# Case Study

# Swanbank Waste Management Facility, QLD

**Green File**

The landfill is designed to minimise the production of and contain all leachate, as well as to maximise the amount of gas contained and collected.

Landfill gas is generated from the decomposition of refuse and is primarily methane and carbon dioxide.

In addition to annual environmental monitoring reports to the EPA, monthly waste transportation reports are submitted to the EPA and the Ipswich City Council.

Swanbank Waste Management Facility (WMF) is the first privately owned and operated engineered landfill in Queensland. Comprising 250ha of former coal mines, the site is located adjacent to the Swanbank power station near Ipswich, 50km from Brisbane's CBD.

Together with the engineered landfill at Rochedale and transfer stations throughout Brisbane, the Swanbank WMF provides South East Queensland with a fully integrated waste infrastructure.

**Location**
Ipswich, QLD

**Client**
Owned and Operated by Thiess Services

**Project Time-frame**
1997 -

**Referee**
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**Design**
The Swanbank site provides an ideal location for a WMF, being close to major arterial roads and situated within an industrial area. The main component of Swanbank WMF is the engineered putrescible landfill, designed and constructed by Thiess Services. Swanbank WMF consists of two major stages.

Landfill operations are currently in Stage 1, which is progressively being divided and constructed into fully lined landfill cells. Stage 1 covers approximately 46ha and has an approximate life span of 10 years. Once this Stage has been completed, the landfill operations will progress to Stage 2.

Each stage will be progressively filled in alternating layers of refuse and daily/intermediate cover material to the height of that stage's potential. As each stage is nearing completion, final cover materials and landscaping using native vegetation will be placed.

The landfill cells incorporate a groundwater interception system, a composite clay bentonite mat/high density polyethelene liner, a leachate collection system and a gas extraction system.

**Working with the Community**
Thiess Services is committed to maintaining a strong relationship with the community. Through regular community meetings, sponsorships and educational initiatives Thiess Services is able to communicate effectively with local stakeholders and give back to the community.

**Engineering Innovation**
The facility's location is among some severely degraded coal mines, combined with the need to comply with unprecedented environmental regulations, created a number of design challenges.

Work completed by the project team led to the innovative design of the landfill, and although these design features are unique to the Swanbank site, the principles may be applied to any potential landfill site with a history of mining activity. Design challenges included:
• potential subsidence of old underground workings;
• potential for spontaneous combustion;
• management of landfill gas and leachate;
• existing surface and underground conditions;
• nature of groundwater system; and
• material quality for liner system, cover material and final capping.

**Mine Subsidence and Settlement**
The potential for underground mine subsidence and settlement was a major design consideration, with the integrity of the drainage and liner systems dependent on stable foundations. Design elements to minimise mine subsidence and settlement include:
• the pre-loading of selected areas with landfill construction material;
• the prepared landfill base needed to be mapped to define the natural surface/backfilled open cut interfaces. These areas were evaluated to assess where reworked material needed to be included in the construction program to smooth any potential settlement effects; and
• the provision of a minimum 800mm thick low permeability base and a flexible geo-synthetic lining system designed to enhance the distribution of settlement.

**Spontaneous Combustion**
The presence of burning coal reject stockpiles has focussed attention on the potential problems of combustion associated with the landfill development, particularly in relation to the integrity of the proposed liner system. To prevent spontaneous combustion under the landfill liner, the following innovations have been implemented:
• any smouldering material located within the area of the landfill has been excavated and appropriately managed elsewhere on site;
• evaluation of the presence of heating beneath the low-permeability landfill base is undertaken using a temperature-monitoring program on a 10m grid; and
• evaluation of landfill construction materials is undertaken to ensure any materials with energy contents greater than 1Mj/kg are not included in the liner or in various other cover uses.

**Liner Design**

One of the major differences between an engineered landfill and traditional landfilling methods is the liner system, designed to ensure leachate does not enter the groundwater system.

The successful management of leachate is dependent on the integrity of the liner system. The Swanbank liner system comprises the following:

- depressurisation drainage, consisting of a slotted pipe in a gravel drain with a geotextile cover (used only in areas with an elevated groundwater table);
- a layer of site soils conditioned and compacted to achieve the lowest practical hydraulic conductivity, with a thickness of 0.8m;
- a 1.5mm High Density Polyethelene (HDPE) Flexible Membrane Liner (FML);
- a geotextile protection layer to separate gravel drainage material from the FML;
- a liner system protection layer consisting of selected refuse;
- a Geosynthetic Clay Liner (GCL) over the compacted site soils to provide a very low permeability mineral layer. The GCL is placed over the landfill base providing protection over the areas where leachate could potentially pond;
- a coarse gravel drainage level not less than 0.3m deep with slotted collection pipes embedded in the gravel to act as a leachate collection layer; and
- a collection sump, which leachate gravitates to through the drainage layer.

**Stormwater Drainage Control**

The stormwater drainage system is an essential component of the engineered landfill as it minimises the amount of stormwater that can contribute to the production of leachate.

The Swanbank WMF stormwater drainage system comprises three separate systems:

1. external catchments containing stormwater - designed to collect existing flows and direct them around the landfill back into the existing watercourses;
2. internal catchments with uncontaminated stormwater - designed to collect water from disturbed internal catchment areas in which erosion may occur. The stormwater is collected and channelled to one of the existing sedimentation ponds in which silt will be deposited before the water is directed back into the natural watercourses; and
3. internal catchments with waste contamination potential - contaminated waters are directed into the leachate collection system.

Where applicable, to maximise the efficient sediment collection, a system of hay bales, silt screens and other sediment control devices may be used in cells that are operational.

The final product is a manufactured topsoil product. This topsoil mix is a biosolid enhanced soil product that will be used to rehabilitate the landfill site. Other uses for this topsoil product are also being explored e.g., mine site rehabilitation.

**Swanbank Biosolids Treatment**
Since landfilling commenced at Swanbank in 1997, Thiess Services has endeavoured to create a facility capable of managing every aspect of the waste stream, including biosolids (sewerage sludge). In May 1998, Thiess Services began treating Brisbane Water's biosolids, and since then has won contracts to manage biosolids from other councils including the Sunshine Coast, Ipswich City, Logan City and the Gold Coast.

Thiess Services treats approximately 160,000 tonnes of biosolids per year. This equals approximately 140 trucks per week, each carrying approximately 22 tonnes of biosolids per load. The biosolids is mixed with coalstone and is allowed to cure for approximately six months. It is then put through another mix cycle. This mixing cycle continues until the properties of the mix make it suitable for use.

**ReOrganic Energy Swanbank**
ReOrganic Energy Swanbank is a 'green' waste to energy project that is the only one of its kind in Australia and second only in the world. The project involves the utilisation of leachate recirculation technology to accelerate the production of landfill gas.
The landfill gas is then harnessed and pumped to the adjacent CS Energy power station where it is converted to electricity via a modified boiler in the Swanbank B Power Station. ReOrganic Energy Swanbank Project has the potential to reduce greenhouse emissions by 364 000 tonnes per year, which equates to taking 68,000 cars off the road each year or planting 30,000ha of trees.

ReOrganic Energy Swanbank is endorsed by the Australian Greenhouse Office (AGO), having received a $1 million grant under the Renewable Energy Commercialisation Program (RECP).

**Closure and Post-closure Care**
Prior to the redevelopment of Swanbank WMF, the coal mine operator was required to rehabilitate the mine site as part of its requirements under the Mining Act. Once Swanbank WMF has reaches its maximum capacity, a closure and post-closure care strategy has been designed to rehabilitate the area so it can be used further as a recreational resource for the Ipswich community. Thiess Services has committed to provide for the long-term care and maintenance of the site over a 30-year period

Final capping of the cells will consist of a clay liner covered by a layer of earthern material of a minimum 1m depth. The layers will be capable of sustaining native plant growth to minimise the infiltration of water into the landfill cell and provide effective erosion protection to both the final cover system and the landfill materials.

- A final surface gradient of 5 per cent has been adopted.
- Side slopes will be terraced to minimise slope erosion.
- Stormwater collected on terraces will be conveyed to either the sedimentation system or external water system, depending on the standard of revegetation of the landfill's final capping.

With the redevelopment of the site as a landfill, these rehabilitation requirements were negotiated between Thiess Services, the mining company and the Department of Natural Resources and Mines. An agreement was met which will see the rehabilitation requirements form part of the landfill post-closure plan. Thiess Services has developed a landfill cell rehabilitation plan to comply with EPA regulations. Being a privately owned facility, the plan will incorporate a 30-year period of maintenance including erosion, leachate and gas collection and environmental monitoring.


**Filbert's Place**

In July 2001, 'Filbert's Place', the Swanbank Environmental Interpretive Centre, was launched at the Swanbank MF. 'Filbert's Place' is an environmental interpretive education centre, and is sponsored by Thiess Services and managed by the Keep Australia Beautiful (Qld) Council Inc (KABQ).

*SWANEEE* or Swanbank Environmental Educational Experiences is the educational programme that has been designed to reinforce the importance
of waste minimisation and energy conservation.

'Filbert's Place' is open to students from Years 4 to 12 and the curriculum is in accordance with the current Queensland education regulations. School groups can phone KABQ on (07) 3252 2886 for booking information.