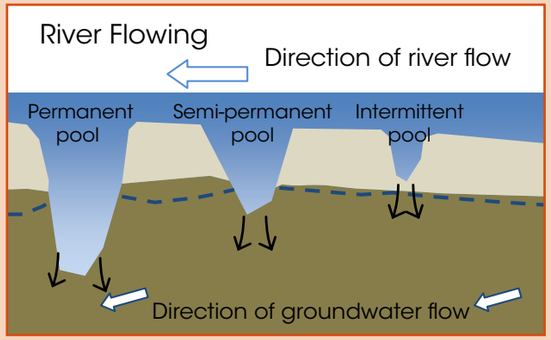
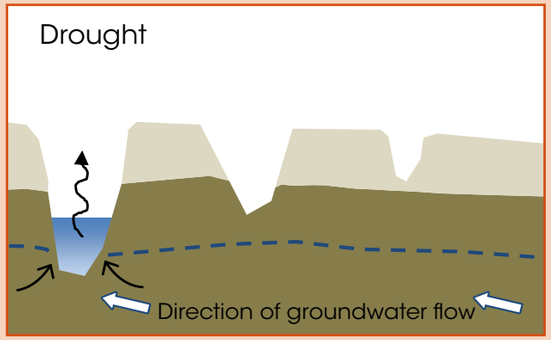
How have we used the information?

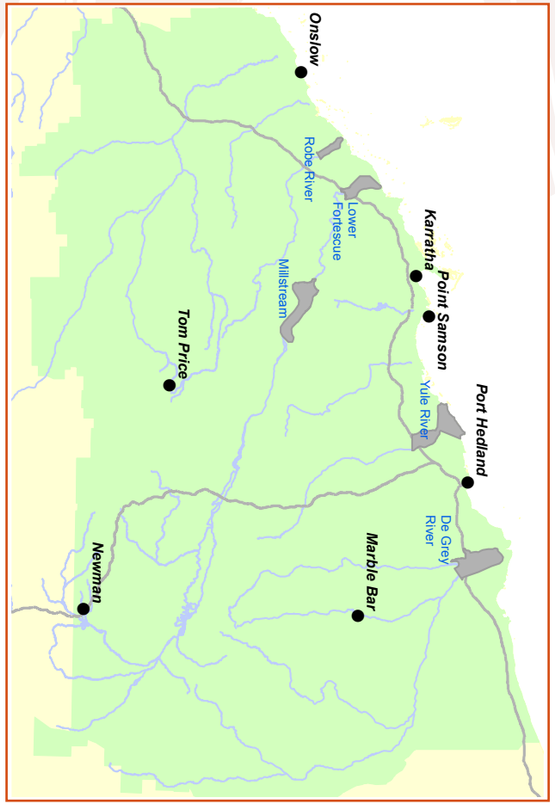
All information and mapping was used to describe the ecological values of the study areas and to develop conceptual models of how groundwater supports river ecosystems.

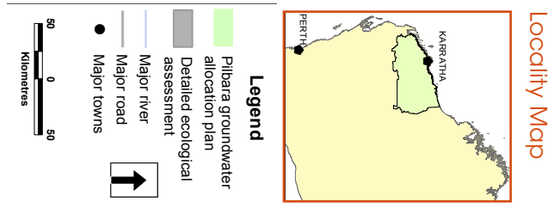




During periods of river flow groundwater is recharged, as shown in the figure above. As the river dries pools become isolated and gradually dry until only permanent pools remain, fed by groundwater inflow. Permanent pools act as drought refuges for aquatic flora and fauna allowing species to recolonise the rivers once flows return.

Pilbara Ecological Map





Locality Map

Want to know more?

Further information can be found at www.water.wa.gov.au. Select > Water regions > Pilbara > relevant links publications and click on 'to view entire listing please click here' for the following reports:

- *Lower Robe River ecological values and issues*
- *Yule River ecological values and issues*
- *Lower Fortescue River ecological values and issues*
- *Determining water level ranges for Pilbara riparian species*
- *Groundwater ecosystems for Millstream: ecological values and issues*
- *Lower De Grey River ecological values and issues.*

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Government of **Western Australia**
Department of **Water**

Managing groundwater-dependent ecosystems of the Pilbara

Looking after all our water needs

April 2011

The Department of Water manages the amount of water taken from rivers and groundwater through water allocation plans, which guide water licensing. To meet increasing demands for water from the growing Pilbara mining industry, we are developing a groundwater allocation plan for the Pilbara region.

In 2007, we implemented a suite of projects in the Pilbara, partly funded by the Australian Government's *Water for the Future* program.

The ecological projects focused on aquifers that were current or potential water supplies for coastal ports and towns where water demand was increasing. These aquifers also often supported groundwater-dependent ecosystems (GDE). Our work included investigations to identify GDE and understand how they were connected to groundwater.

We are now using this scientific data and information from stakeholder and community consultations on economic, environmental, social and cultural water issues to develop the groundwater allocation plan. The plan will be released for public comment in 2012.

A permanent pool on the Robe River

Which resources were studied?

Numerous river systems are associated with the alluvial aquifers of the Pilbara coastal plains. The map on the back panel shows the rivers at which we investigated GDE:

- Lower De Grey
- Lower Yule
- Lower Robe
- Lower Fortescue

and at the Millstream aquifer on the Fortescue River.

What did we do?

Ecological work and hydrogeological investigations were carried out across the target resources. The following ecological work was in partnership with the University of Western Australia, Murdoch University and the Department of Environment and Conservation.

Mapping. We used remote sensing, aerial photography and groundwater data from bores and site visits to build geographical information system layers to show:

- river pool location and degree of permanence (permanent, semi-permanent or intermittent)
- distribution and extent of riparian (riverine) vegetation
- depth to groundwater (how deep the watertable is below the ground surface).

- Fauna studies. We used existing information and some extra field surveys to find where aquatic fauna occur. Our studies:
  - looked at fish, aquatic insects and water quality of pools on the Robe River using a 17-year data set
  - compared fish of the Lower Fortescue and Lower Yule rivers to regional data sets
  - compared aquatic insects of the Lower Fortescue, Lower Yule and Lower De Grey rivers with water quality and habitat characteristics.
- Vegetation studies. We worked out where vegetation was getting its water from and how much it was using by:
  - conducting surveys of riparian vegetation to confirm species identity and location
  - calculating the water level range of key riparian species to better understand vegetation tolerances to water level changes
  - measuring tree water use on the Yule River and at Millstream.

What did we find?

The studies produced several important outcomes.

- Pool mapping. More than 4 000 river pools occur across the Pilbara region including 251 permanent pools, 654 semi-permanent pools and more than 3 000 temporary or intermittent pools.
- Fauna studies
  - Deep, permanent pools support more species of fish.
  - Pools closer to the ocean support marine and estuarine as well as freshwater species.
  - Two possible new fish species were found in the Lower Fortescue (only 33 known species in the Pilbara).
  - Aquatic insects are adapted to variable water regimes as most have a flying life-stage and can move between habitats.
  - Shallower pools show greater fluctuations in water quality.
  - Large floods can influence pool structure and habitat and affect fauna distribution.
- Vegetation studies
  - The estimated total annual tree water use across Millstream is between 1.8 and 3.1 GL/yr.
  - Water level ranges for 16 Pilbara riparian species show that riparian vegetation occurs where watertables are less than 10 m below the ground surface across our 23 study sites.
  - We developed a rule of thumb method to determine susceptibility of species to changed water regimes.

Surveying riparian vegetation on the Yule River