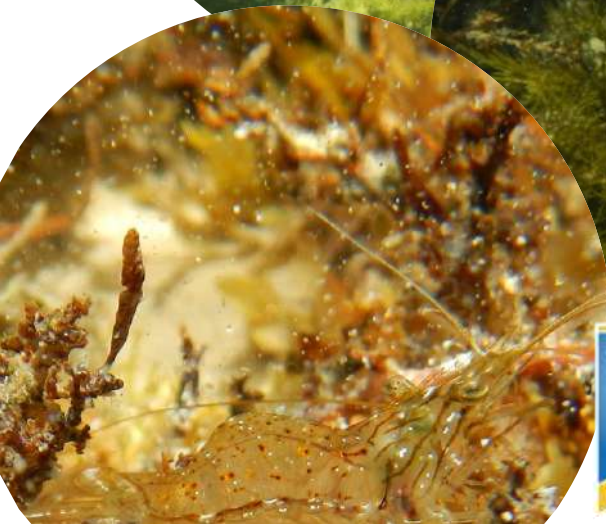
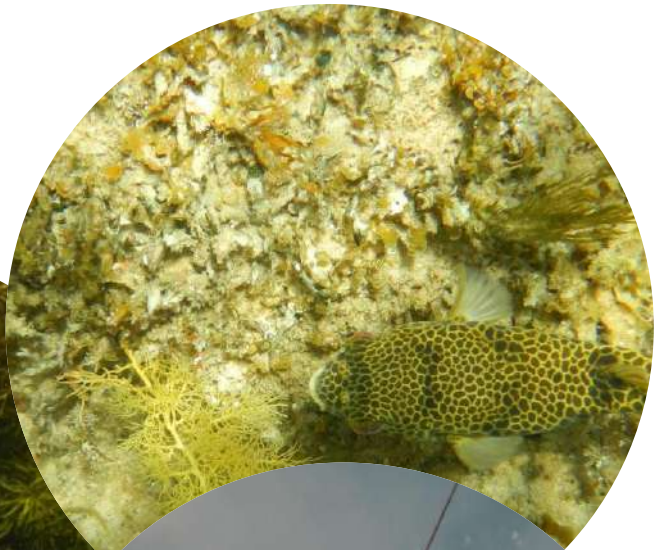




Secchi Disk Monitoring Manual

FRIENDS OF GULF ST VINCENT

*"Fostering a unified community approach
to the protection and wise use
of the Gulf of St Vincent"*



This guide was produced by the **Friends of Gulf St Vincent** with financial assistance from the **Adelaide and Mount Lofty Ranges Natural Resources Management Board**.

The Friends group was formed in 2003 in response to a perceived need for a coordinated approach by the coastal community to the protection and conservation of Gulf St Vincent. The Friends of Gulf St Vincent is a member group of Friends of Parks Inc.

The Friends' objectives are to:

1. To foster a unified community approach to the protection and wise use of Gulf St Vincent
2. To advocate for the
 - conservation of marine and coastal environments
 - protection of key habitats in the Gulf
 - sustainable use of marine resources
3. To promote awareness of issues relating to the health of Gulf St Vincent
4. To provide a means of conveying community concerns to the government

Acknowledgements

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Disclaimer

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Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

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INTRODUCTION

This manual has been prepared for people wanting to take part in the Friends of Gulf St Vincent's Secchi disk project. This community-based project was started to monitor water quality in the Gulf and encourage people to be learn more about how to care for our marine environment.

There has been growing concern, in the past decades, about the deterioration of water quality and the marine environment in Gulf St Vincent. This has led to a number of long-term studies investigating the causes and effects of pollution from metropolitan and rural sources.

It is now understood that wastewater, industrial discharges and stormwater carrying pollutants (particularly nutrients) are a major culprit in the extensive loss of seagrasses (and their associated marine life) off Adelaide and other coastal regions.

Can you see your toes?

If you are wading at the beach and can't see your toes that's a good indication of poor water quality.

Low water clarity or 'turbidity' is a direct and immediate sign that there is a problem. After heavy rain, stormwater runoff is highly discoloured and can reduce visibility, making it unsafe to swim at the beach. Turbid stormwater may also contain chemicals that can cause skin and eye irritations. These risks can lead to some Surf Lifesaving Clubs cancelling events in summer.

While there has been some decrease in pollution from sewage outfalls, this is not enough to stop the damage to the Gulf.

This project will seek to recruit people, with access to a suitable, safe sampling point, who would like to monitor water clarity using the Secchi disk. Volunteers can be interested individuals or members of a range of community groups including boating, fishing, surf lifesaving clubs, schools, resident and environmental groups.

Participants will take measurements of water clarity at the same location, at regular intervals.

Participating individuals or groups use a commercially available Secchi disk and prepared instructions for taking measurements. The Friends of Gulf St Vincent will undertake assessment of the data to determine trends and changes in water quality associated with particular events.



What affects water clarity in seawater?

Before major coastal development began in Adelaide, most of the creeks and rivers flowing to the coast from the hills to the east of the city flowed out into floodplain and swamps behind what was once a long coastal dune system from Brighton to Port Adelaide. The swamps basically filtered stormwater before it found its way into the Gulf.

Now, all those swamps have been drained and permanent outlets constructed to carry stormwater away from the suburbs to the beaches.

Along the coast, water clarity can be affected by many factors such as naturally occurring algal or plankton blooms. However more than a century of human alteration of the coastal environment, including vegetation clearance, residential development, runoff bearing nutrients and sediment, and pollution from industry, have introduced new problems, affecting the quality of water in the Gulf.

Adjacent to areas of development, and point sources of pollution, it is common to find localised fine sediment which, when stirred by wind and storms, can dramatically and quickly affect water clarity.

Why does it matter?

Clear water is indicative of a healthy Gulf. Clear water is critical to seagrasses and other marine life. The amount of sunlight that can penetrate the water is affected by water clarity. Seagrasses are underwater plants that need light to grow. Poor water clarity or high turbidity over a long time can reduce the amount of light reaching these plants. Nutrients can also impact on seagrasses.

The nutrients and sediments deposited in the Gulf have caused large-scale changes, most particularly loss of seagrass beds that are integral to the shape of our beaches and the abundance of marine life.

Seagrasses are literally the 'glue' that enables marine coastal waters to teem with life, but their steady decline over the decades has caused a retreat of these meadows.

Why monitor water clarity?

The Secchi disk project will build a picture of the variability of water clarity around the Gulf. By taking regular Secchi measurements at a wide range of locations, over time, a pattern will emerge showing the 'hot spots' for Gulf pollution.

It is a good way to build awareness in the community of the threats that sediments, nutrients and other pollutants pose for users of Gulf waters.

When the Secchi depth is 1.2 metres or less (i.e. when you can't see your feet in water that is 1.2 metres deep) the water is considered unsafe for swimming or other water based activities.

When the water is murky, obstacles in the water may not be visible and an unconscious person in the water may be difficult to locate.

Our coastline now has signs (in locations where pollution is severe during heavy rains) that warn people from entering the water.

Polluted stormwater can carry debris, heavy metals, oils and grease from roads, chemicals, and pathogens from septic tanks and animal faeces.

Health authorities recommend not swimming in areas affected by stormwater runoff for up to three days after heavy rain to ensure that pathogens are no longer a hazard. Skin irritation is also a possibility.

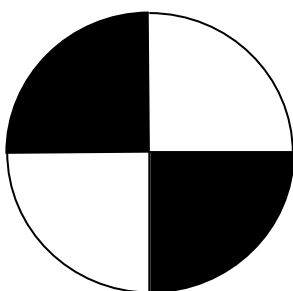
Trash racks and artificial wetlands have been installed along some waterways to reduce the amount of gross pollution and sediment reaching beaches. Despite this, heavy rain can overwhelm the rubbish interception devices, and the holding capacity of wetlands may not be able to deal with heavy flooding.



What is the Secchi disk?

The Secchi disk is a low-tech device used to measure water clarity. It is a weighted, 20 centimetre (eight inch) disk, usually painted white or with alternating black and white quadrants. It is lowered into a water body until it can no longer be seen from directly above.

The weight of the disk is important to ensure the disk hangs straight when there is a current or tidal flow.



The Secchi disk takes its name from an Italian astronomer and astrophysicist, Father Pietro Angelo Secchi (1818-1878), a scientific adviser to the Pope of the day.

Father Secchi tested a new transparency device at the request of the Papal Navy. The instrument—now known as the Secchi disk—was first lowered from the papal steam yacht in the Mediterranean in 1865.

YOUR SAFETY

Your safety and well-being while monitoring is vital. Before you begin monitoring, please notify a responsible person of when and where you will be monitoring and your expected time of return.

Anyone participating in the Secchi disk project must fill in a registration form (available from the Project Officer) and any injuries sustained while monitoring should be reported to the Project Officer as soon as possible.

Safety - First and Foremost!

1. Choose a safe location for monitoring

- a. Jetties with safety rails are ideal for taking readings. They are stable and accessible, and it is easy to use exactly the same location each time.
- b. If you are in a boat, it is essential that a licensed and experienced person is in control of the vessel and that all passengers are wearing life jackets.
- c. Make sure the place you take readings is not vulnerable to waves, e.g. rocks, steps that are slippery or underwater or unprotected ledges.
- d. Make sure the place is at a safe distance from any potential danger.

2. Don't go out in hazardous conditions

- a. Do not take readings in a storm. It is hard to see the Secchi disk in choppy water and can be unsafe. Wait until waves and wind have subsided.
- b. Ideally go out with at least two people. If you must monitor by yourself, notify someone of your movements and expected time of return.
- c. If it is windy, secure loose items to ensure they are not blown into the water.

3. What if the disk falls into the water

- a. Do not put yourself in danger to attempt to retrieve the disk.

4. Use Personal Protective Equipment

- a. Be sun safe. Wear a long sleeved shirt, sunscreen, hat and sunglasses.
- b. Wear sturdy closed in shoes with a good tread. Thongs and sandals are not appropriate footwear.
- c. Gloves may be useful for pulling up the wet line.
- d. Consider taking a first aid kit with you when monitoring.
- e. Take drinking water to keep hydrated in hot weather.
- f. Take a mobile phone in case of an emergency call

Ambulance/ Fire/ Police: 000

Mobile phone alternative emergency number: 112

TAKING SECCHI DEPTH MEASUREMENTS

What is Secchi depth?

The depth at which the disk is no longer visible when lowered from the surface is called the **Secchi depth** and is a quick way to measure of the transparency of the water.

In crystal clear water, the theoretical maximum Secchi depth is 70-80 metres. In Gulf St Vincent, the range is generally up to 10 metres.

Monitoring Locations

Monitoring locations need to be over relatively deep water so you can get a range of readings. This can be on jetties, pontoons, boats or other stable safe sites.

You should monitor from the same spot each time. If monitoring from a boat or other vessel you may want to use your GPS to find the same spot.

It is essential that the site you choose to take your readings is easy to reach no matter what the tide level, is safe and has enough room for you and your kit. Ideally there should be a sturdy rail to tie your Secchi disk to, in case it is dropped or knocked into the water.

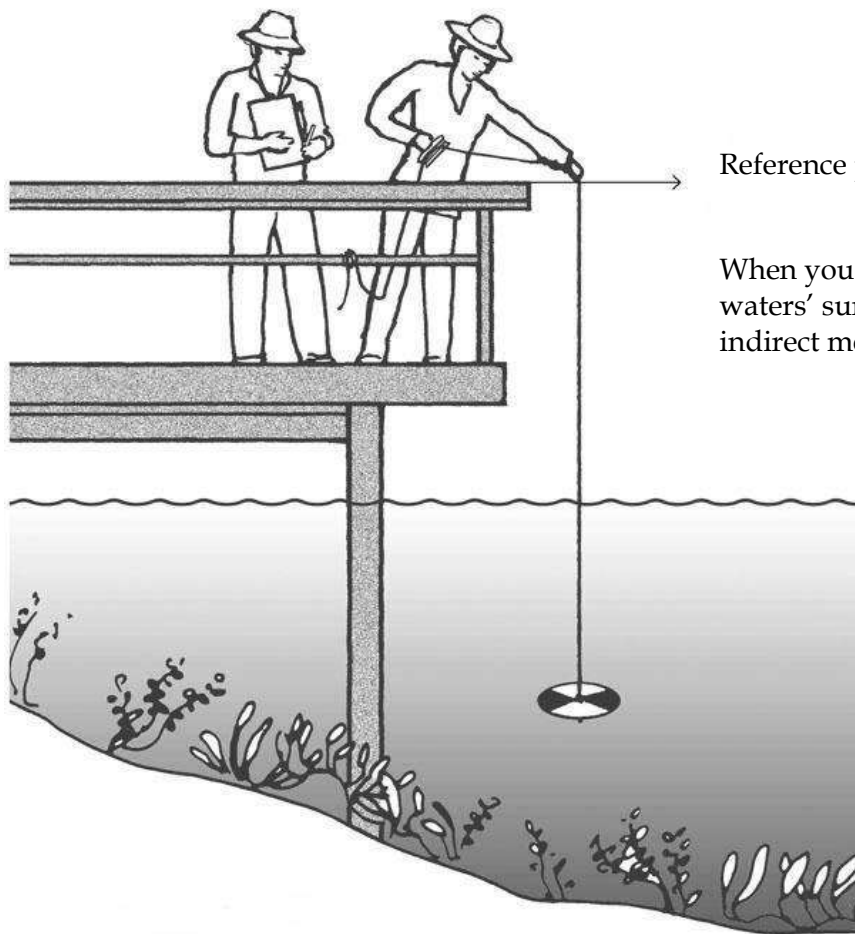
Personal safety is paramount, and you should not put yourself or others at risk to retrieve a Secchi disk.

How to measure Secchi depth

There are two ways to measure the Secchi depth, depending on how close you are to the water. They are known as the direct and the indirect method. The direct method applies when you can easily reach the sea surface e.g. in some boats or pontoons. The indirect method applies when you are on a jetty, or other position from which it is not easy to reach the waters' surface (see drawing below).

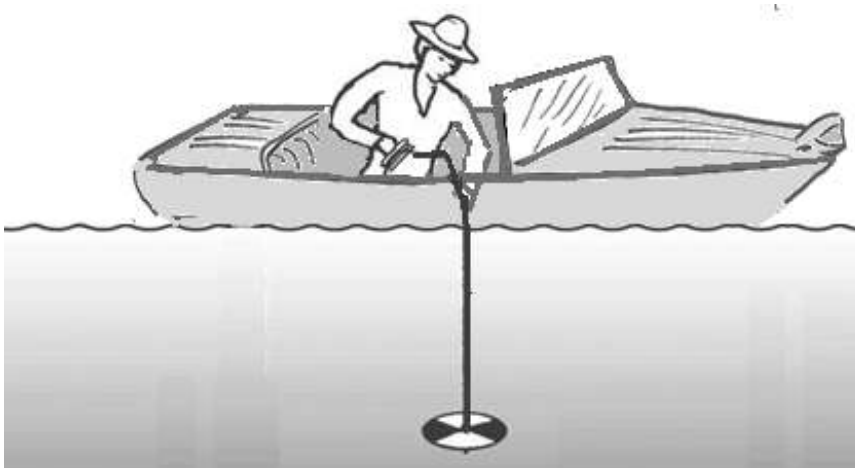
Reference point

You should measure the Secchi depth from the same distance above the water each time. The point you measure from is the reference point. This could be the jetty railing if using the indirect method, or the water's surface if using the direct method. Only measure from the waters' surface if it is safe to do so. Don't want to lean over to reach the water and risk the chance of falling in.



Reference point.

When you can't reach the water's surface, use the indirect method.



Reference point.

When you can reach the water's surface, use the direct method.

Indirect method

If you cannot reach the water's surface safely, you will use the indirect method with the reference point usually being a rail or part of the jetty or rail of a boat.

1. Lower the disk. When the disk is just below the water's surface place a peg on the line/ tape measure at the reference point.



This beam is used as the reference point as it is not safe to lean down to the water's edge.

Water is just lapping over the disk.

2. Continue lowering the disk until it just disappears from view. Place a peg on the line/ tape measure at this point.



3. Pull the disk up carefully so that the pegs do not move. The Secchi depth is the distance between the two pegs (i.e. steps 1 and 2), recorded to the nearest centimetre.



Direct method

If you can reach the water's surface safely, you will use the direct method.

1. Lower the disk until it disappears from view.



2. Place a peg on the rope/ tape measure at the water's surface when the disk disappears from view. This is the Secchi depth (record it to the nearest centimetre).



Monitoring considerations for more accurate readings

- ☛ It is recommended to take readings at a time of day when visibility into the water is best – not too early or too late in the day. Between 10am and 3pm is ideal.
- ☛ To minimise effect of sun glare, if possible, take readings from the shady side of the location.
- ☛ If the measuring location is high above the water surface this may affect visibility, and hence the Secchi depth reading may be less. If it is safe to do so, get as close to the waters' surface as possible.

- ☛ Readings should be taken with corrected vision. If you wear glasses use them when taking your reading, just ensure you don't lose them in the water.
- ☛ Ideally, readings should be taken under the same tidal conditions. Generally, it is suggested to sample on the low tide. This will minimise natural input of sediment from the tide into your sample site and ensure consistency.
- ☛ **Readings are most accurate when the water is calm, not choppy, and there is little wind. This is also suggested for your own safety.**
- ☛ Ensure the Secchi disk hangs vertical. If there is a current wait until the tide slackens, or if the boat is drifting, anchor the boat.
- ☛ If possible secure the disk to a firm object on the jetty or boat (so that if the disk and line slip from your grasp it will not be lost in the water).
- ☛ Allow sufficient time when travelling to a site by boat or kayak for the water and sediment to settle down again.

Secchi disk maintenance

After use in salt water, wash the Secchi disk in fresh water and allow to dry.

Recording data

The Secchi disk data sheets ask you to record observations. These variables can explain unusual readings and can provide more information on why a low Secchi depth is observed.

Site code: You will be given a unique site code to help us distinguish between any nearby sampling sites.

Observer's name: Different people have slightly different eyesight's. Recording the observer's name will allow us to accommodate for any small changes due to different people measuring the depths.

Drop site: Record the type of structure you are sampling from such as a jetty, bridge, marina, pontoon, boat etc...

Nearest town: Readings will be taken from the same point each time, but the location should still be recorded.

Date/ Time: Record the date and time the sampling is undertaken.

GPS reading: If taking your reading from a boat, a GPS reading will be valuable to make sure you are sampling in roughly the same spot. This data isn't needed

when taking readings from a fixed location such as a jetty. We will collect this data the first time you sample.

Wind direction: Wind direction is the direction a wind is coming from. The direction of the wind may tell you where the pollution and sediment are coming from.

Wind strength: Use the Beaufort Scale on the back of the laminated sheet in the Secchi kit as a guide. A copy is also included in this manual. Try to monitor when the water is relatively calm and less than Fresh Winds on the Beaufort Scale. This is for your own safety and to give a more reliable reading. Strong winds can cause stronger waves and churn up more sediment and increasing natural turbidity.

Sea condition: e.g. calm, small waves, large waves, choppy. Volunteers should not be taking readings if conditions are stormy. It normally takes a couple of days for sediments to settle after a storm, so it is preferable to wait until the sea becomes calmer as the turbidity from storms will still be there.

Tide: Take note if the tide is incoming, outgoing, high or low. This will let us analyse any variations due to tide washing sediment in or out of your sampling site.

Shade: Is the water at your sampling site in weak shade, strong shade, or full sunlight can affect the disk's visibility. Strong shade, could be from shadows or overcast conditions; whereas weak shade might be dappled or faint.

Cloud cover: Cloud cover will affect the ability of sunlight to penetrate water and hence may affect observed Secchi depth. A visual assessment to whether the sky is clear, partial cloud cover, or overcast. In meteorological terms, overcast is where cloud covers the majority of the sky (i.e. >95%). Clear sky is mostly free from cloud cover (i.e. cloud cover is <5%).

Water colour: It can be useful to record an approximate colour to help understand the reason for a shallow Secchi depth. This can give us an indication if it is phytoplankton (often causing a green colour) or sediment causing the turbidity (often brown or tea coloured water).

Is the disk visible on sea floor?: At some shallow sites with relatively clear water, the Secchi disk will still be visible on the ocean floor. Even though your disk doesn't disappear, it is still useful information to record.

Comments: Record any other information that may be useful, such as activity in the area that may be affecting water clarity (e.g. dredging), visible algal blooms, floating seaweed, slicks, foam or scum.

Copy of data sheet

Site code								
Observer's name								
Date	___ / ___ / 20___			Time	_____ : _____ am / pm			
Drop site (e.g. jetty, boat, pontoon, marina, bridge)								
Nearest town:								
GPS coordinates (only needed if sampling new sites)								
Wind direction	N	NE	E	SE	S	SW	W	NW
Wind strength (Beaufort Scale)	0 Calm	1-3 Light	4 Moderate	5 Fresh	6 Strong	7 Near Gale	> 8 Gale (consider safety)	
Tide	Low Tide		Outgoing		High tide		Incoming	
Sea condition	Calm		Small waves		Large waves		Choppy	
Shade	Sampling site is in sunlight		Sampling site is in weak shade			Sampling site is in strong shade		
Cloud cover	Clear sky		Partial cloud cover			Overcast		
Water colour	Brown	Tea	Green	Clear	Other (specify) _____			
Secchi Depth (in centimetres):								
Is the disk visible on the sea floor?			Yes			No		
Comments/ extra considerations								

Beaufort Scale

Beaufort scale number	Descriptive term	Units in km/h	Units in knots	Description on Land	Description at Sea
0	Calm	0	0	Smoke rises vertically	Sea like a mirror.
1-3	Light winds	19 km/h or less	10 knots or less	Wind felt on face; leaves rustle; ordinary vanes moved by wind.	Small wavelets, ripples formed but do not break: A glassy appearance maintained.
4	Moderate winds	20 - 29 km/h	11-16 knots	Raises dust and loose paper; small branches are moved.	Small waves - becoming longer; fairly frequent white horses.
5	Fresh winds	30 - 39 km/h	17-21 knots	Small leaves in tree begin to sway; crested wavelets form on inland waters	Moderate waves, taking a more pronounced long form; many white horses are formed - a chance of some spray
6	Strong winds	40 - 50 km/h	22-27 knots	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty.	Large waves begin to form; the white foam crests are more extensive with probably some spray
7	Near gale	51 - 62 km/h	28-33 knots	Whole trees in motion; inconvenience felt when walking against wind.	Sea heaps up and white foam from breaking waves begins to be blown in streaks along direction of wind.
8	Gale	63 - 75 km/h	34-40 knots	Twigs break off trees; progress generally impeded.	Moderately high waves of greater length; edges of crests begin to break into spindrift; foam is blown in well-marked streaks along the direction of the wind.
9	Strong gale	76 - 87 km/h	41-47 knots	Slight structural damage occurs -roofing dislodged; larger branches break off.	High waves; dense streaks of foam; crests of waves begin to topple, tumble and roll over; spray may affect visibility.
10	Storm	88 - 102 km/h	48-55 knots	Seldom experienced inland; trees uprooted; considerable structural damage.	Very high waves with long overhanging crests; the resulting foam in great patches is blown in dense white streaks; the surface of the sea takes on a white appearance; the tumbling of the sea becomes heavy with visibility affected.
11	Violent storm	103 - 117 km/h	56-63 knots	Very rarely experienced - widespread damage	Exceptionally high waves; small and medium sized ships occasionally lost from view behind waves; the sea is completely covered with long white patches of foam; the edges of wave crests are blown into froth.
12+	Hurricane	118 km/h or more	64 knots or more	Very rarely experienced - widespread damage	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected

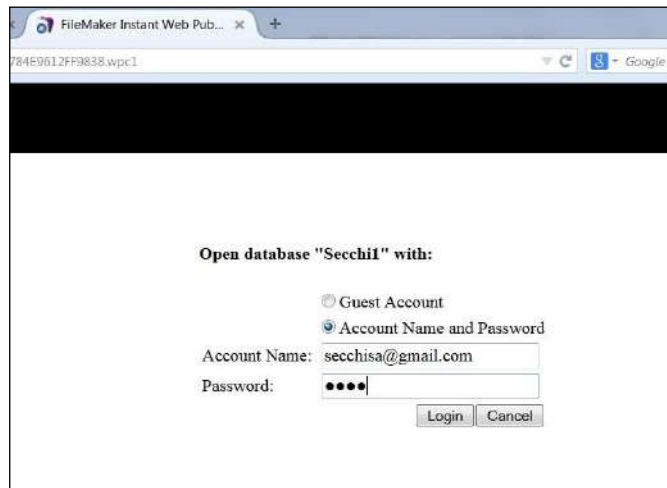
Entering data

The Friends of Gulf St Vincent will provide data sheets with the Secchi kit to record your data.

These data sheets can be scanned and emailed, or posted to the Secchi Disk Project Officer. They can also be entered directly onto the online Secchi Disk database. A username and password will be provided. The data base is fairly self-explanatory but detailed instructions are included below.

Secchi Disk Monitoring database instructions:

- Click on the link on the Friends of Gulf St Vincent website or use the following link:
<http://150.101.100.212/fmi/iwp/cgi?-db=Secchi1&-loadframes>
- The following page comes up and asks for your account name and password



- Click 'Enter your reading'



- Enter your data from your data sheets in the relevant fields:

The screenshot shows a web browser window with the URL `150.101.100.212/fmi/iwp/cgi?-db=Secchi1&-loadframes`. The page title is "Secchi Project" and the main heading is "Your observations". The form contains the following fields and elements:

- 0887** (ID number)
- Site Code**:
- Observer**:
- Sampling Date**: change the date if necessary
- Sampling time**:
- Drop site**:
- Town**:
- GPS**: (if available)
 - GPS Longitude**:
 - GPS Latitude**:
 - GPS Format**:
- Wind**: Check Beaufort Scale
- Tide**:
- Sea Condition**:
- Extra considerations**:
- Shade**:
- Cloud**:
- Water Colour**:
- Depth of Disc in cms**: eg 324 cm (to closest cm)
- If disc is Visible on sea floor**:
- Water Colour Other**:
- Submit**: (highlighted with a black arrow)

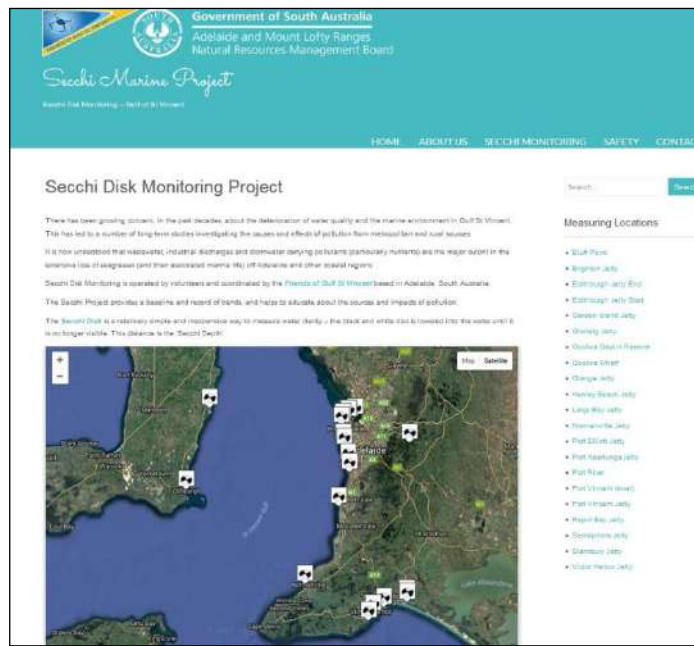
At the bottom of the page, there is a navigation bar with the following buttons: **New Reading**, **Find**, **Delete**, **List**, **Main Menu**, navigation arrows, and **Logout**.

- Click submit at the bottom of the screen, or New Reading to enter more data.

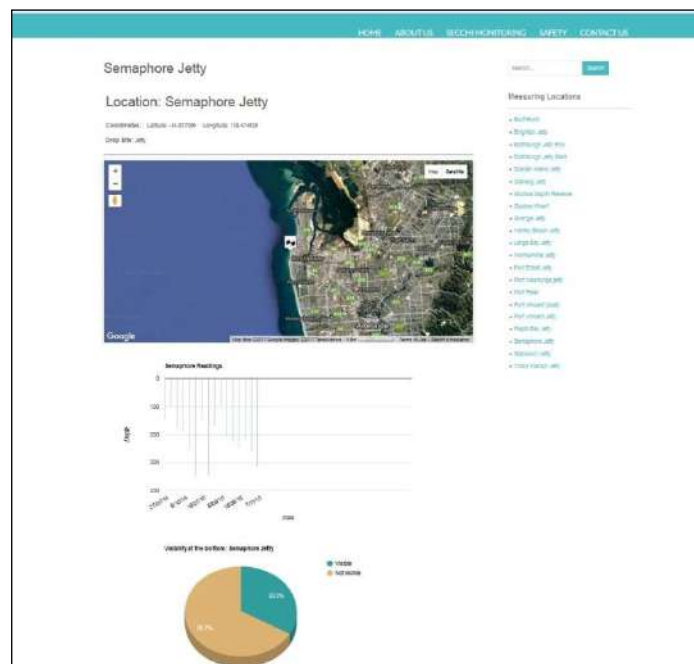
Secchi Disk resources

You can find more information on the project on the Friends of Gulf St Vincent website: <http://friendsofgulfstvincent.org.au/what-we-do/secchi-project/>

Data of secchi readings across the Gulf is displayed in graphical form on the Secchi website: <http://secchi.org.au/>



- Click on your measuring location on the side bar or the icon on the map to view maps of each site, and graphs showing data and trends over time.



Facebook page

The Secchi Disk Facebook page contains information, tips, interesting marine events and an opportunity for volunteers to share their experiences and photos.

<https://www.facebook.com/SecchiSA/>

Friends of Gulf St Vincent also has a useful and informative Facebook page.

<https://www.facebook.com/friendsofgulfstvincent/>

Youtube channel

The Secchi Disk project also has a Youtube channel with promotional, instructional videos and interesting footage.

https://www.youtube.com/channel/UCs_Nt_e3FF9GcsK8sdMOXYQ