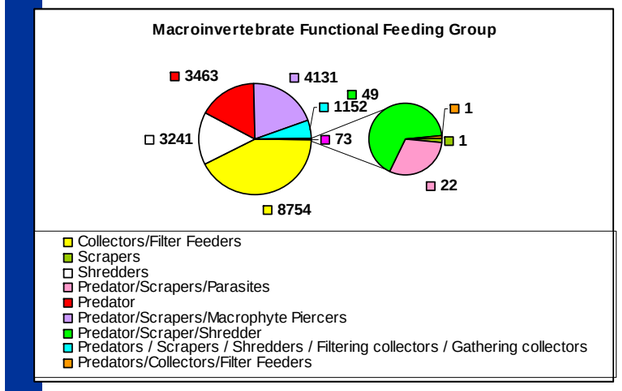
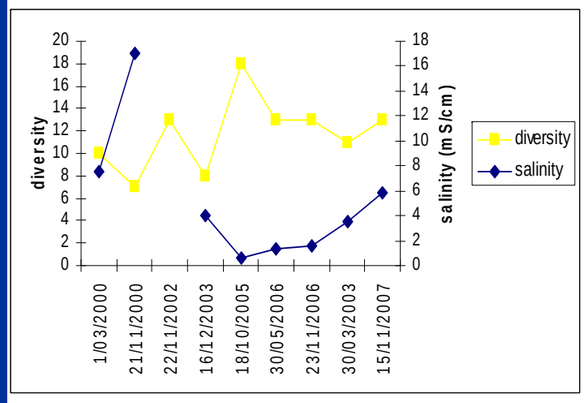
Mill's Lake

South Coast Wetland Monitoring Project **June 2008**



Macroinvertebrate diversity was highest when salinities were lowest which coincides with the trend that higher diversities relate to low salinities as illustrated when salinity is graphed against macroinvertebrate diversity at Mill's Lake.



Macroinvertebrate diversity v's Wetland Salinity

Conclusion

Mill's Lake ranged between fresh and saline which is influenced by both groundwater and surface water. Groundwater monitoring conducted in 1997 reported fresh perched groundwater discharges into the eastern margin of the lake and freshens lake waters while the lake recharges the groundwater in the western margin. Total nutrients were high on most occasions which triggered a number of algae blooms. The main issues to consider is the current wetland/ groundwater relationship, groundwater salinities and rate of rise and changing effects on ecology.

Some knowledge gaps were identified during the investigation, monitoring and data analysis for this wetland which should be addressed to improve understanding of the water quality and biodiversity and to detect changes over time. The monitoring period was relatively short and some effects of previous and current land use change and management may not yet be evident. Macroinvertebrates would need to be identified to family or species level to allow more detailed analysis of ecological condition and relationship to other wetland characteristics. The hydrology of the wetland and its catchment is not fully understood or monitored, particularly the interaction between groundwater and surface water. A future monitoring program should be developed to address these issues.

Acknowledgements

The Department of Water would like to sincerely thank and acknowledge the following people for their assistance and contribution toward the South Coast Wetland Monitoring Program and production of this report.

- Tim Foster for his support of the project and allowing access to the lake through the property.
- Ruhi Ferdowsian (Department of Agriculture and Food, Albany) for providing knowledge of the hydrogeology associated with Mill's Lake.
- Ania Lorenz, Sherrie Randall, Kevin Hopkinson, and Albany Department of Water team who conducted the monitoring.
- Kevin Hopkinson, Naomi Arrowsmith, Andrew Maughan and others for their support and editing assistance.
- Sherrie Randall and Tracy Calvert for data analysis and report compilation.

Mill's Lake after the dry winter of 2007

For further information please contact Tracy Calvert at the Department of Water Albany (08) 9842 5760.

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This report card summarises the Department of Water's current state of knowledge of the physical, chemical and biological characteristics of Mill's Lake based on the knowledge gained from investigation and monitoring conducted by the Department of Water through the South Coast Wetland Monitoring Program.

Accompanying this document are appendices providing more detailed information about the wetland monitoring program, terminology of wetland classification, parameters monitored, methodology and the ANZECC&ARMCANZ guidelines used in this report.

Funding for this program has been provided through the South Coast Natural Resource Management Inc. - supported by the Australian Government and the Government of Western Australia.

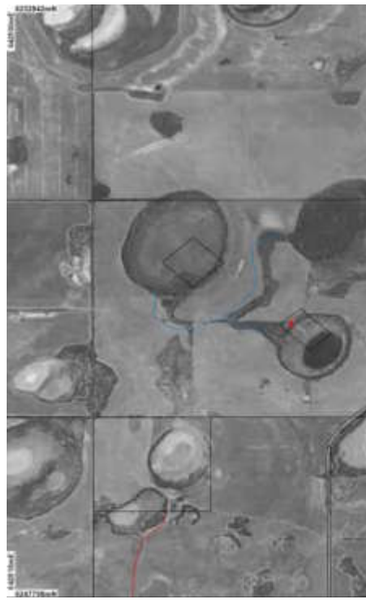
About Mill's Lake

Mill's Lake is located approximately 24km north east of Ongerup, north of the Stirling Range in Western Australia, within the Mill's Lake catchment. The wetland is at approximately 255m AHD (Australian Height Datum) and the area receives an annual average rainfall of 370mm.

	GPS Location Coordinates		
Wetland Suite	**Easting**	**Northing**	**MGA Zone**
No Suite listed	644512	6250104	50

Mill's Lake is located on privately owned land within a catchment of approximately 238km^2. The Lake lies within an unfenced narrow wetland vegetation buffer zone which is open to stock access.

Vegetation in the upper storey consists of *Eucalyptus occidentalis* (Yate) *Melaleuca cuticularis* (Saltwater paperbark) in the mid storey and some grasses encroaching where the lake has dried. There are a number of dead and stressed trees within the lake.



Mill's Lake

Vegetation surrounding Mill's Lake

Approximately 90% of the catchment has been cleared of native vegetation for cropping.

Water quality monitoring commenced in November 1999 which included physical, chemical and biological parameters as outlined in the appendices.

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Mill's Lake

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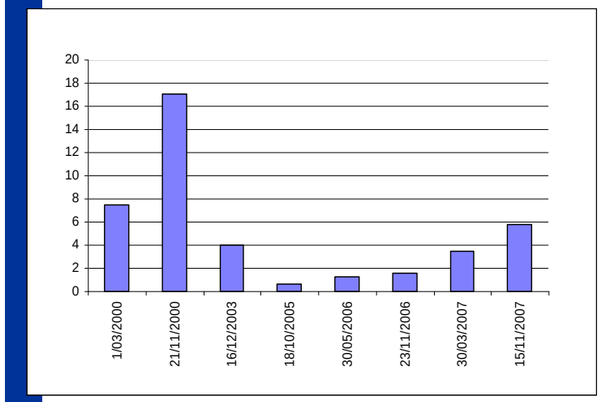
Wetland Classification

Wetland type	*Water Salinity*	*Consistency of Salinity*	*Size (Metres)*	*Shape*
Playa	Fresh-Subhaline-Hyposaline	Poikilohaline	Mesoscale 445-600m	Ovoid

Classification of Mill's Lake has been evaluated on the basis of guidelines developed by V & C Semeniuk Research Group. For further explanation please refer to the appendices.

Salinity

Salinity over the sample period ranged between fresh (0.65mS/cm) and saline (17.0mS/cm). Fluctuations in salinities relate to seasonal fluctuations in rainfall, evaporation and hence water level variation in lake, as well as interaction with the regional groundwater system.



Salinity (mS/cm) over sample period

Surface runoff flows from the east toward Mill's Lake as well as through a neighbouring swamp before entering Mill's Lake which was reported to be fresh in 1997.

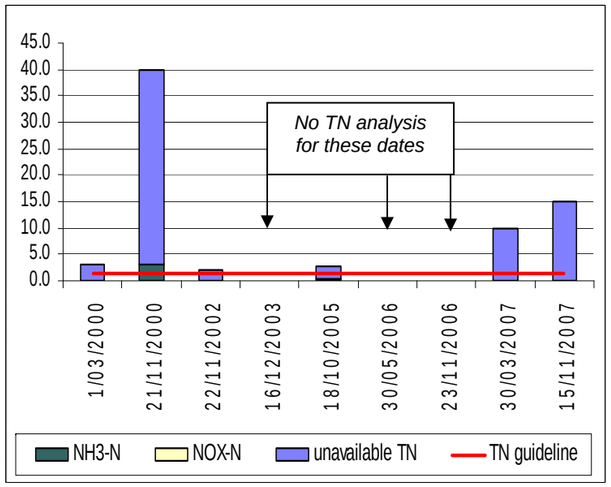
Mill's Lake is one of many lakes within the catchment which was formed in old drainage valleys in deep tertiary sediments. The lake was once fresh, perched above the saline regional groundwater and seasonally inundated. It was reported in 1997 that fresh groundwater (mounded above the deeper saline groundwater) to the east discharges into and freshens the lake water while on the western side lake water recharges the groundwater.

From 1974 Mill's Lake and the neighbouring Windmill Lake were used for drinking water supply for Ongerup and Jerramungup and a Water reserve has been gazetted over a portion of the lake. Due to pumping and reduction of water levels in the lake the groundwater began to rise and saline water collected in the lake basin. In 2001 it was decided due to rising groundwater levels the lake was no longer a suitable source of potable water.

Nutrients

Total Nitrogen (TN) concentrations ranged between 2.1-40.0mg/L which exceeded the guidelines developed for ecosystem protection for southwest Australian wetlands for slightly disturbed systems of 1.5mg/L on all sample occasions.

Dissolved inorganic nitrogen fractions of ammonia (NH_3-N) ranged between 0.01-0.16mg/L which exceeded the recommended guideline value of 0.04mg/L on three of the eight sample occasions. Total oxidised nitrogen (NOx-N) ranged between 0.01-3.2mg/L which exceeded the recommended guideline value of 0.1mg/L on three of the eight sample occasions.



Nitrogen fractions in mg/L over the sample period with TN guideline illustrated

Total Phosphorus (TP) concentration ranged between 0.02-1.1mg/L which exceeded the water quality guidelines of 0.06mg/L on seven of the eight sample occasions.

Soluble Reactive Phosphorus (SRP) (form of phosphorus available for uptake by plants) ranged between 0.005-0.39mg/L which exceeded the recommended water quality guideline value of 0.03mg/L on five of the eight sample occasions.

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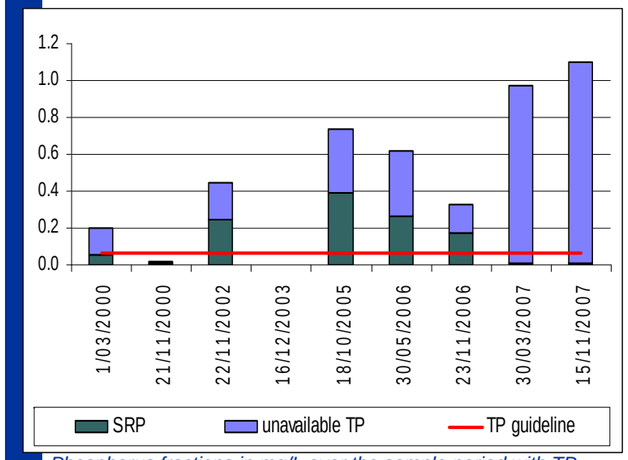
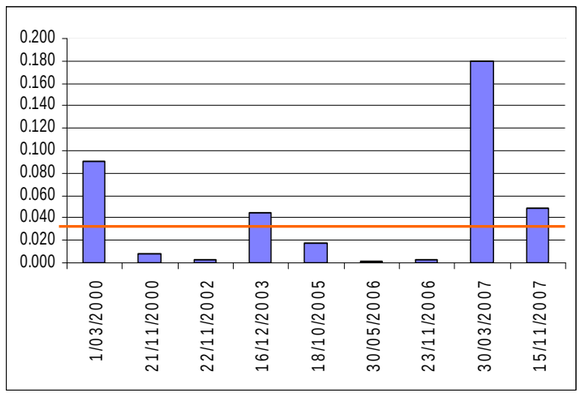


Phosphorus fractions in mg/L over the sample period with TP guideline illustrated

Nutrients may enter Mill's Lake through surface runoff and sub surface flow from surrounding agricultural lands, through stock access and via groundwater.

Chlorophyll *a*

Chlorophyll *a* concentrations over the sample period ranged from 0.003 to 0.18 mg/L. Chlorophyll *a* exceeded the water quality guideline of 0.03mg/L on four of the nine sampling occasions. A higher concentration of chlorophyll *a* is indicative of high nutrient content providing adequate food source for algal growth.



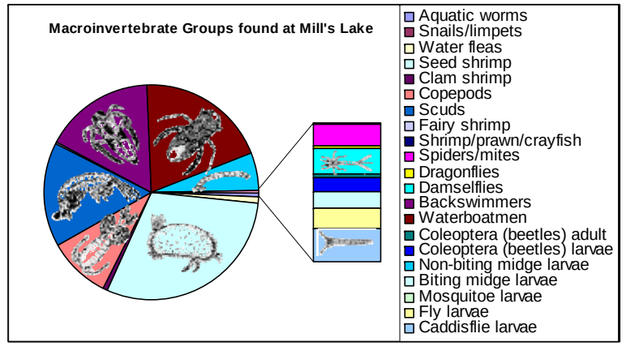
Chlorophyll a (mg/L) over sample period in comparison to recommended guideline value of 0.03mg/L.

Macroinvertebrates

Twenty one groups of macroinvertebrates were found at Mill's Lake during the monitoring period of which the most abundant included; Ostracoda (seed shrimp), Copepoda (copepods), Amphipoda (scuds), Notonectidae (backswimmers), Corixidae (waterboatmen), Chironomidae (non-biting midge larvae), Oligochaeta (aquatic worms), Cladocera (water fleas), Conchostraca (clam shrimp), and Anostraca (fairy shrimp).

Other groups of less abundance were found including; Gastropoda (snails/limpets), Decopoda (shrimp/prawn/crayfish), Acarina (spiders/mites), Epiproctophora (dragonflies), Zygoptera (damselflies), Coleoptera (beetles) adult, Coleoptera (beetles) larvae, Ceratopogonidae (biting midge larvae), Culicidae (mosquitoe larvae), Other Diptera (fly larvae) and Trichoptera (caddisflie larvae).

The diversity of macroinvertebrates found over the sample period ranged between seven to eighteen groups with a median of twenty one which rates as average based on the Ribbons of Blue Wetland Habitat Score.



Each group of Macroinvertebrate play a different role in the food chain, some feed on organic material (Shredders), others feed on fine organic particles (Collectors/filter feeders), others graze on algae (Scrapers), some feed on each other (Predators), others are parasitic (Parasites) and some are Macrophyte piercers that feed off living plants and algae fluids. These groups are called Functional Feeding Groups (FFG). Some Macroinvertebrates fit into more than one of these groups, for example the Water Boatman is a Predator, a Scraper and a Macrophyte piercer.

A healthy wetland should have a representative of each functional feeding group. A loss or dominance in a particular group may indicate a change in ecology of the wetland. The composition of these groups at Mill's Lake are displayed in the below graph. This wetland appears to be well composed with fairly even numbers of the principle functional feeding groups.