Water Treatment
Waste Water Filtration

A sewage works, such as this, treats nearly forty-thousand cubic-metres of; mainly, domestic sewage each day. At this site, trade waste, from two local food manufacturers, comprises about 8% of the total flow.

Rainwater runoff, referred to as 'Surface Flow' is also treated. For simplicity, we'll refer to all the incoming wastewaters as sewage. The "pollution-load" in the sewage equates to a population of two-hundred and twenty-thousand.

A large works like this requires only four people to operate it, thanks to telemetry, which monitors equipment, and alerts technicians whenever any malfunctions occur.

The raw sewage entering the works passes through six-millimetre mesh-screens. The collected solid matter is called 'screenings', and typically comprises rags, cotton-buds, sanitary products and paper. The screenings are compacted and sent to landfill.

The sewage then flows to a 'grit extractor' of the 'Crossflow type', where road-grit and other inorganic matter, 'settle-out'. This material is subsequently washed, and also sent to landfill.

On leaving the 'grit extractor', the sewage enters the primary settlement tanks. Here approximately 70% of the remaining solid-matter 'settles-out' and forms 'Primary Sludge', which collects in a sump at the bottom of the tank. Periodically, the sludge is pumped away for disposal or for treatment.

Above the sludge lies the 'wastewater'. It now has a greatly reduced amount of suspended solids, and with it, about 30% less Bio-chemical Oxygen Demand or "Bee-Oh-Dee" for short.

On this site, the wastewater is treated in one of three different types of biological system, namely:
biological filters, activated sludge units, or oxygen ditches. When the site first opened there were only the biological filters, but as the site grew and evolved over the years, the Activated sludge units……..and oxygen ditches were installed.

Here you can see the rectangular biological filters; in many works, they're circular. But irrespective of their shape, biological filters are robust and easy to operate.

Micro-organisms growing on the 'clinker' in the bed; break down the organic matter in the effluent.

On leaving the filters, the effluent is dosed with ferric sulphate, in order to precipitate out the phosphates. This prevents 'eutrophication' occuring in the river when the treated effluent is finally discharged at the end of the process.

The effluent then goes to a Humus tank for 'Secondary Settlement', where microbial solids and precipitated phosphate settle-out, and are removed as 'sludge'. You can see that the water looks much cleaner than it was at the inlet!

To improve the water quality further, the effluent is filtered through 'Gravel Filters', sometimes referred to as deep sand filters. Once these filters are full of solids, they're 'Backwashed', and the washings go to the inlet of the works.

The treated effluent is now suitable for discharge to a river.

An alternative to the ‘Biological Filter’ is the ‘Activated Sludge Unit’. Here the wastewater is aerated and mixed by fine bubbles of air blown through hundreds of ceramic or plastic diffusers such as this. The organic matter in the sewage is again broken down by micro-organisms but this time they’re suspended in the mixed liquor in the tank.

The remaining system is the ‘Oxygen Ditch’, where almost one-fifth of the sewage at this plant is treated. Interestingly, the Oxygen Ditch doesn’t require ‘Primary Settlement’. The sewage is aerated with the help of large ‘Brush-Aerators’, and the effluent moves around the ditch, allowing the organic-matter to be degraded by microbes in suspension. On exiting, it goes to a ‘Settlement Tank’ and then to the gravel filter.

Treated effluent from all three systems comes together before discharge into the nearby river.

The ‘Sludge’ from the ‘Primary and Secondary Settling-Tanks’ is thickened in a ‘Picket-Fence Thickener’, …then centrifuged ….and finally, lime is added to stabilise it.

Sewage sludge can be: anaerobically digested to produce a combustible gas, buried in landfill sites, composted or incinerated.
…..but most of it’s transported to farms for use as a soil conditioner.

Water-quality is constantly measured using remote automatic sensors and double-checked periodically by technicians. The final output from this works is very good indeed - about two-grams per cubic metre BOD, eight-grams per cubic metre Suspended Solids, and point-zero-seven of a gram per cubic metre of Ammonia-Nitrogen, which are all well inside the statutory requirements.

Water-quality is constantly measured using remote automatic sensors and double-checked periodically by technicians. The final output from this works is well inside the statutory requirements.

The works can fully treat three-times ‘Dry Weather Flow’. If the incoming flow is greater, then after passing through the grit extractor, the excess cascades over this ‘Weir’ into the channel on the left and flows into ‘Storm Tanks’. Here just under Fourteen-and-a-half-Thousand cubic-meters of sewage can be stored and treated later. This is the equivalent to three-times Dry Weather Flow for two hours.

In the unlikely event that the flow to the works is greater than six times the Dry Weather Flow, the storm tanks are designed to overflow and discharge direct to the river. Only in exceptionally heavy rainfall would this occur; typically about twelve to fifteen times a year.

This isn’t as bad as it sounds:
Firstly, the effluent is highly diluted with rain. And secondly, the river will be in spate, and hence further dilution of the effluent takes place, thus minimising its impact on the environment.

And finally, any discharge direct into the river has the associated and necessary legal consent, issued by the national regulator.