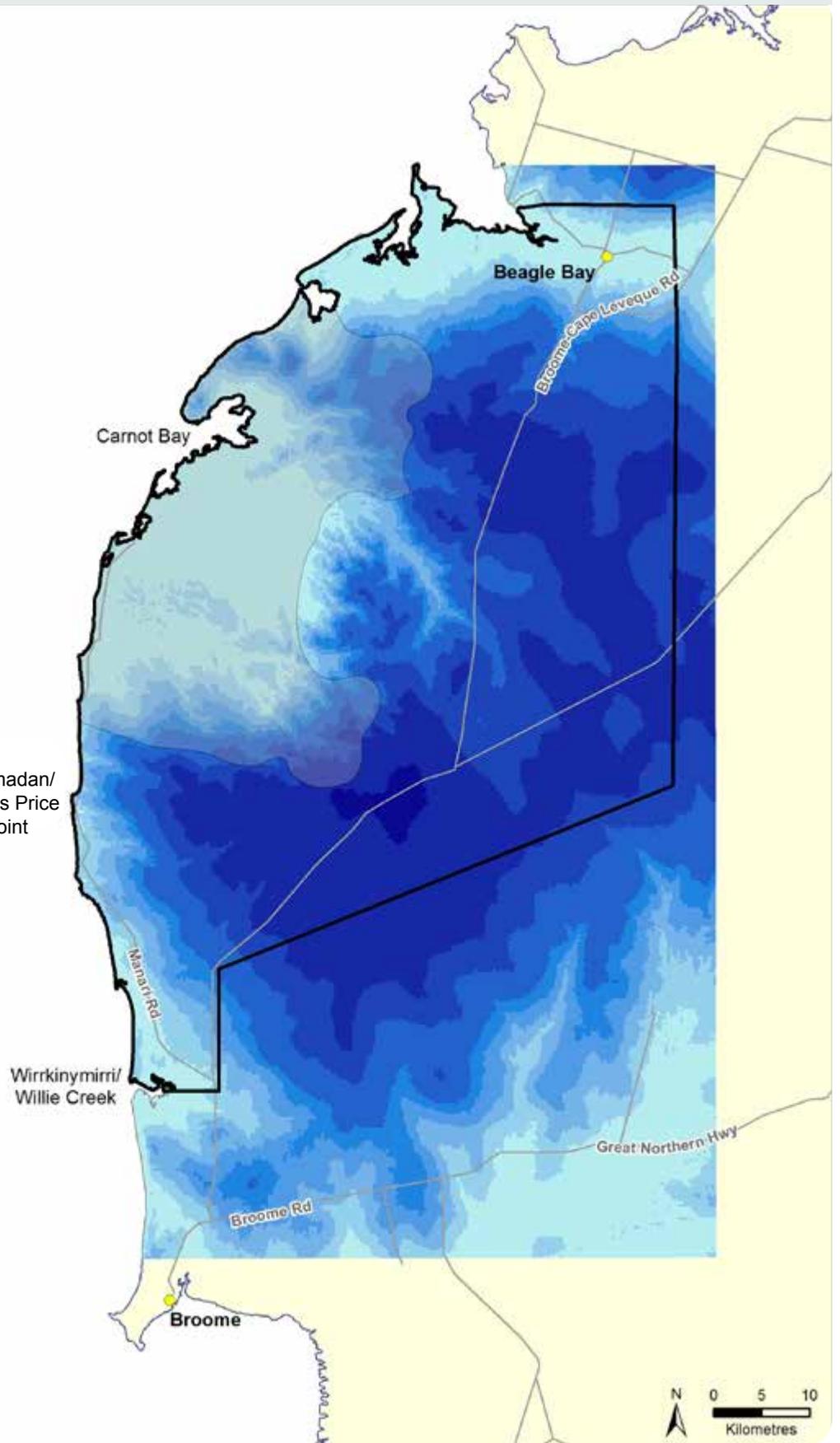
## Legend

- Project area
- Confining layer

## Depths to watertable (m) for Broome Sandstone aquifer

- < 10
- 10-20
- 20-30
- 30-40
- 40-40
- 50-75
- 75-100
- 100-150
- >150

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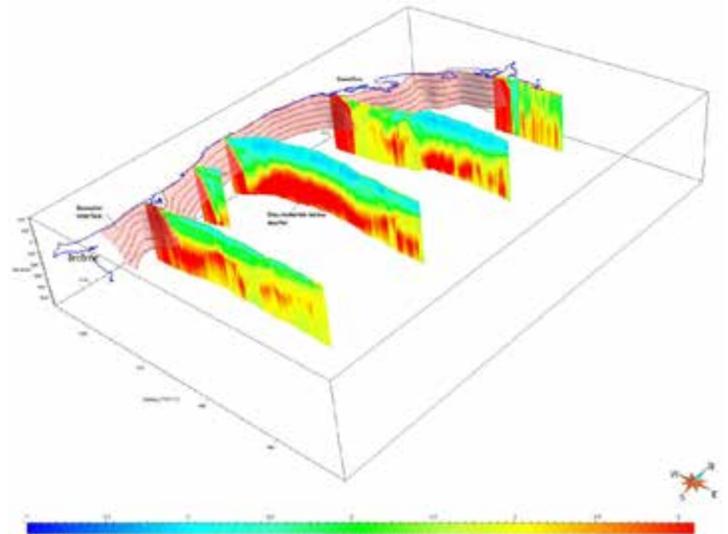
## Seawater interface

The Department of Water has located the inland interface between seawater and fresh groundwater. Locating the seawater interface is important because it lets us know where bores can be drilled to access fresh, usable groundwater.

The position of the seawater interface is usually kept stable by the natural pressure from the fresh groundwater pushing against it as the groundwater flows towards the sea. If the pressure drops because the volume of water flowing out to sea changes through rainfall variations or because too much groundwater is pumped out of the aquifers, the seawater interface can move further inland and make bores that were once fresh, salty.

Groundwater use on the Dampier Peninsula is currently low, but with growing communities and the increased interest in development in the region, it is very important to monitor for movement of the seawater interface so that current and future groundwater use is protected.

We can now clearly see how far inland the seawater is and at what depth it naturally occurs. Along the peninsula near Willie Creek the seawater interface reaches 11 km inland at depths of 230 m in the Broome Sandstone aquifer. Further north around Coulomb Point, the interface is sharp, shallow and comes only 1.7 km inland. This provides critical information to understand where you can take water and what impacts it might have.



### Seawater interface contours and airborne electromagnetic survey sections

The seawater interface is shown as a three dimensional 'ribbon' that roughly follows the coast. Electrical conductivity, important for showing the location of possible fresh water sources, is shown in colourful cross sections.

High conductivity (warmer colours) can indicate salty water, such as along the coastline of the Dampier Peninsula, or clay materials, such as shown at the base of the aquifer across the peninsula. Low conductivity (cooler colours) can indicate fresh water or sand materials.

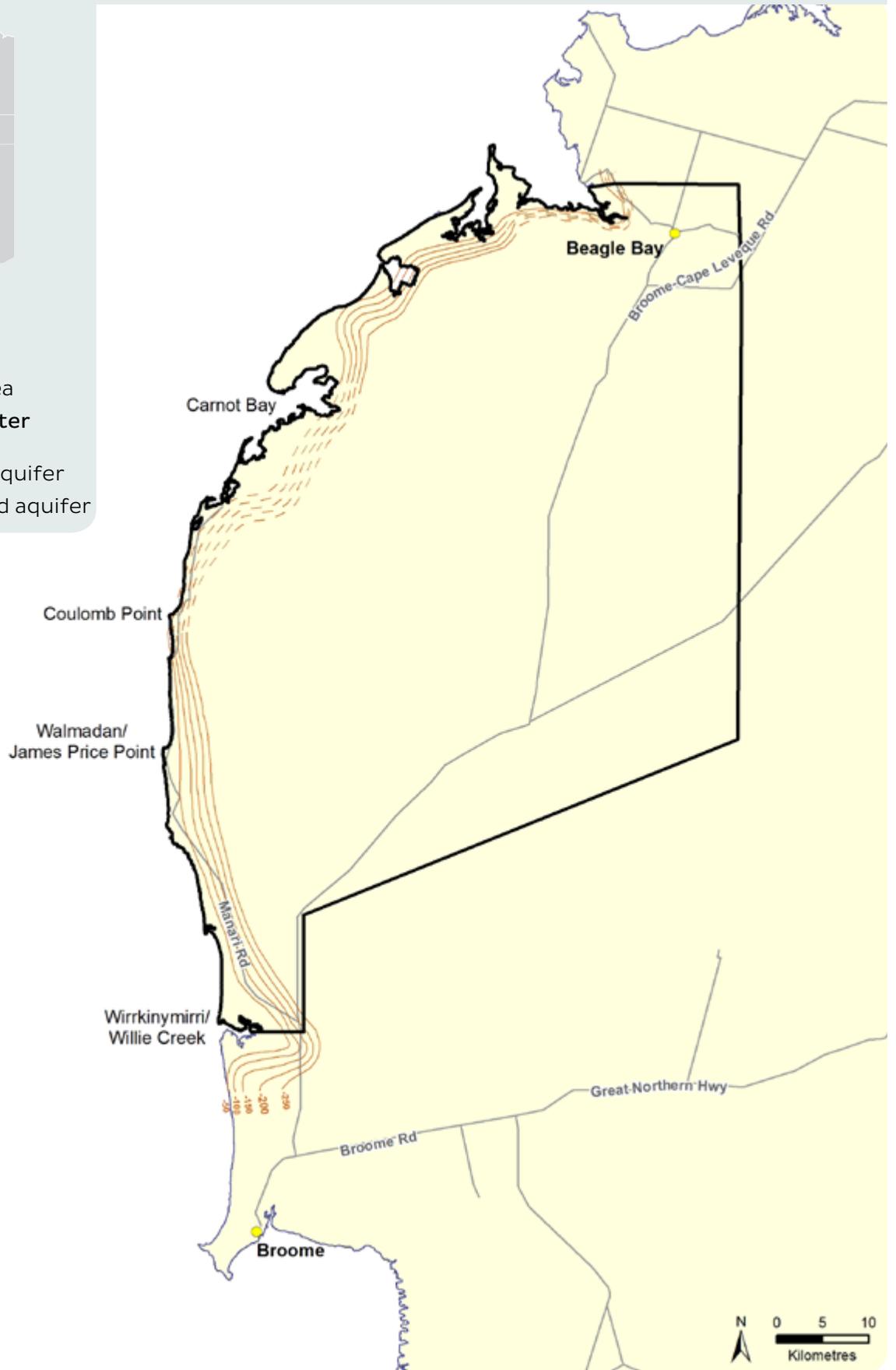
The contours on the map show the shallowest elevation where fresh groundwater and seawater are mixing. The dashed lines show where the Broome Sandstone is either very thin or not present at all. In these areas, at the scale of our mapping, we first detected seawater in the confined aquifer underneath the Broome Sandstone aquifer.

# Depth to seawater map for the Dampier Peninsula study area



## Legend

- Project area
- Depth to seawater (mAHD)
  - Confined aquifer
  - Unconfined aquifer





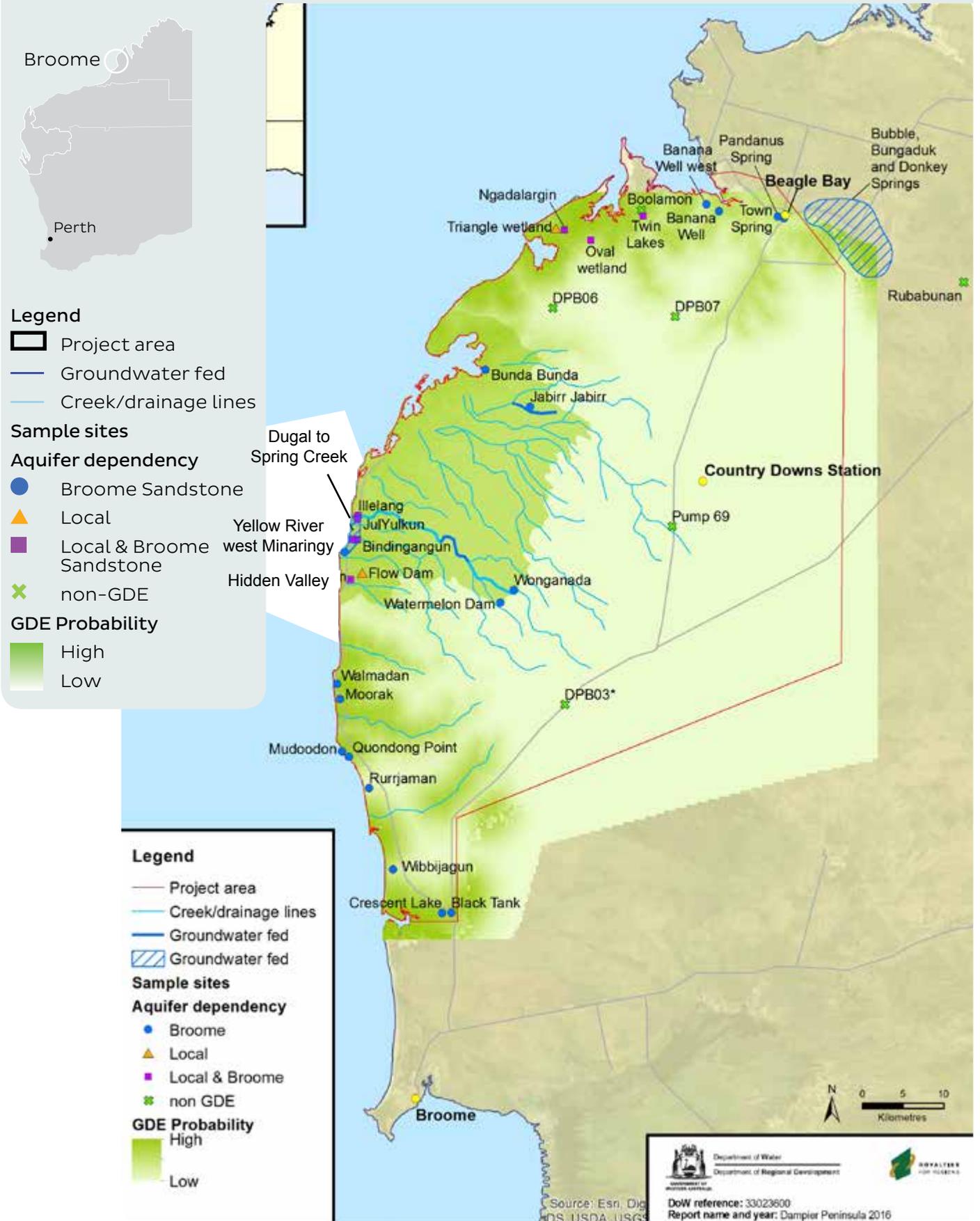
## Groundwater-dependent ecosystems

The Department of Water studied five types of groundwater-dependent ecosystems across the Dampier Peninsula including wetlands, creeks, springs, vegetation in constant contact with shallow groundwater, and monsoon vine thickets. We then identified their likely aquifer dependency, e.g. Broome Sandstone, local aquifer, combination of Broome Sandstone and local aquifer or non-groundwater dependant ecosystems.

We combined this information with vegetation species distribution data, ecosystem mapping, depth to groundwater, vegetation density data and distance from creek lines, to estimate where groundwater-dependent ecosystems are most likely situated (the green areas in the map). We had help from local people in locating and studying sites within these ecosystems and this research will assist in protecting these important habitats.



# Groundwater-dependent ecosystems probability map for the Dampier Peninsula study area



## How we use this data for management

Licensing and allocation planning are the main tools the Department of Water uses to manage water resources. The data from the project provides us with an up to date understanding of water resources and the values it supports.

We currently have a groundwater allocation plan for Broome but not the broader Dampier Peninsula. We can still manage water through licences even when there is no allocation plan, but with the new data we will start to develop a combined groundwater allocation plan for Broome and the Dampier Peninsula over the next two years.

The allocation limit for the Canning-Broome resource in the Canning-Pender subarea, of which the Dampier Peninsula is a part, is 50 GL/year. Our recharge calculations, updated through the study, confirm that this is a good estimate of the volume of water that can be sustainably abstracted from the Canning-Pender subarea each year.

The amount of water available at any given site will however be constrained by the local impact of groundwater abstraction on movement of the seawater interface and groundwater-dependent ecosystems. Specifically, proponents will need to consider the impact of their proposal on:

- movement of the seawater interface, up-coning of saline water, and water level drawdown in coastal areas
- artesian pressure, and groundwater-dependent ecosystems, where the confining layer is present.

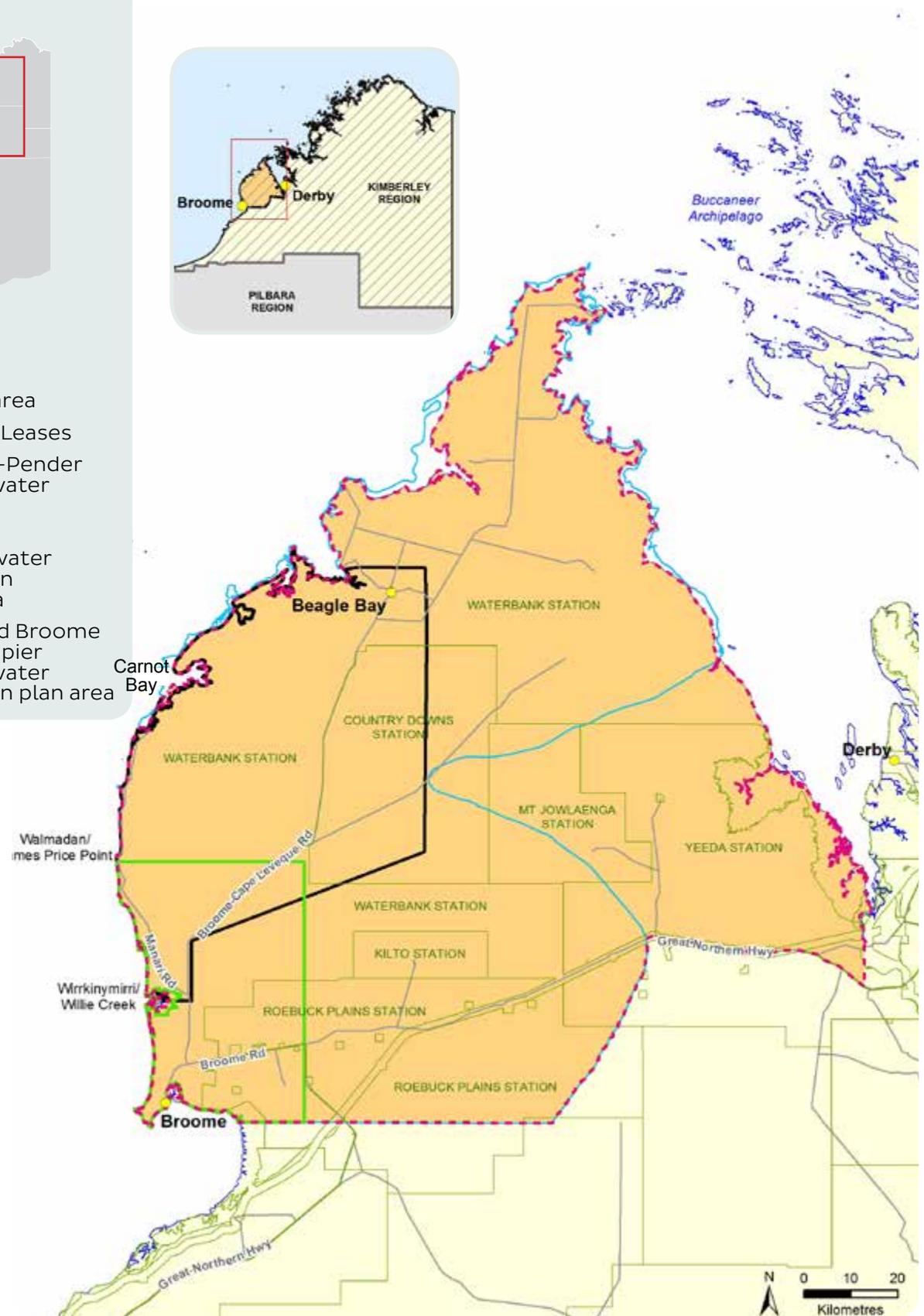
The department will use the new data to assess new applications for water licences, and to develop appropriate monitoring and management regimes. Proponents can access information from the study by contacting our Kununurra office on 9166 4100.



# Current Broome groundwater allocation plan area with proposed combined Broome and the Dampier Peninsula groundwater allocation plan area



- Legend**
- Project area
  - Pastoral Leases
  - Canning-Pender groundwater subarea
  - Broome Groundwater allocation plan area
  - Proposed Broome and Dampier groundwater allocation plan area



All information used to compile the water opportunities map is available from the Water Information Reporting portal on the Department of Water's website at [www.wir.water.wa.gov.au](http://www.wir.water.wa.gov.au). Spatial datasets can be accessed by emailing: [spatial.data@water.wa.gov.au](mailto:spatial.data@water.wa.gov.au)

The methods used to product the water opportunities map is described in more detail in:

Searle, J, Degens, B, 2017, *Shallow aquifer hydrogeology of the Dampier Peninsula – Royalties for Regions groundwater investigation*, Hydrogeological record series, report no. HG65 [In prep], Department of Water, Government of Western Australia, Perth

Loomes R 2017, *Groundwater-dependent ecosystems of the Dampier Peninsula – Royalties for Regions groundwater investigation*, Environmental Water Report series report no. 29, Department of Water, Government of Western Australia, Perth.

## Further information

Water availability from the Kimberley is available online through the department's water register at [www.water.wa.gov.au](http://www.water.wa.gov.au). The water register is a web-based application that allows you to search, view and print information about water availability and licenses, free of charge.

For further information contact our North-West regional office.



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### Department of Water

#### North-West regional office

27 Victoria Highway  
Kununurra Western Australia 6743  
Phone: +61 9166 4100  
Email: [kununurra@water.wa.gov.au](mailto:kununurra@water.wa.gov.au)

#### Head office

168 St Georges Terrace  
PERTH Western Australia 6000  
PO Box K822 PERTH WA 6842  
Phone: +61 6364 7600  
Fax: +61 6364 7601

[www.water.wa.gov.au](http://www.water.wa.gov.au)

National Relay Service: 13 36 77  
@ Government of  
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