

Case Study

City of Mt. Gambier - Caroline Landfill

Leachate Pump System with Monitoring/Telemetry Operations

Background

The City of Mount Gambier is the second largest city in South Australia with a population of over 26,000 people and is the regional centre for the South East of South Australia. The Caroline Landfill receives municipal, commercial and industrial waste from the City of Mount Gambier and District Council of Grant areas.

Project Description

In 2013 plans to develop the Caroline Landfill site with a new cell to be constructed and the existing cells 1 & 2 to be capped. Airwell Group was initially engaged by a civil engineering contractor to fabricate, supply, install, and commission a leachate pumping and monitoring system with telemetry operations.

The tender for the new works included:

Features

- Design, supply and installation of intrinsically safe pumps and controllers for cells 1, 2 & 3.
- Monitoring equipment and telemetry operations for cells 1 & 2
- Installation of pump and monitoring equipment into exiting leachate sumps for cells 1 and 2
- Installation of pump and monitoring equipment into new leachate sumps being constructed for Cell 3
- Installation of fluid level monitoring equipment for all 3 leachate ponds on site.

Specifications

- System that was robust and capable of handling corrosive fluid better than other existing forms of leachate pumping.
- Ability to automatically adjust it's pumping rates to varying fluid levels in the cells.
- System to be intrinsically safe.
- Capable of monitoring all aspects of the pumping process from fluid levels in the sumps and evaporation ponds.
- Capture, record and report this information in real time.

The unique features of the Airwell Leachate Pumping system provided the solution to meet the City of Mt. Gambier specifications and requirements.

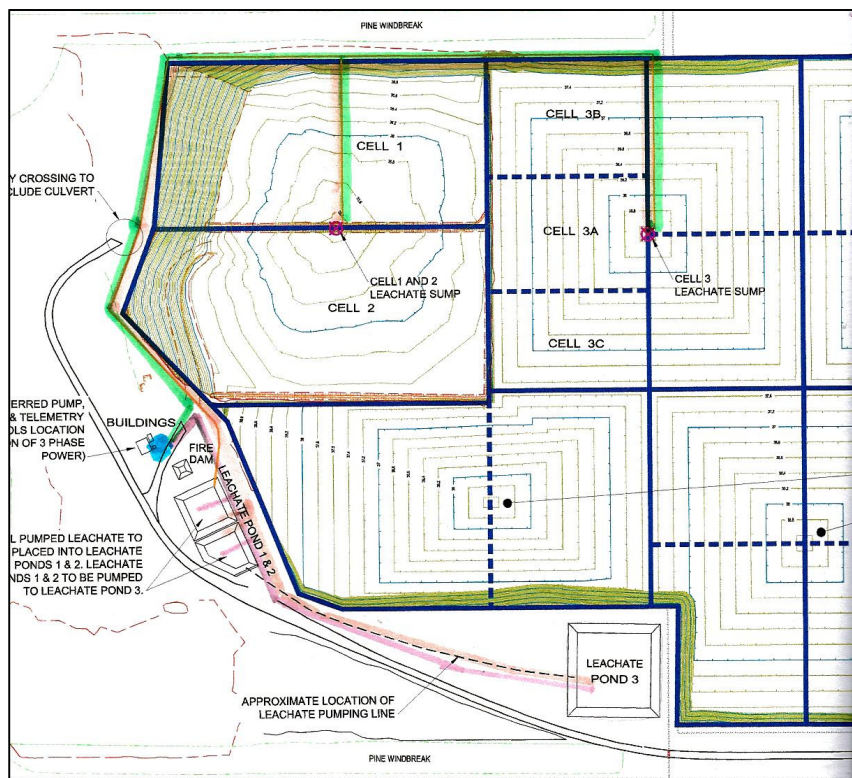
The Airwell Solution

Pipelines and Airlines

The design of the network of pipe lines and airlines to connect to the original sump in cell 1 & 2, and the new constructed sump in cell 3, had to incorporate the requirements for future expansion and works at the site. All pipe work had to be located and installed to have minimal impact and disruption to the operations and ongoing delivery of waste to the site.

From information supplied on expected flow rates and other requirements, 63mm PN 12.5 poly pipe was recommended to transfer the pumped leachate fluid to the evaporation ponds. After calculating the required volume of compressed air for the pumps, and allowance for future expansion, 32mm PN 16 poly airline was selected for the main airline. The airline was to be laid from the container which houses the air compressor and telemetry equipment to pump locations and leachate ponds.

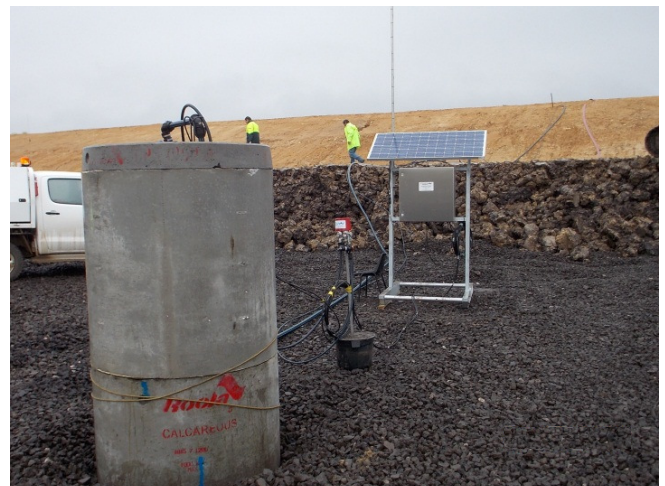
These pipe lines run around the northern side of cell 1 & 2 to the east boundary of the landfill site. From there they have been extended up to the southern end of the new cell 3 for future expansion. From each of the sump locations in the centre of the two cells, a 50mm PN12.5 poly pipe and a 16mm poly airline connect back to the main pipe lines on the cells perimeter.



Airwell Pumps

The pump specifications for cells 1 and 2 required the ability to pump a minimum of 13,000 litres per day from each pump to the evaporation ponds.

For cells 1 and 2, Airwell 4" x 1 metre BF (bottom fill) leachate pumps were selected to meet the Council and EPA specification. This style of pump has the capacity of pumping up to 60,000 litres per day if required.



In the new cell 3 we installed an Airwell sump pump which sits horizontally on the floor of the concrete sump. This will allow the fluid level in this new sump to be pumped down to 300mm from the floor of the new cell. This style of pump has the capacity of pumping up to 80,000 litres per day if required.

The initial project specification called for a transfer pump to be installed at a later date to move leachate from the evaporation ponds 1 & 2 to evaporation pond 3 when required.

Following a review and modification to the direction of the existing water pipe line between evaporation ponds 1, 2 and 3 and the installation of some isolating valves, the new Airwell pumps installed had the ability to transfer leachate directly to pond 3 when needed. This provided the Council with significant savings as the future transfer pump was no longer required.



Airwell Control Skids

Each Airwell pump location at the landfill site has a control skid unit which is solar powered and houses the RTU (Remote Telemetry Unit), solar regulator, batteries and an Intrinsic Safe liquid level sensor for the probes in the Airwell pump.

The control skid also has a "Trio" radio to allow communications and transfer of data to the central "Control Hub". The central control hub is mounted on the inside wall of the air compressor shed.



Compressor Shed and Control Hub

The compressor shed is a customised, fitted out and well-ventilated 10 foot shipping container which is located next to the main work shop building where there is an existing 3 phase power source. This provides good security for the compressor and central control hub equipment.

This control hub also has a “Trio” radio to communicate with all the remote pump controllers. Up to 256 separate units can be monitored by this one control hub which provides for any future expansion plans for this site. The central control hub has a SIM card modem to allow for full control and monitoring over the internet from any authorised computer in any location. (For example Airwell currently controls systems in Australia, Canada and the USA from our offices in Perth WA in exactly this way)

It was recommended that a “Pilot” brand three phase K 30 two stage compression compressor be specified for this job. These units offer an economic purchase price with excellent reliability, simple maintenance and long life. Fitted with a VSD (Variable Speed Drive) the compressor can now be de-rated or slowed down to only produce sufficient compressed air to operate the pumps. This helps increase the life and reliability of the compressor and improve energy efficiency. When new pumps are added to the system, a simple speed adjustment to the compressor will generate more compressed air to operate the pump.

Other features of the compressors and control hub are:

- Auto shut off of compressors when pumping system is idle.
- Auto re-start of compressors when pumping system recommences.
- Control hub also monitors and controls the compressors on this project.
- Each pumping sump has an intrinsic safe bubbler tube setup to provide water level feedback into pressure transmitters located in the control hub which report directly to the SCADA system.
- Pumping flow rates and total flow rates are recorded by the RTU.



Leachate Pond Monitoring

The monitoring of the liquid levels in the leachate ponds are often problematic using standard level measuring devices as the ponds are full of dirty water. The suggested Airwell method to monitor levels in the leachate ponds is very simple, inexpensive and highly reliable.

Our solution was to run single lines of 16 mm poly pipe from each of the three ponds separately back to the location of the compressor shed/central control hub. At each pond, the end of the poly line is simply weighted so that the end of it remains at the bottom of the pond.

At the compressor shed/central control hub this 16 mm poly pipe is connected to a small needle valve that meters a very small amount of compressed air into the “Bubbler Tube” (16mm poly pipe). By applying constant air pressure to the Bubbler Tube you are ensuring that the line remains full of air and therefore empty of water. A pressure transducer is fitted to each bubbler tube and located inside the compressor shed and located close to the central control hub.

The pressure that is required to push a bubble of air out of the bubbler tube sitting on the bottom of the pond is equal to the water pressure at the bottom of the pond. This provides for an accurate record of bottom of pond pressure, the RTU is programmed to convert this bottom of pond pressure into a liquid level and logged by the Data Logger as required. Very high accuracy is possible with this method. The method is completely intrinsic safe by nature and is physically robust, as only poly pipe is used to run to each pond.



Control Dashboard

The SCADA package we use to log on to our remote equipment is called “ClearSCADA” and is produced and sold by the same supplier as the “SCADAPack” hardware we use. Both these products are now part of the “Schneider Electric” company group.

Airwell Group pre-program all devices with the logic required to operate the system in the factory prior to arriving on site. City of Mount Gambier will maintain a licence for the use of the Clear SCADA software with an annual licence payment to Schneider Electric, but this licence fee is a minimal cost for this small system.

Airwell Group provides a pre-programmed Dashboard template ready for the City of Mount Gambier to use ClearSCADA on their PC.

Each RTU stores data in time stamped log registers for water flow and sump water level for easy local or remote access. The data logging frequency can be set via the SCADA Dashboard at any time to whatever time interval is desired. As with all data loggers, more frequent logging will use up more memory and will therefore have to be downloaded more frequently.

AIRWELL PUMP CONTROL

Remote Pump Run ON OFF ENABLED Local Pump Run Switch ON

Solenoid Valve State

Seconds For This Cycle

Seconds For Last Cycle

Water Flow Rate

Accumulated Water Today

SUMP WATER LEVEL - IN METERS ABOVE SENSOR

Sump Water Level

RTU INFORMATION

Board Temperature Input Voltage RAM Voltage

Local Control Switch State Receiver Pressure

Remote Receiver Drain ON OFF Compressor Start Pressure

Receiver Drain Status Compressor Stop Pressure

COMPRESSOR No. 1

Compressor 1 Run Enable RUN STOP ENABLED

Compressor 1 Run Status

Compressor 1 Set Speed

Compressor 1 Frequency

Compressor 1 Run Hours

COMPRESSOR No. 2

Compressor 2 Run Enable RUN STOP DISABLED

Compressor 2 Run Status

Compressor 2 Set Speed

Compressor 2 Frequency

Compressor 2 Run Hours

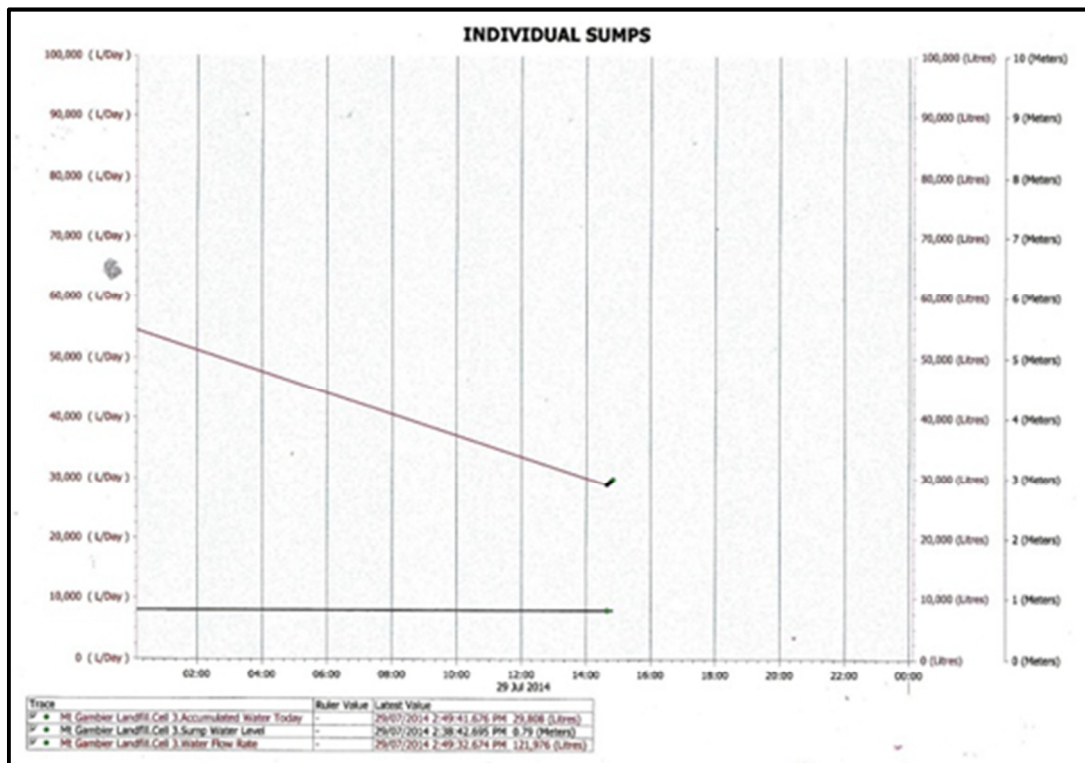
Pond 1 Level

Pond 2 Level

Pond 3 Level

Board Temperature Input Voltage RAM Voltage

With authorities requiring more stringent data reporting on a regular basis, the clear SCADA software can provide real time data reporting with all the necessary information in graph form direct to the clients PC. This information can be down loaded and checked at any time before being sent to the relevant reporting authorities.



Airwell Evaporation Pond Pump (A late addition to the project)

Airwell Group has designed an Evaporation Pond Pump system to be used on evaporation ponds in landfills to help increase the evaporation rate of leachate. This pumping system like all other Airwell pumps uses compressed air to operate the pump.

The Evaporation Pond Pump system is operated by an Airwell Surface pump fitted with 4 inlets and a quick exhaust valve to allow the pump to fill quickly. The pump is then connected to a floating pipe work frame which is 6 metres long by 3 metres wide and fitted with 6 rotor frame spray heads spaced evenly around the pipe work. This frame work can be held into position anywhere on the pond with 4 securing ropes to allow for wind drift, etc.

The solar controller and air regulator that are a part of the Airwell surface pump are located on the Evaporation Pond bank and out of the spray zone.

This pump has been installed on evaporation pond 3 and is linked into the existing poly airline and compressor. No telemetry or reporting capabilities is required for this pump.

The advantages of this pump system are;

- *No electric power required at the Evaporation Pond site*
- *The pump can handle all types of fluid*
- *The spray nozzles have large orifice to handle thick sludge*
- *Air pressure is used to alter the spray pattern of the nozzles*
- *By adjusting the air pressure regulator you are able to alter the mist vapour created by the spray nozzles*
- *The pump will not be damaged if the evaporation pond leachate levels get to low to be pumped*
- *The Airwell system has the ability to operate 24 hours a day regardless of the weather conditions*
- *High quality 316 stainless steel is used throughout the system*
- *All the pipe work in the spray frame structure is made of high grade pro pol pipe materials*
- *Rotor frame spray nozzle are stainless steel*
- *A sacrificial anode is fitted to the pump barrel for extra protection against corrosion from the leachate liquid*



About Leachate Recovery Systems:

Landfill leachate recovery practices can vary from one site to the next, based on the nature of the leachate, how old the site is, the methods used to recover the leachate and what is done with the leachate once recovered.

Leachate can vary in its flow rate, viscosity and corrosiveness even from bore to bore or sump on the same site. Individually, these variables can be quite easily managed. However it is the combination of these variables that make reliable and efficient pumping difficult to achieve.

With these variables in mind, an Airwell air-operated landfill leachate recovery pumping system has several advantages over other methods of pumping leachate such as:

- Increased safety due to NOT having to run power lines around an active landfill site
- Added safety due to NOT having a 240V electrical power supply close to a bore and potentially explosive environment (methane gas)
- Cost savings with no power infrastructure needed close to bores
- Easy to maintain with few mechanical parts
- Adjusts to varying bore yields
- Handles solids and corrosive fluids better than other pumps
- Self-regulating (shuts down automatically when there is no fluid to pump and restarts when fluid is detected)
- Multiple pumps can be operated and controlled from one power source
- Capable of operating 24/7
- Highly suitable for remote control and telemetry options

The ability of the Airwell pumping system to handle low flow or varying yield bores; solids and corrosive fluids; extreme pumping conditions and bores located remote from power are some of the unique features of the pumping system, this making it ideal for leachate recovery on tailing dams and landfill sites.

The Airwell Group has been manufacturing and installing **direct air displacement** leachate recovery systems for tailings dams and landfill sites for nearly 30 years in Australia and currently has systems in operation in several landfill locations around Australia. As well as its landfill leachate recovery capabilities, the Airwell pumping system is also ideal for methane gas well dewatering and gas line low point drainage.

Client Testimonial:

Airwell Group were able to supply and install such a system that has proven to be easy to control, and maintain, as well as being reliable in providing real time data reporting that is critical to the City of Mount Gambier being able to operate the landfill within the constraints of its environmental licence conditions.

Council staff are, at any point in time, now able to dial in to the system from the office, and check pond levels and run time data related to the leachate pump, in both of the landfill cells. This gives staff the peace of mind that the system is operating how it should be without having to check onsite every day.

The City of Mount Gambier was extremely pleased with the workmanship and the system delivered by Airwell Group and would have no hesitation in recommending them to others.

Daryl Morgan
Engineering Manager
City of Mount Gambier

