





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

# Regional Surface Water Monitoring Program – Quality and Quantity

- REVISION 2
- 15 July 2008

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Sinclair Knight Merz  
ABN 37 001 024 095  
Level 5, 33 King William Street  
Adelaide SA 5000 Australia  
Tel: +61 8 8424 3800  
Fax: +61 8 8424 3810  
Web: [www.skmconsulting.com](http://www.skmconsulting.com)

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# 1 Introduction

The Adelaide and Mount Lofty Ranges (AMLR) Natural Resources Management Board ('the Board') has developed a Natural Resources Management (NRM) Plan for the region. The Plan will guide investment in actions to improve the condition of the region's natural resources (soil, water, geological features, landscapes, native flora and fauna and ecosystem) for current and future generations.

The Board is also responsible for monitoring, evaluating and reporting on progress in implementing parts of the plan associated with its investment plan, the achievement towards stated targets and the condition of the region's natural resources.

Three 20 Year Regional Targets (RTs) have been developed relating to water quality and the impacts of surface water on the receiving environment (refer to Table 1). The Monitoring, Evaluation and Reporting Framework (MERF) identifies environmental indicators related to these RTs. (Note that only those indicators relating to water quality are included in the table below.)

■ **Table 1 – Regional targets and indicators (water quality)**

| Regional Target | Target  | Information requirement | Environmental Indicator(s)  |
|-----------------|---|-------------------------|---|
| <b>T1</b>       | <b>Stormwater and waste water used</b><br>• 75% of stormwater used<br>• 100% of waste water reused  | Stormwater Quality      | Volume of stormwater discharge to coast or marine systems                           |
|                 |   | Stormwater Quality      | Stormwater pollutant load   |
| <b>T2</b>       | <b>Surface water and groundwater quality</b><br>All water resources meet water quality guidelines to protect defined environmental values | Surface water quality   | Exceedances of pH water quality triggers (surface water)                            |
|                 |   |                         | Exceedances of salinity water quality triggers (surface water)                      |
|                 |   |                         | Exceedances of suspended solids water quality triggers (surface water)              |
|                 |   |                         | Exceedances of total nitrogen and phosphorus water quality triggers (surface water) |
|                 |   |                         | Exceedances of turbidity water quality triggers (surface water)                     |
| <b>T10</b>      | <b>Land based impacts on coastal, estuarine and marine processes</b><br>Impacts reduced from current levels                               | Catchment condition     | Catchment sediment load   |
|                 |   | Stormwater quality      | Stormwater pollutant load   |



The MERF describes numerous key actions relating to these water quality indicators including:

- **Implement the recommended actions of the Adelaide Coastal Waters Study Report regarding stormwater pollutant and catchment sediment load estimates through development of stormwater monitoring program;**
- **Align Composite Sampler Project with Waterproofing the North and South;**
- **Determine requirements for water quality monitoring;**
- Develop monitoring and reporting framework for volume of stormwater generated in conjunction with DWLBC and BoM;
- Summarise and document baseline information regarding catchment sediment load, surface water quality and quantity and stormwater quality and quantity;
- Implement stormwater monitoring program (quantity and quality);
- Implement surface water quality monitoring program; and
- Implement a catchment sediment monitoring program.

This report addresses the actions above related to regional monitoring of surface water (including stormwater quality and quantity) highlighted in bold text. It describes the recommended requirements of a pollutant load water quality monitoring program to be undertaken using a composite sampler network that will provide information on both quality and quantity. The composite sampler network will collect data on stormwater (end of catchment monitoring stations) and regional water quality.

The remaining actions will be addressed in separate monitoring plans.

### 1.1 Stakeholders

Key stakeholders to be consulted on the proposed composite sampler network include:

- EPA, including the Adelaide Coastal Waters Study team;
- Water Proofing the North (Cities of Salisbury, Playford and Tea Tree Gully);
- Water Proofing the South (City of Onkaparinga and other organisations);
- DWLBC;
- Bureau of Meteorology;
- SA Water and,
- DEH.



## 2 Water Quality Monitoring

The Board has agreed on a water quality monitoring program that includes both ambient and pollutant load monitoring. The ambient monitoring program will collect data that will enable an assessment of water quality and river health across the AMLR. This program will be the focus of a separate monitoring plan. Project specific water quality monitoring may also be undertaken by the Board.

Pollutant load monitoring will provide an additional level of information, allowing estimates of pollutant loads to receiving waters, in particular to Gulf St Vincent and Barker Inlet.

Measuring pollutant load requires the collection of composite samples, where a series of water samples are taken over a set period of time and weighted by flow rate.

Water Data Services Pty Ltd have developed the Composite Volume Proportional method of water quality sampling. Box 1 provides a description of the composite sampler.

### ■ Box 1 – Composite Volume Proportional Sampling

The Composite Volume Proportional method requires that an accurate predetermined calibration of the river flow versus height relationship is available. This relationship together with other relevant information is used to program a data logger.



The logger extracts water samples at predetermined volume increments and stores them in a large plastic container during the sampling period. A composite sample is collected from the tub at each sample visit and a reliable estimate of load concentration for the sampling period is determined.

Composite Sampler Set Up

*Reference: Water Data Services*





### 3 Proposed Monitoring Program

It is proposed that there be two types of composite sampler monitoring sites, depending on their location:

- End of catchment sites which will enable stormwater pollutant and catchment sediment loads to be assessed, and
- Water quality sites which will enable an assessment of regional water quality.

Table 2 summarises the parameters to be monitored by the composite samplers.

■ **Table 2 Monitoring Parameters**

| PARAMETER                             | END OF CATCHMENT MONITORING | WATER QUALITY MONITORING |
|---------------------------------------|-----------------------------|--------------------------|
| pH                                    | YES                         | YES                      |
| Salinity (EC)                         | YES                         | YES                      |
| Suspended Solids                      | YES                         | YES                      |
| Turbidity                             | YES                         | YES                      |
| Nutrients (TP, TKN, NO <sub>x</sub> ) | YES                         | YES                      |
| Heavy Metals (Cu, Zn, Pb)             | YES                         | NO                       |

NOTE - pH is included as it is a national NRM (matters for targets) indicator (for advice) for river condition water quality.





## 4 Proposed Composite Sampler Network

The table below summarises the location of sampling sites proposed for the composite sampler network. It includes a description of the current (monitoring) status of the site and existing infrastructure.

■ **Table 3 Proposed Sampler Network**

| Region   | Site Description                            | Type             | Existing Facilities | Site number | Comments and Additional Infrastructure Required  |
|----------|---|------------------|---------------------|-------------|--|
| Fleurieu | Hindmarsh River u/s estuary                 | End of Catchment | No                  | NEW         | New station  |
| Fleurieu | Inman River u/s WWTP                        | End of Catchment | Yes                 | A5010503    | Flow monitoring currently  |
| Fleurieu | Tunkalilla Creek u/s mouth                  | Water Quality    | No                  | NEW         | New station (suggested as access better than Callawonga Creek)   |
| Fleurieu | Yankalilla River                            | Water Quality    | Yes                 | A5011006    | Flow monitoring currently  |
| Fleurieu | River Bungala u/s estuary                   | End of Catchment | No                  | NEW         | New station  |
| Southern | Pedler Creek u/s mouth                      | End of Catchment | No                  | NEW         | New station  |
| Southern | Onkaparinga River u/s Old Noarlunga         | End of Catchment | Some                | A5031005    | Flow monitoring station only – site set up with large solar panels and ready for CS installation                   |
| Southern | Christie Creek d/s Galloway Road            | End of Catchment | Yes                 | AW503547    | Composite Sampler in place   |
| Southern | Field River d/s Main South Road             | Water Quality    | Yes                 | AW503546    | Composite Sampler in place   |
| Southern | Field River u/s mouth                       | End of Catchment | No                  | NEW         | New station  |
| Southern | Onkaparinga River d/s Clarendon weir        | Water Quality    | Yes                 | A5031004    | Flow only. Review need for this site as low flows. Might just be ambient only. Requires additional infrastructure. |
| Southern | Onkaparinga u/s Hahndorf Dissipater         | Water Quality    | Yes                 | A5031001    | Composite Sampler in place   |
| Central  | Sturt River d/s Minno Creek near Winns Road | Water Quality    | Upstream            | NEW         | New station. May be able to use equipment from u/s station and existing culvert.                                   |
| Central  | Sturt River d/s Anzac Highway               | End of Catchment | Yes                 | AW504549    | Composite Sampler in place   |
| Central  | Brown Hill Creek @ Morphett Road            | End of Catchment | Yes                 | AW504583    | Composite Sampler in place   |

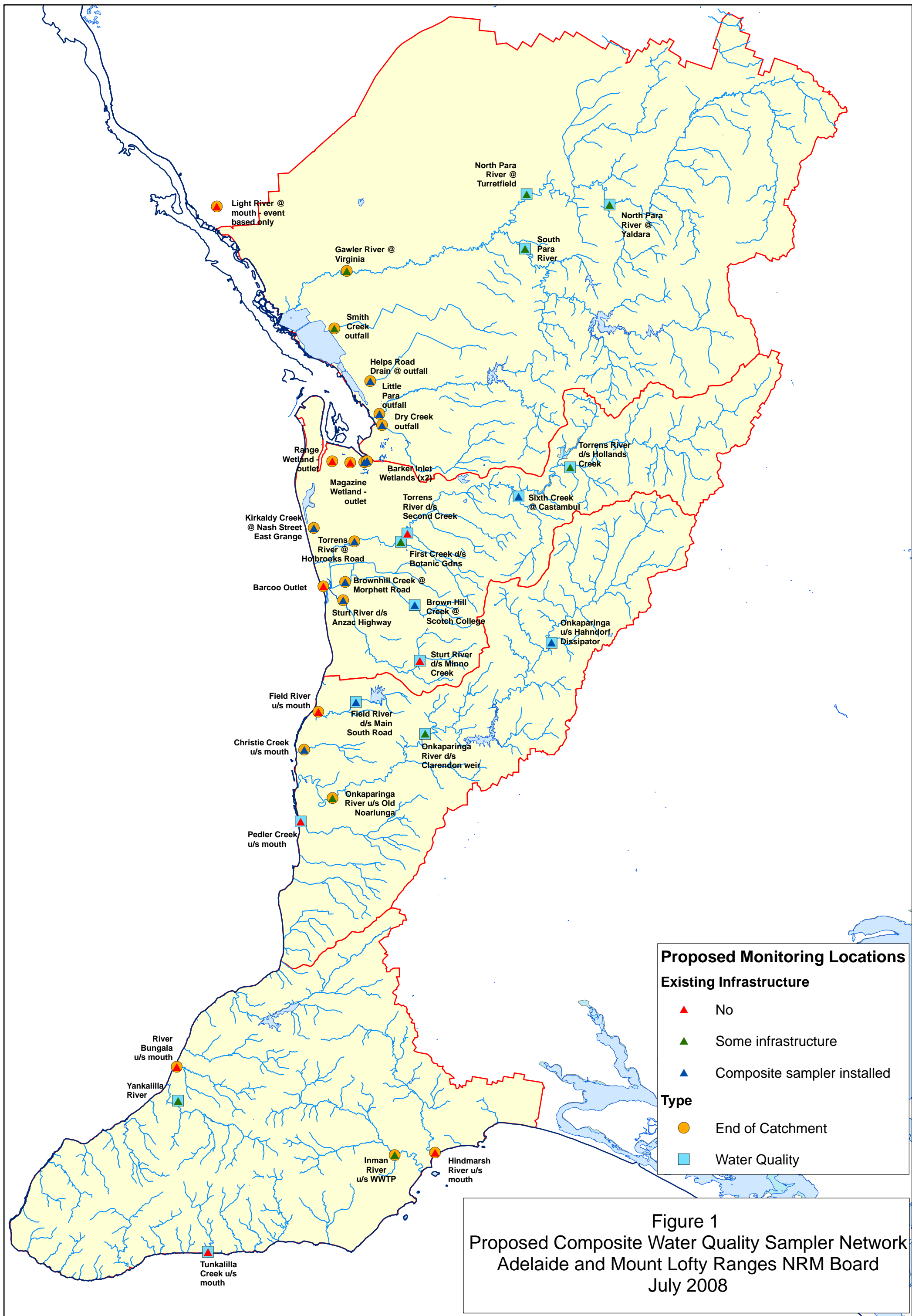


| Region   | Site Description                         | Type             | Existing Facilities | Site number | Comments and Additional Infrastructure Required   |
|----------|--|------------------|---------------------|-------------|---|
| Central  | Brown Hill Creek @ Scotch College        | Water Quality    | Yes                 | AW504901    | Composite Sampler in place  |
| Central  | Torrens River @ Holbrooks Road           | End of Catchment | Yes                 | AW504529    | Composite sampler in place  |
| Central  | First Creek d/s Botanic Gardens          | Water Quality    | Yes                 | AW504578    | Composite Sampler in place  |
| Central  | Barcoo Outlet                            | End of Catchment | No                  | NEW         | Could use large inspection point. Would require Doppler meter   |
| Central  | Torrens River d/s Second Creek           | Water Quality    | No                  | NEW         | New station – recommended by Torrens Taskforce  |
| Central  | Sixth Creek @ Castambul                  | Water Quality    | Yes                 | AW504523    | Composite Sampler in place  |
| Central  | Torrens River d/s Hollands Creek         | Water Quality    | Yes                 | A5041003    | EC and flow monitoring only. Needs infrastructure upgrade   |
| Central  | Kirkaldy Creek @ Nash Street East Grange | End of Catchment | Yes                 | A5041016    | Composite Sampler in place  |
| Central  | Range Wetland - outlet                   | End of Catchment | No                  | NEW         | New station   |
| Central  | Magazine Wetland - outlet                | End of Catchment | No                  | NEW         | New station   |
| Central  | Barker Inlet Wetland – outlet 1          | End of Catchment | Yes                 | ??          | Composite Sampler in place  |
| Central  | Barker Inlet Wetland – outlet 2          | End of Catchment | Yes                 | ??          | Composite Sampler in place  |
| Northern | Gawler River @ Virginia                  | End of Catchment | No                  | A505510     | Suitable site for composite sampler installation at Virginia. Low inflows downstream to Gawler River. |
| Northern | Light River @ mouth                      | End of Catchment | No                  | NEW         | Event monitoring only – exact location to be determined   |
| Northern | South Para River                         | Water Quality    | Yes                 | A5050503    | EC and flow monitoring only. Needs infrastructure upgrade   |
| Northern | North Para River @ Yaldara               | Water Quality    | Yes                 | A5050502    | EC and flow monitoring only. Needs infrastructure upgrade   |
| Northern | North Para River @ Turretfield           | Water Quality    | No                  | NEW         | New station to be installed as part of Turretfield Flood Control Dam construction. DWLBC responsible. |



| Region   | Site Description    | Type             | Existing Facilities | Site number | Comments and Additional Infrastructure Required  |
|----------|---------------------|------------------|---------------------|-------------|--|
| Northern | Little Para outfall | End of Catchment | Yes                 | WPN         | Composite sampler installed for Waterproofing the North. Repairs to weir required.                               |
| Northern | Dry Creek outfall   | End of Catchment | Yes                 | WPN         | Composite sampler to be for Waterproofing the North. Awaiting completion of construction for final installation. |
| Northern | Helps Road Drain    | End of Catchment | Yes                 | WPN         | Composite sampler installed for Waterproofing the North.   |
| Northern | Smith Creek outfall | End of Catchment | Yes                 | WPN         | Not yet installed.   |

Figure 1 shows the distribution of the sites across the AMLR NRM Board area.





## 5 Cost Estimate for Regional Monitoring Program

Costs have been provided 'Commercial and In Confidence' by Australian Water Technologies to assist the AMLR NRMB to budget for the water quality monitoring program. Detailed information for each site is included in Appendix A – Cost Estimates for Network Installation and Ongoing Monitoring.

### 5.1 Network Establishment

Table 4 summarises the approximate costs associated with establishing the composite sampler network.

■ **Table 4 Cost Estimate of Proposed Sampler Network**

| Region            | Comments on Composite Sampler Establishment | Cost Estimate       |
|-------------------|---|---------------------|
| Fleurieu          | 3 new stations and 2 upgrades               | \$90,000            |
| Southern          | 2 new stations and 2 upgrades               | \$42,000            |
| Central           | 5 new stations and 3 upgrades               | \$135,000           |
| Northern          | 5 new stations and 3 upgrades               | \$117,000           |
| <b>TOTAL COST</b> |   | <b>\$384,000.00</b> |

### 5.2 Ongoing Monitoring

Costs have also been estimated for ongoing monitoring. The costs have been based on the average of the current monitoring program (existing composite samplers) and assuming approximately 40 visits for each site each year. For 36 sites the ongoing fee is estimated to be **\$450,000 p.a.**

This fee could be reduced by reducing the number of visits to sample each site. (Many sites will have several months during summer when there is little or no flow).

### 5.3 Additional Equipment Requirements

Most of the streams in South Australia require verification of the flow ratings particularly for medium to high flows. New ADCP (Acoustic Doppler Current Profilers) technology provides an improved and safer method of obtaining medium to high flow gaugings.

The equipment described in Table 5 will assist the Board to improve the current Flow ratings for each station and is listed. The RiverSurveyor will provide an additional method to measure flows in large bodies of water such as river estuaries and Onkaparinga River and as well as looking at current profiles in the ocean, reservoirs and lakes. The RiverCat, with the addition of the trimaran option will allow the measurement of flow in fast flowing stormwater channels which cannot currently be measured using traditional methods. The RiverCat will significantly improve safety during gaugings as the work can be undertaken safely from the river bank.



This new equipment, when used over time, will improve the accuracy of the current flow ratings and provide all users with higher quality data.

In addition, three existing gauging stations in the Torrens catchment have telemetry set up with CDMA modems and hence require upgrade to be compatible with the 3-G network. An external antenna may also be required.

■ **Table 5 Cost Estimate of Proposed Sampler Network**

| Equipment Required   | Use  | Cost Estimate      |
|--|--|--------------------|
| Sontek Flow Tracker ADV (Acoustic Doppler Velocimeter) hand held current meter | Hand held flow measurements and is required for low flow measurements in all streams   | \$15,000           |
| Sontek RiverSurveyor ADP (Acoustic Doppler Profiler)                           | Used to measure medium to high flows. It is accurate and will vastly improve safety as it enables the measurement of flow from the waters edge rather than by boat or travellerway | \$30,000           |
| Sontek RiverCat (mini ADP) with GPS  | As above but can be used in the largest rivers, ocean or reservoirs. It attaches to a boat and can be used to analyse velocity profiles  | \$30,000           |
| Training in use of Sontek equipment  |  | \$1500             |
| Digital 3-G Modems   | Update modems for gauging station telemetry.   | \$1000 (estimated) |
| <b>TOTAL COST</b>  |  | <b>\$77,500.00</b> |



## Appendix A – Cost Estimates for Network Installation and Ongoing Monitoring

The following costs have been provided ‘Commercial and In Confidence’ by Australian Water Technologies to assist the AMLR NRMB to budget for the water quality monitoring program.

### A-1 Network Establishment

The table below summarises the approximate costs associated with establishing the composite sampler network.

■ **Table A-1 Costs Estimates for Composite Sampler Network Installation**

| Region   | Site Description                            | Type             | Comments on Composite Sampler Establishment  | Cost Estimate |
|----------|---|------------------|--|---------------|
| Fleurieu | Hindmarsh River u/s estuary                 | End of Catchment | New station  | \$20,000      |
| Fleurieu | Inman River u/s WWTP                        | End of Catchment | Flow monitoring currently  | \$15,000      |
| Fleurieu | Tunkalilla Creek u/s mouth                  | Water Quality    | New station  | \$20,000      |
| Fleurieu | Yankalilla River                            | Water Quality    | Flow monitoring currently  | \$15,000      |
| Fleurieu | River Bungala u/s estuary                   | End of Catchment | New station  | \$20,000      |
| Southern | Pedler Creek u/s mouth                      | End of Catchment | New station – Relocate existing site to near mouth (Nashwauk Cres)   | \$12,000      |
| Southern | Onkaparinga River u/s Old Noarlunga         | End of Catchment | Flow monitoring station only – site set up with large solar panels and ready for CS installation                               | \$5,000       |
| Southern | Christie Creek d/s Galloway Road            | End of Catchment | Composite Sampler in place   | \$0           |
| Southern | Field River d/s Main South Road             | Water Quality    | Composite Sampler in place   | \$0           |
| Southern | Field River u/s mouth                       | End of Catchment | New station  | \$20,000      |
| Southern | Onkaparinga River d/s Clarendon weir        | Water Quality    | Flow only. Review need for this site as low flows. Might just be ambient only. Cost to upgrade to a CS would be approx \$5,000 | \$5,000       |
| Southern | Onkaparinga u/s Hahndorf Dissipater         | Water Quality    | Composite Sampler in place   | \$0           |
| Central  | Sturt River d/s Minno Creek near Winns Road | Water Quality    | New station. May be able to use equipment from u/s station and existing culvert.   | \$20,000      |
| Central  | Sturt River d/s Anzac Highway               | End of Catchment | Composite Sampler in place   | \$0           |





| Region   | Site Description                         | Type             | Comments on Composite Sampler Establishment   | Cost Estimate |
|----------|--|------------------|---|---------------|
| Central  | Brown Hill Creek @ Morphett Road         | End of Catchment | Composite Sampler in place  | \$0           |
| Central  | Brown Hill Creek @ Scotch College        | Water Quality    | Composite Sampler in place  | \$0           |
| Central  | Torrens River @ Holbrooks Road           | End of Catchment | Composite sampler in place – needs Telemetry and equipment upgrade  | \$15,000      |
| Central  | First Creek d/s Botanic Gardens          | Water Quality    | Composite Sampler in place, Needs telemetry upgrade   | \$5,000       |
| Central  | Barcoo Outlet                            | End of Catchment | Could use large inspection point. Would require Doppler meter   | \$25,000      |
| Central  | Torrens River d/s Second Creek           | Water Quality    | New station – recommended by Torrens Taskforce. Open channel and requires ADCP  | \$25,000      |
| Central  | Sixth Creek @ Castambul                  | Water Quality    | Composite Sampler in place  | \$0           |
| Central  | Torrens River d/s Hollands Creek         | Water Quality    | EC and flow monitoring only. Needs infrastructure upgrade   | \$5,000       |
| Central  | Kirkaldy Creek @ Nash Street East Grange | End of Catchment | Composite Sampler in place  | \$0           |
| Central  | Range Wetland - outlet                   | End of Catchment | New station   | \$20,000      |
| Central  | Magazine Wetland - outlet                | End of Catchment | New station   | \$20,000      |
| Central  | Barker Inlet Wetland – outlet 1          | End of Catchment | Composite Sampler in place  | \$0           |
| Central  | Barker Inlet Wetland – outlet 2          | End of Catchment | Composite Sampler in place  | \$0           |
| Northern | Gawler River @ Virginia                  | End of Catchment | Suitable site for composite sampler installation at Virginia. Low inflows downstream to Gawler River.   | \$15,000      |
| Northern | Light River @ mouth                      | End of Catchment | Event monitoring only – exact location to be determined   | \$22,000      |
| Northern | South Para River                         | Water Quality    | EC and flow monitoring only. Needs infrastructure upgrade   | \$5,000       |
| Northern | North Para River @ Yaldara               | Water Quality    | EC and flow monitoring only. Needs infrastructure upgrade   | \$5,000       |
| Northern | North Para River @ Turretfield           | Water Quality    | New station to be installed as part of Turretfield Flood Control Dam construction. DWLBC responsible. Proposed use of Acoustic Doppler Current Profiler (ADCP) (cost approx \$25,000). If a new wier is required, will cost | \$25,000      |



| Region  | Site Description    | Type             | Comments on Composite Sampler Establishment  | Cost Estimate       |
|---|---------------------|------------------|--|---------------------|
|   |                     |                  | approx \$120,000   |                     |
| Northern  | Little Para outfall | End of Catchment | Repairs to weir required. (Leaking and in-sensitive to low flows)  | \$10,000            |
| Northern  | Dry Creek outfall   | End of Catchment | Composite sampler to be for Waterproofing the North. Awaiting completion of construction for final installation. | \$15,000            |
| Northern  | Helps Road Drain    | End of Catchment | Composite sampler installed for Waterproofing the North.   | \$0                 |
| Northern  | Smith Creek outfall | End of Catchment | Not yet installed.   | \$20,000            |
| <b>TOTAL COST (assuming no weir at Turretfield)</b> |                     |                  |  | <b>\$384,000.00</b> |

## A-2 Ongoing Monitoring

Costs have also been estimated for ongoing monitoring. The costs have been based on the average of the current monitoring program (existing composite samplers).

Monitoring has been estimated at \$12,500 (ex GST) per site per year.

This is an all inclusive price for:

- Operation and Maintenance,
- Data Management – collection, verification, archiving and WEB Reports presentation, and
- Laboratory Analysis.

Therefore for 36 sites the ongoing fee would be approximately **\$450,000 p.a.**