

Gnangara Mound

Students will learn about Gnangara Mound, one of the precious water sources that the Waugal created and WA's largest groundwater system.

Subject area:

Humanities and Social Sciences

Year level:

Year 7 - 10

Learning objectives:

- Analyse and interpret a university research paper about Gnangara catchment.
- Draw evidence-based conclusions from research of a topic and apply to a detailed research report.
- Create interpretive signage for visitors to a location.

Curriculum links

<i>Geography</i>	ACHGK037
<i>Geography</i>	ACHGK040
<i>Place and liveability</i>	ACHGK045
<i>History</i>	ACDSEH148
<i>Questioning and researching</i>	WAHASS64
<i>Evaluating</i>	WAHASS75

Cross curricular priorities - Aboriginal and Torres Strait Islander Histories and Cultures

OI.2	Aboriginal and Torres Strait Islander communities maintain a special connection to and responsibility for Country/Place.
OI.3	Aboriginal and Torres Strait Islander Peoples have holistic belief systems and are spiritually and intellectually connected to the land, sea, sky and waterways.
OI.4	Aboriginal and Torres Strait Islander societies have many Language Groups.
OI.5	Aboriginal and Torres Strait Islander Peoples' ways of life are uniquely expressed through ways of being, knowing, thinking and doing.

General capabilities



Literacy



Critical and creative thinking



Intercultural understanding

> Activity 1

Gnangara catchment – Lifeblood for Perth

Students will recall the main elements to the [Walk with the Waugal Gnangara groundwater system](#) video, then analyse an extract from [Living water: Groundwater and wetlands in Gnangara, Noongar boodjar](#), research paper conducted by respected UWA researcher and Noongar elder, [Dr Len Collard, Pierre Horwitz and Sandra Wooltorton](#).

Time required:

1 hour

Resources required:

- A screen (iPad, Laptop, TV)
- [Living water: Groundwater and wetlands in Gnangara, Noongar boodjar](#)

Preparation:

1. Print [Living water: Groundwater and wetlands in Gnangara, Noongar boodjar](#).
2. Ensure students have previously viewed [Walk with the Waugal Gnangara groundwater system](#) video and completed the [Gnangara comprehension sheet](#).

Steps:

1. Discuss whether the students were aware of the Gnangara groundwater system before viewing the [Walk with the Waugal](#) video? If students live within the catchment, ask the students what bodies of water they are familiar with which make up the network of waterways?
2. As a class, recall the main points of the Gnangara groundwater system and record this on the board or in their student workbooks.
3. Allow time for students to summarise the video from their own point-of-view, highlighting the elements that resonated with them.
4. Ask students to analyse the extract from [Living water: Groundwater and wetlands in Gnangara, Noongar boodjar](#), research paper conducted by respected UWA researcher and Noongar elder, Dr Len Collard, Pierre Horwitz and Sandra Wooltorton. Students will then answer the questions in the activity page to demonstrate their understanding.



> Extension Activity 1

Gnangara Kaartdijin

Students will study a map of the Gnangara groundwater catchment, researching one of the many lakes within the catchment to create a detailed research report.

Time required:

2 hours

Resources required:

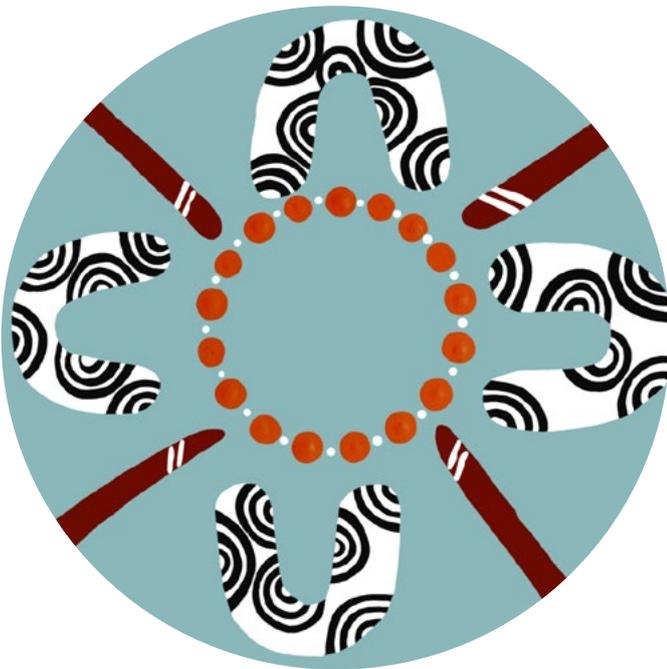
- iPad or laptop per student

Preparation:

1. Print [Activity page – Gnangara catchment map](#) for students to refer to.
2. Completed [Living water: Groundwater and wetlands in Gnangara, Noongar boodjar](#) activity page.

Steps:

1. Review content covered in previous lesson and completed [Living water: Groundwater and wetlands in Gnangara, Noongar boodjar](#) activity page.
2. The Gnangara groundwater system comprises of a network of above and below ground waterways. As a class, review the [Activity page – Gnangara catchment map](#).
3. Identify familiar places on the map and activities they may enjoy doing when they visit the locations.
4. Allocate bodies of water within the Gnangara catchment to pairs of students in the class. Students will work to create a report on their body of water.
5. Report should include:
 - a. Name of body of water
 - b. Location of body of water
 - c. Size
 - d. Type of body of water
 - e. Explanation of how the Noongar people believe the body of water was created
 - f. The plants and animals within this body of water
 - g. Impacts on this body of water from community
 - h. Industry surrounding this body of water and possible impacts to the waterway



Kaartdijin Signs

Students will apply their research and learnings about a body of water within the Gngangara catchment to create an interpretive sign for visitors to the area.

Time required:

1 hour

Resources required:

- iPad or laptop (1 per student)
- Optional poster paper for interpretive sign
- Markers and colouring pencils

Preparation:

1. Completed research report linking to [Activity page - Gngangara catchment map](#).
2. Ensure students have access to [Canva](#).

Steps:

1. Students reflect on the information from the previous lessons to design an interpretive sign for tourists visiting their body of water in the Gngangara catchment.
2. The sign must include:
 - a. Information about the body of water they have researched, both historical and present day.
 - b. How the body of water links to the Gngangara catchment.
 - c. The story of how the body of water was created by the Waugal.
 - d. Actions to prevent water scarcity in the catchment.
3. Students may choose to use a digital platform, such as [Canva](#) to produce their sign, or they may prefer to create a hard copy using poster to display.

Living water: Groundwater and wetlands in Gngangara, Noongar boodjar

The Gngangara groundwater system is an interconnected system of underground water catchments. This system is a vital element to the Nyoongar people as they have a deep connection to the groundwater ecosystems, believing there is an interdependence and relationship between place and knowledge, requiring a respect and care for water as the interconnected waterways offer a healing of spirit and an opportunity for sharing of knowledge. In seeing water as an extension of their culture, the protection of this system is a protection of their mind, body and spirit.

The Gngangara groundwater system is located on the Swan Coastal Plain, a bioregion in southwestern Australia that lies to the west of a significant linear escarpment known as the Darling Fault. The Swan Coastal Plain is largely covered by sandy windblown sediments which may be up to 110 m thick. These sands have been deposited relatively recently, over the last million years or so. Their high permeability means that rainfall on the Swan Coastal Plain tends to infiltrate locally, and this has two important consequences. One is that the plain lacks surface drainage like creeks; rather, most of the water goes immediately underground, and the only fresh surface water in the region is in wetlands in the depressions between the longitudinal dunes. So these wetlands are surface expressions of a shallow water table, and for these reasons the groundwater system is referred to as an 'unconfined aquifer', and the Swan Coastal Plain is regarded as a vast wetland bioregion, where ecosystems have a so-called 'dependence' on groundwater. The second consequence is graphically demonstrated by the elevated dunes at the highest points of the Gngangara system, where the unconfined water table is mounded, and from here it flows radially towards the coast, rivers and estuaries which are the boundaries of the system.

Beneath the sandy sediments of the Swan Coastal Plain lie a series of vertically interconnected sedimentary layers, kilometres thick, resulting from sediments filling up the Perth Basin over around the last one hundred million years. Each sedimentary layer is water-filled. So, for the Gngangara system, rainfall recharges the groundwater mound in the top unconfined sands, each subsequent geological layer is to a certain degree, and in certain places, recharged by the one above it. In this sense it is one hydrological unit even though it is composed of a vertical sequence of interconnected but geologically distinct aquifers.

The people of Perth have overused the Gngangara Mound to the extent that it is in a serious state of deficit, and the system as 'out of balance', where more water is being taken than is currently being replaced. There is a suggestion that overdrawing from deeper aquifers has contributed to this by creating a negative pressure and drawing down water from layers on top. Managing the overconsumption of this resource in the face of climate change, with its projected rainfall declines, is a considerable challenge.

The Gngangara system is the main source of water, the lifeblood to the majority of the Perth population (over 2 million people) with more than half of the city situated on top of the Gngangara groundwater system. For the catchment to survive continual population growth, there needs to be an increase in collaborative responsibility for the protection of the interconnected waterways and drainage areas.

Wooltorton, Sandra; Collard, Len; Horwitz, Pierre (2019): Living water: Groundwater and wetlands in Gngangara, Noongar boodjar. Monash University. Journal contribution. <https://doi.org/10.26180/5cc683f98a6b3>



> Activity 1: Gnangara catchment - Lifeblood for Perth

1. The Gnangara groundwater system sits on the Swan coastal plains of Perth made of 110km thick wind-blown sediment. What impact does this have on the drainage network and flow of water?

2. The Gnangara drainage system is made up of three underground aquifers. What are the names of these aquifers and what size are they?

3. The Gnangara groundwater system is 'out of balance'. Explain the reasons for this and what actions and innovations Water Corporation has put in place to protect the Gnangara groundwater system to be more climate resilient.

4. Aboriginal people have a strong understanding of how the Gnangara groundwater system was created. Explain this in your own words.

Gngangara catchment map

