GELLIBRAND RIVER ESTUARY

An interpreted summary of data

Extract from *Gellibrand River Data Analysis 2007-2012*

CORANGAMITE CMA

EstuaryWatch

View of Point Ronald, Princetown Beach, June 2012

Summary

This is a summary of the key elements of a Corangamite Catchment Management Authority's Gellibrand River data report. It includes analysis of data from the EstuaryWatch database, a 24-hour data logging system, and local rainfall and catchment river flow data.

The Gellibrand River estuary environment includes a range of bird, plant and fish communities that depend on the estuary's dynamic variable nature, e.g. river flow, flooding, variable salinities and salt wedge movement. The summary of estuary data will assist community to improve their understanding and estuary managers to make informed management decisions to protect and restore the estuary's environmental values.

A healthy and functioning estuary system allows a multitude of uses to be enjoyed and sustained. Indigenous communities have a long association with the Gellibrand River estuary. The Gellibrand River has also supported generations of social and economic uses and users, since European settlement in the early 1800s. This includes recreational and commercial fishers, campers, walkers and picnickers, township residents, rural landholders and agriculture, school groups and day trippers. The river also provides drinking water to major population centres of Warrnambool, Cobden, Terang and Camperdown.

In terms of system management the summary identifies river flow as the main factor influencing the Gellibrand River estuary's condition, particularly during summer and autumn. This means management during that period is the most critical. The Corangamite CMA will use this information to inform future management decisions.

Estuary Fact File

Type of Estuary:	Riverine (Wave/Tide dominated)
Location:	143°9'24.3257"E 38°42'23.0748"S
Nearest town:	Princetown
Landscape Zone:	Gellibrand
Catchment Area:	2,346 Ha
Estuary Area:	29.25 Ha
Estuary Length:	13 km
River Length:	120.137 km
Mouth Direction:	West facing
Mouth State:	Intermittently open
Tributary:	La Trobe Creek
Wetland Listing:	Yes, 320 Ha listed as Wetlands of National Importance
Heritage River:	No
Estuary Management Plan:	No – Wetlands plan written in 2005
Description:	Begins south of the township of Gellibrand. The river winds its way through the Otway ranges, a mix of native and plantation forests and cleared agricultural land and exits to the sea at Point Ronald.

EstuaryWatch is a community based estuarine monitoring program, aiming to:

EstuaryWatch

Raise awareness and provide educational opportunities to the community in estuarine environments, and enable communities and stakeholders to better inform decision making on estuarine health.

Since 2007, when the Corangamite CMA set up the EstuaryWatch program, 1,100 data records have been stored on the EstuaryWatch database for the Gellibrand, including 335 profiles from the G2 site on the Old Coach Road bridge.

EstuaryWatch website: www.estuarywatch.com.au

Stratification, dissolved oxygen and marine fish

In a closed estuary, salinity stratification and subsequent available dissolved oxygen (DO) can have severe impacts on saltwater dependent fish species. The generation of anaerobic conditions or environments free of oxygen, occurs predominately in the bottom waters. Habitat preference resigns some fish species to certain salinity levels and confines them to that layer. While other fish species depend on estuarine and freshwater environments and are able to move between the levels to more favourable locations.

Gellibrand River floodplain inundation between EstuaryWatch sites G4 and G5, June 2012.

Unfavourable DO conditions are generally less than 5mg/l and to as low as 0mg/l. The decline in DO levels in the bottom waters of the Gellibrand River estuary begins soon after the estuary mouth closes. The DO is consumed by oxygen dependant organisms and microbial activity and depending on the closure duration may continue until the bottom waters are fully depleted of DO.

This is a natural process and in the Gellibrand River these conditions would have occurred repeatedly prior to European settlement during the centuries. When estuary managers plan an artificial opening fish species and water quality are among the main considerations.

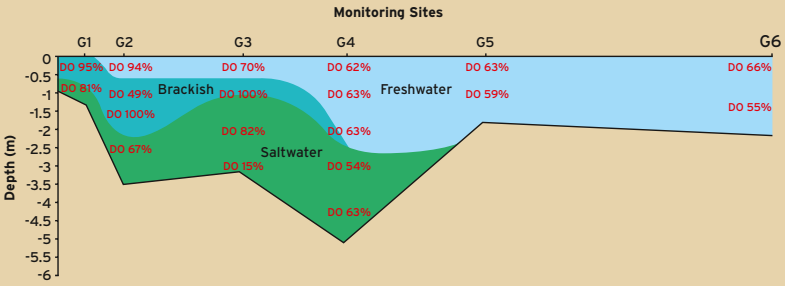
Estuary mouth openings - natural and artificial

When the estuary mouth opens, either artificially or naturally, similar changes occur in water quality. A potential threat is the top, less saline waters, which usually contain moderate levels of dissolved oxygen drain off, leaving generally low dissolved oxygen waters in the estuary. While occurring with natural openings, the duration of closure is generally much less and inflows are higher, usually greater than 300 ML/day (million litres).

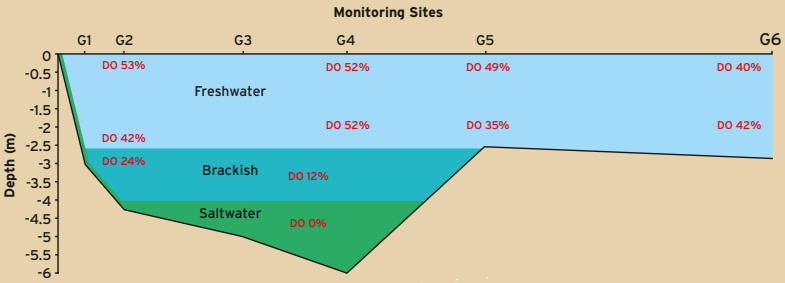
Recovery of oxygen levels depends on the reintroduction of high DO water from river inflows and the return of tidal influence on the estuary. Data analysis and anecdotal evidence indicates the duration of closure has a significant role on the potential impacts of poor water quality, particularly dissolved oxygen levels. A theory the community strongly support.

Longer estuary closures increase the potential for anaerobic conditions in the bottom waters and inundated floodplains.

Longitudinal profile when an estuary is open 20/04/2007



Longitudinal profile during and estuary closure 23/03/2008



Estuary closures

Natural processes such as sea state, longshore drift and wind direction influence estuary mouth closures as well as the downstream movement of sediment derived from catchment sources. But the major factor in estuary closure is low river flows.

All closures identified had flows lower than 150 megalitres per day (ML/day) for two to four weeks prior to closure, and in many instances flows were less than 100 ML/day. When the berm is at 0.9m or higher, and flow is low it appears this is when the estuary is most susceptible to closure.

When the estuary is closed its likely only rainfall producing flow in excess of 300 ML/day will open the estuary mouth. Flow below 300 ML/day may still open the estuary if variables such as sea state and berm height and length allow, but it is more unlikely.

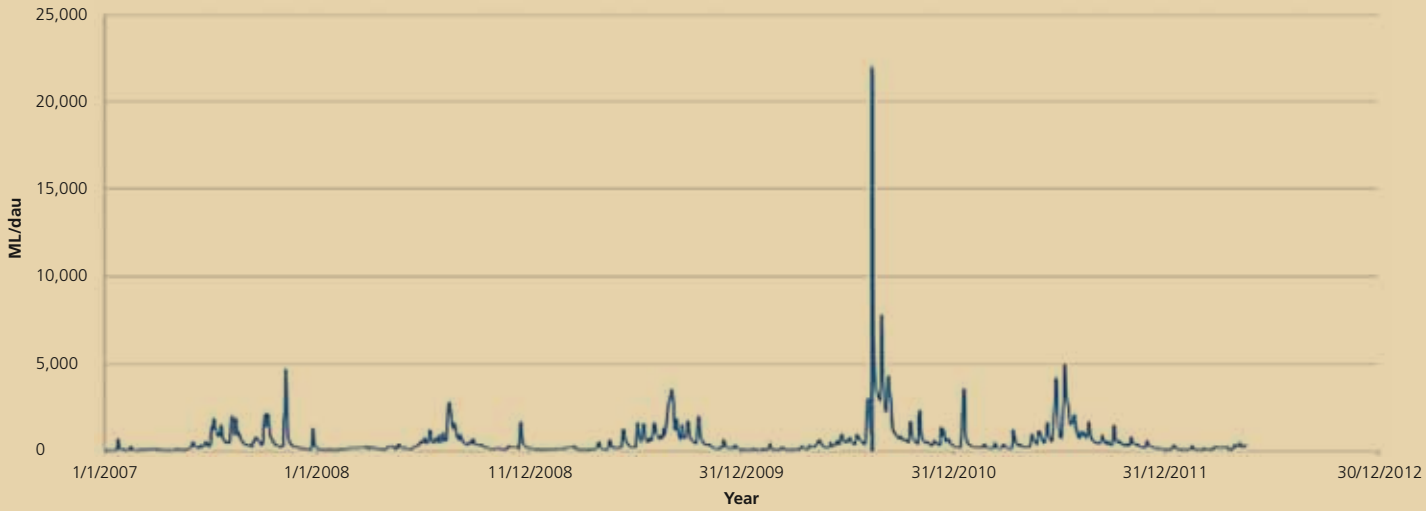
Seasonal flow patterns

Volume, and the seasonal variation of flow, influence estuary health and biota. This also determines the extent seawater penetrates the estuary affecting estuary condition.

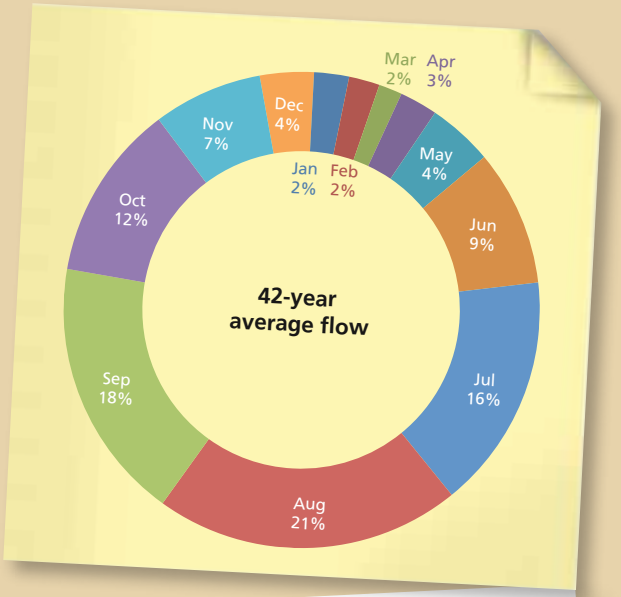
The Gellibrand River's flow is seasonal, and as expected, the highest flows are in winter and spring. On average, summer and autumn flow account for only 20 per cent of the annual flow. Several high-flow events, e.g. the August 2010 event resulted in extensive flooding in the lower catchment.

Summer low-flow periods can result in the estuary mouth closure mainly when flow is less than 150 ML/day for two to four weeks.

The dissolved oxygen levels in the estuary also exhibit seasonal patterns. During winter, the DO is most stable with minimal variation in the top and bottom. The greatest variation between top and bottom is in spring to late autumn. Observations indicate DO has historically dropped as low as 0-5 per cent saturation, usually following the stratification on a salinity gradient.




Gellibrand River estuary mouth, June 2012



Stratification process

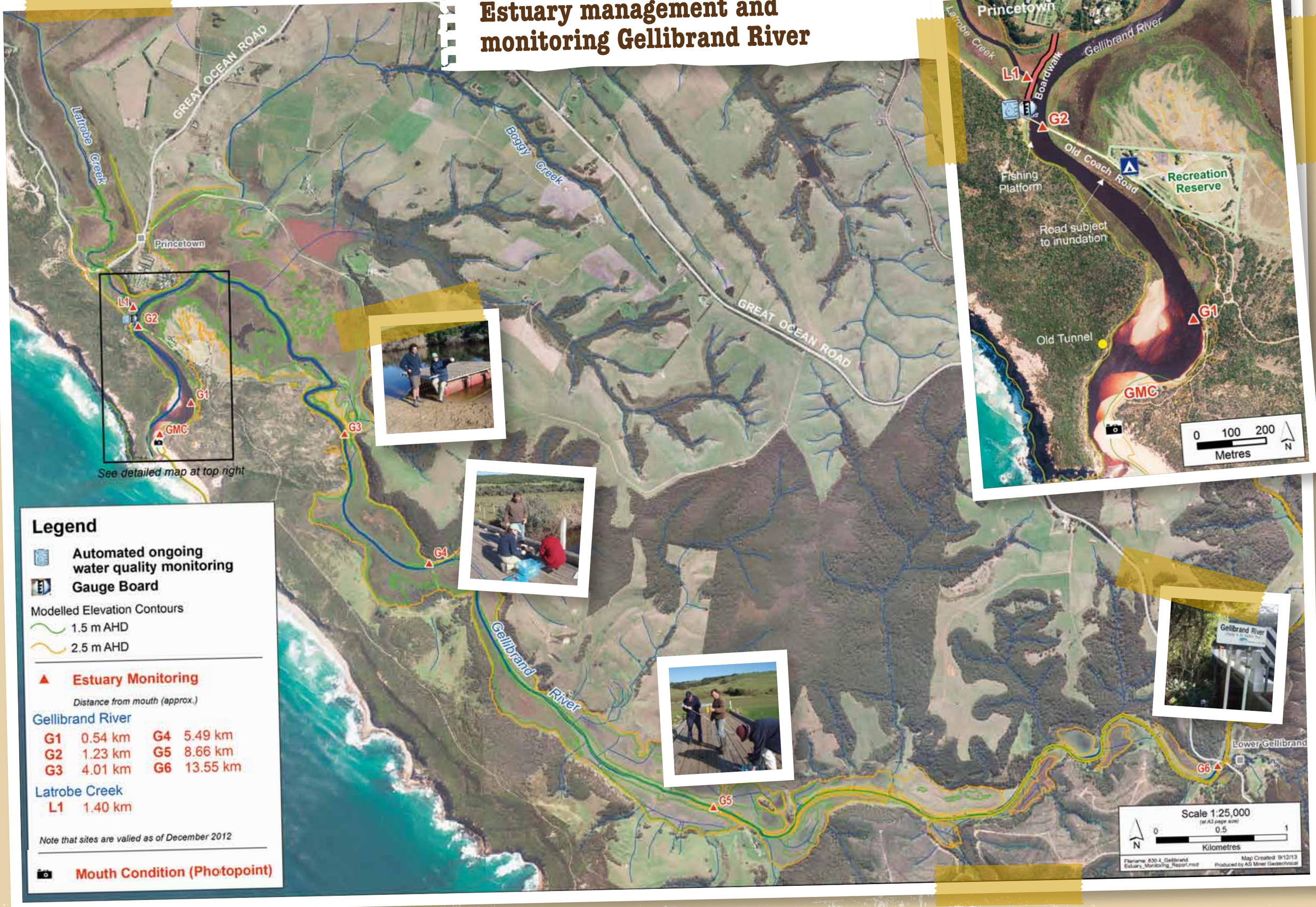
Stratified estuaries are characterised by a distinct increase in salinity with depth, where less dense influent river water overlies the denser sea water with little or no mixing between the layers. This boundary layer, or halocline, marks salinity increase/decrease.

Saltwater or seawater incursion occur during high tide or during storm events, with the volume of seawater and depending on several factors, including river flow, entrance channel width and depth, and tidal range.

Dense seawater sinks below the less dense freshwater and slowly moves to the bottom parts of the estuary. As the tide recedes, the freshwater flows over the seawater trapping it in the deeper parts of the estuary. Some mixing may occur creating a brackish layer. The returning high tide begins the process again and more seawater enters the estuary.

Estuary bathymetry influences the length of time bottom waters remain. The sites G3 and G4 (see internal map), are 4 to 5.5 kilometres upstream of the estuary mouth and the deepest sites monitored. The deep profiles of 5 to 6 metres can develop up to 2 metres of poorly oxygenated bottom waters. High winter flows can push this water downstream and even out to sea with little negative impact, and may be responsible for the data observations of short periods of poor water quality. But during an artificial mouth opening, depending on the river inflows, this water may move downstream without mixing with any well oxygenated inflows, resulting in downstream water being low in oxygen. During low flows the freshwater can flow over the top and the only source of oxygenated water is from tidal marine inflows on the returning tides, provided the estuary mouth remains open.

Estuary management and monitoring Gellibrand River



Gellibrand River floodplain inundation. June 2012

Estuary condition monitoring method

The EstuaryWatch program collects data at eight locations in the Gellibrand River estuary which is entered on the web-based database. The map shows the seven water quality monitoring sites (G1-G6 and L1) and one observational mouth condition assessment.

The water quality data amounts to a profile at 50-centimetre intervals from the surface, including depth, temperature, dissolved oxygen, salinity and electrical conductivity. Turbidity and pH is sampled from the surface and bottom of the water column. This methodology enables vertical water profiles and an assessment of changes in the measured water quality parameters, salinity stratification within the estuary and halocline location.

Water column profiles are also collected when estuary managers are considering artificially opening the estuary mouth using methods and sites consistent with EstuaryWatch. This monitoring is taken pre and post artificial opening.

The 24-hour monitoring station records continuous data and is viewed through web-based systems using SMS to send data to estuary managers. The station on the Gellibrand River is beside G2 and logs estuary water levels in metres surveyed to AHD 0m, electrical conductivity and dissolved oxygen every 15 minutes from a fixed point near the bottom and river surface waters. Rainfall and flow data is collected from a number of weather stations and flow gauges.

Where can you find more information?

Corangamite Catchment Management Authority
www.ccma.vic.gov.au

EstuaryWatch
www.estuarywatch.com.au/CCMA

OzCoasts
www.ozcoasts.gov.au

Corangamite Shire
www.corangamite.vic.gov.au

Parks Victoria
www.parkweb.vic.gov.au

DEPI
www.depi.vic.gov.au

Heytesbury and District Landcare Network
www.heytesburylandcare.org.au

Rainfall
www.bom.gov.au/

River flow
www.vicwaterdata.net

Gellibrand River EstuaryWatch training day, April 2007

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