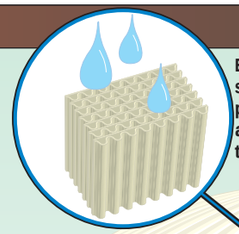
WHAT HAPPENS AFTER YOU FLUSH

Christchurch sends 140 million litres of waste water, or sewage, every day to the treatment works at Bromley. The network of pipes carrying the waste takes advantage of the slope of the Canterbury Plains and Port Hills to carry the sewage by gravity towards the treatment works. More than 70 pumping stations move the sewage from low-lying areas.

Almost all of the sewage is water, but 30 tonnes of solids are removed each day by various treatments at the plant. The aim is to remove all the pollutants and produce an effluent that is near as possible to fresh water, which can then be reused or returned to the environment. The pollutants are also treated so they can be safely reused.

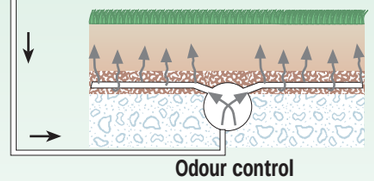


Effluent is sprayed onto a plastic media to allow slime to grow.

Trickling filters

From the primary sedimentation tanks the effluent is pumped to the top of the two trickling filter towers. These towers are 53 metres in diameter and 8 metres high and are packed with a plastic media.

Air passes up through the holes in the plastic media and provides oxygen to the biological slime growing on the media. This biological slime contains helpful micro-organisms such as bacteria and protozoa which feed on the dissolved organic pollution as the liquid trickles down over the media. Portions of the slime are continually breaking away from the media and being washed with the flow into the secondary sedimentation tanks.

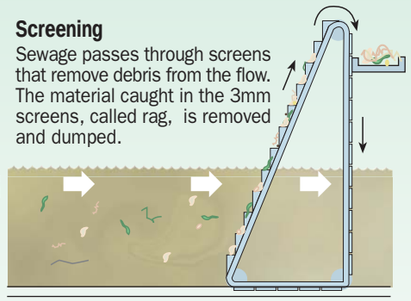


Odour control

Air that passes up through the plastic media is trapped under the large fibreglass domes. It is then pumped through a soil filter where the odorous compounds in the air stream are absorbed on to soil particles and then destroyed by naturally occurring soil bacteria.

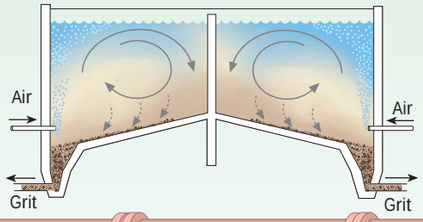
Screening

Sewage passes through screens that remove debris from the flow. The material caught in the 3mm screens, called rag, is removed and dumped.



Pre-aeration and grit removal

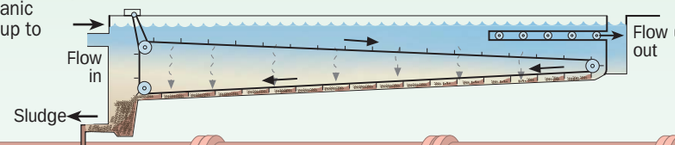
Air is injected along one side of the pre-aeration tanks above the hoppers that the settled grit is pumped from. The injected air provides oxygen to prevent odours, assists in removing fat and grease, and induces a spiral-flow pattern that allows the grit and sand-size particles to settle and be removed while maintaining organic matter in suspension. About 4m^3 of grit is removed each day for burial.

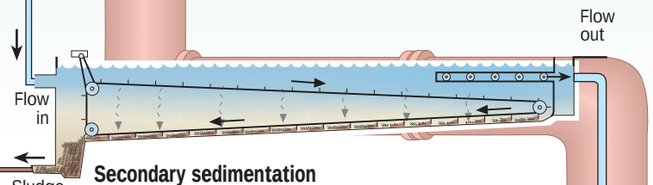


Primary sedimentation

Movement of the sewage in the primary sedimentation tanks is slow. The suspended organic matter settles to the bottom of the tank where a slow moving scraper drags this raw sludge to a hopper at one end of the tank. The sludge is pumped to digesters for separate treatment.

Floating scum is skimmed off using water sprays. These skimmings from the surface are pumped to the digesters with the raw sludge. Primary treatment removes up to 30 per cent of the organic pollution load and up to 60 per cent of the suspended solids.





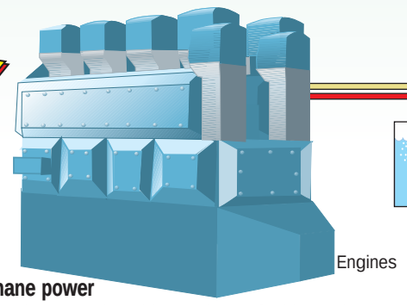
Secondary sedimentation

Slime from the trickling filters is collected on the bottom of the secondary sedimentation tanks and pumped away to the digesters for separate treatment.

The flow passes from the secondary tanks to the oxidation ponds. By the time the effluent reaches the ponds 90 to 95 per cent of the settleable solids and 70 per cent of the original pollution load has been removed.

Electricity is generated to power the waste water treatment plant.

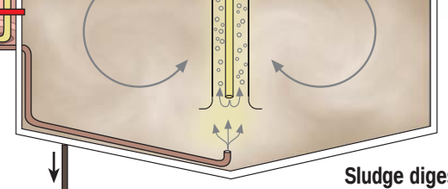
Excess electricity is exported to the national grid.



Methane power

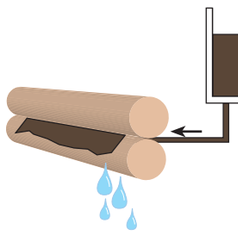
The methane produced is used as a fuel in engines to provide electric power for the plant. Surplus electricity is often exported to the rest of the city.

Heat is recovered from the engines and used to heat the digesters. The methane is also used to fuel boilers when extra heat is required for the digesters or for building heating. Some of the methane and carbon dioxide is separated, and this carbon dioxide is used in tree-growth trials.



Sludge digesters

Raw sludge from the primary sedimentation tanks and the biological solids from the secondary sedimentation tanks is pumped to four digesters. The digesters have a floating cover to exclude air, and are built half above ground and half below ground with the upper half surrounded by a brick veneer for heat insulation. Each digester holds 5000m^3 of sludge and each is heated to 38 deg C. Bacteria break down the sludge releasing carbon dioxide and methane. The process changes the highly putrescible sludge into an almost odourless, free draining material that is stored in open tanks.



Moisture extraction

The treated sludge is taken from storage tanks and compressed to remove most of its moisture. The dried material can then be used as a fertiliser and soil conditioner.

Discharge

After three weeks in the ponds, the remaining effluent is discharged into the Estuary twice a day for the first few hours following high tide. This ensures that most of the discharge moves straight out to sea with the falling tide. Plans are being made to pump the effluent offshore.

The effluent contains little dissolved pollution and virtually all of its suspended material is in the form of green algae and small animals (zooplankton) which are used extensively as a source of food by fish.

The micro-organisms (bacteria and viruses) that remain in the effluent are a mixture of those that survive the pond system and those contributed by the resident birdlife.

Except in an area immediately near the pond outfalls, these micro-organisms do not normally have an adverse effect on the Estuary's recreational activities. In localised areas though, some of them may be accumulated by filter-feeding cockles making them unsuitable for eating.

The effluent contains high concentrations of nitrogen and phosphorus nutrient, a little of which is available for use by macrophytic algae and photosynthetic micro-organisms living in the Estuary. This, in turn, provides more food for a range of benthic organisms such as polychaete worms and cockles, and ultimately fish and birds.

Ultra-violet radiation from the sun kills many micro-organisms in the oxidation ponds.

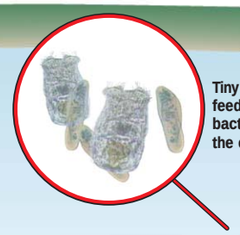
Oxidation ponds

The 230 hectares of ponds removes most of the remaining pollution load and greatly reduces the number of potentially disease-causing microorganisms.

The remaining pollutants settle into sludge at the bottom of the ponds. As the sludge decomposes, gases such as hydrogen sulphide and ammonia are released into the water. Oxygen in the water prevents the gases from reaching the atmosphere.

The level of oxygen is maintained by the combination of wind on the surface of the ponds and photosynthesis in naturally occurring algae. The sun's ultraviolet radiation and feeding by zooplankton kills many disease-causing bacteria and viruses.

The oxidation ponds not only form the final part of the treatment chain for the wastewater, they also include the Te Huinga Manu Wildlife Refuge, an important habitat for a variety of bird species.



Tiny plankton-like animals feed on the remaining bacteria and viruses in the effluent.

The oxidation ponds and estuary support more than 20,000 birds.

SOURCE: CHRISTCHURCH CITY COUNCIL

GRAPHIC: **JOHN HARFORD**