



Simmonds & Bristow

Established 1965 ACN 010 252 418 Pty Ltd

After Flood Advice for your STP

The first and most important thing is to inform the relevant licensing authority (DERM in Qld) that the plant has been affected by the floods (or other such natural disasters) and is no longer producing effluent to the licence standard required. To demonstrate due diligence, it will be necessary to prepare and to communicate planned rectification actions to the EPA or the relevant licensing authority in accordance with the licence conditions relevant to the plant.

Exact rectification steps will vary depending on the type of plant you have, as there are a wide variety of technologies available for the treatment of sewage. Generally the process will fall into one of the following categories.

- Activated Sludge, either as a Continuous Process or a Sequencing Batch Reactor (SBR),
- Trickling Filters or Rotating Biological Contactors (RBC's),
- Membrane Bioreactors (MBR's, a variant on the Activated sludge system),
- Lagoons.



Floodwaters surround the Rockhampton STP. Photo Janie Barratt

If the plant has been inundated:

A number of checks are required before attempting to start the treatment plant. These vary slightly depending on the type of plant.

For an Activated Sludge Plant (Conventional or SBR):

- If the plant has been inundated the first thing to do is to get an electrician to check the electrical systems, primarily the main switchboard and, the aerators.
- Once the electrical system is checked the condition of the tanks should also be assessed to see if there has been any damage to the super-structure or the external pipework.
- Levels of silt should be considered, especially in sedimentation tanks and chlorine contact units that are not actively mixed.
- Silt in aeration tanks with diffusers should be carefully considered, and it should be assessed as to whether the aeration system will provide sufficient mixing to lift the silt and pass it to any sedimentation tanks.
- If the aeration system is capable of suspending the silt, it may be easier to pass the silt downstream into the clarification units and remove it using the waste-activated sludge system. If this is not possible silt will need to be removed from the tanks using a vacuum tanker.
- Chlorine contact tanks will need to be cleaned of any silt, as this will reduce contact time, and maximising contact time when the plant is running impacted is very important to maintain disinfection efficacy.

For a Trickling Filter or Rotating Biological Contactor plant:

- If the plant has been inundated the first thing to do is to get an electrician to check the electrical systems, primarily the main switchboard.
- pumps for a (non-gravity fed) Trickling Filter plant and drive motors will need to be inspected
- Once the electrical system is checked the condition of the tanks should also be assessed to see if there has been any damage to the super-structure or any external pipework.
- Levels of silt should be considered, especially in sedimentation tanks and chlorine contact units that are not actively mixed.
- The waste Activated Sludge system may be used to drain some of the silt, if this is not possible complete draining and cleaning of sedimentation units may be required
- Trickling filters or RBC's should be checked for clogging of the filters/contactors plates and flushed if necessary. RBC discs should be checked for even weighting. If they are not evenly weighted the discs will need to be cleaned as an unevenly weighted discs may twist the drive shaft or shear gears in the gearbox.
- Chlorine contact tanks will need to be cleaned of any silt, as this will reduce contact time, and maximising contact time when the plant is running impacted is very important to maintain disinfection efficacy.

For a Membrane Bioreactor Plant

- If the plant has been inundated the first thing to do is to get an electrician to check the electrical and control systems, primarily the main switchboard and the aerators and membrane systems (feed pumps, permeate pumps, membrane blower, etc). As MBR's feature a high degree of automation the electrical system will be very important and the plant may be off-line until it is completely rectified.
- Once the electrical system is checked the condition of the tanks should also be assessed to see if there has been any damage to the super-structure or any external pipework.
- Levels of silt should be considered, especially in sedimentation tanks and chlorine contact units that are not actively mixed.
- As MBR's do not generally feature sedimentation units the WAS is taken from the aeration tank. Due to this limitation it may be easier to utilise a vacuum tanker to remove any silt from an MBR,

as opposed to using the aeration system to suspend the silt and remove it using the clarifier/WAS. systems.

- Chlorine contact tanks will need to be cleaned of any silt, as this will reduce contact time, and maximising contact time when the plant is running impacted is very important to maintain disinfection efficacy.
- Special care needs to be taken when cleaning out MBR plants;
 - For cross-flow units, consideration should be given to the temporary installation of a bag filter placed before the Membrane units themselves, as grit, silt or detritus (primarily metal shavings or etc) that may have been passed into the tank during the flood event may rupture or damage membrane fibres, requiring replacement of membrane elements.
 - For submerged systems due care will need to be taken when cleaning out tanks.

For a Lagoon system

- Lagoons will need to be assessed for sediment levels and the reduction in process volume. It will need to be decided as to whether the lagoons will need to be emptied and desilted or not. Lagoons with mechanical aerators will need to have the electrical systems assessed
- Lagoons with Imhoff tanks will need to have the Imhoff tanks assessed for structural damage and sediment levels. Again, Waste Sludge systems may be used to remove sediment (in this case Imhoff sludge as opposed to activated sludge)

After initial checks are complete and the plant is found fit-for-service, the plant will essentially have to be biologically re-commissioned. There is generally an optimum sequence for re-starting a treatment plant.

- If available, seed-sludge should be obtained to improve start-up biomass (this is more applicable to activated sludge and MBR processes). This will shorten the time it takes to re-start the biological process, allowing effluent to be brought up to specification promptly.
- If no seed sludge is available new biomass will grow anyway, but it will take longer to reach effluent specification requirements (2-4 weeks depending on design sludge age; could be longer for an MBR or Trickling Filter/RBC).
- For an Activated Sludge plant, an SBR or an MBR, restoring the aeration system should be the first priority, even if other pumps in the process are initially unavailable. Initiating aeration is important to get biomass growth happening quickly.
- For Trickling Filters or Rotating Biological Contactors, it is important to get the spray or contactor rotation systems on line. For trickling filters operated by gravity this will be relatively simple, but pumped systems, or driven systems, will need to have their drives or pumps on-line to function. Similarly with RBC's, the drive motor will need to be online before the system can operate.
- Equally important is getting the disinfection system online and function correctly. If the plant uses chlorine disinfection, the dose should be increased to account for the poor treatment. Free chlorine should be in the range of 0.3-1mg/L in the final effluent, if possible. This reduces the risk of bacteriological contamination.
- After the oxidative and disinfection processes are online, RAS pumping should be rectified. This will enable retention of the new biomass that is now busily growing. If seed sludge is being used, this will allow you to retain the seed as opposed to washing it out.
- Once RAS is online, focus on getting the rest of the ancillary systems operating (i.e service water, waste activated sludge digestion or pressing, etc)
- Take a careful note of the pH and Alkalinity of the process. Since a full de-nitrification cycle will take a while to re-establish, the process will be using more alkalinity than it normally would, which can drive pH down, impacting both nitrification and disinfection. If the pH starts to run low a small plant should be dosed with Soda Ash or similar to increase the pH.
- Once the process biomass starts to reach acceptable levels, the process will need to be re-tuned to achieve acceptable effluent.

If the plant has been impacted by high flows

Even if the plant has not been inundated, it is likely that the operator has been unable to access the plant or that it is accepting very large volumes of water from the raw sewage catchment (part of which may still be under water).

If possible, part of the flow may be bypassed from the pumping stations. This reduces load on the plant but this may only be possible if there are still significant creek or river flows to enable adequate dilution so that pollutant discharges are reduced to 'safe' levels.

Once again the type of plant will alter the recommendations.

For an Activated Sludge Plant:

- Check the process biomass levels and settleability. If the plant has not lost too much biomass it is likely to be quick to recover.
- Check the sludge quality, if the plant has turned anaerobic due to lack of aeration it may be difficult to recover.
- If the electrical system has failed for a reason other than power outage an electrician should check the plant over to ensure that there are no faults or problems.
- If no power is available, a back-up or stand-by generator should be used.
- The aeration system should be re-started as a first priority if it has failed. This will help re-activate the sludge present.
- If high flows are being experienced dosing the aeration tank with Bentonite or Kaolin may help to retain sludge by increasing sludge settleability (preventing or reducing wash-out from clarifiers or shortened SBR settling cycles). The material should be dosed at a rate of approximately 1000mg/L for every litre of aeration tank volume initially, with a daily maintenance dose of between 50mg/L and 100mg/L for every litre of raw influent.
- The chlorine dose rate may need to be boosted to maintain acceptable chlorine levels. Again 0.3-1mg/L of chlorine should be the target concentration after the contact unit. Due to increased flows, the contact unit may not be keeping 30mins residence time. Residence within the contact unit should be assessed and an increase in chlorine dose beyond that required to reach the recommended range may be required.
- Provision of a temporary effluent or raw influent storage may help the plant to overcome short-term high loading, though this will be restricted by the licensing authority's requirements and land availability.

For a Trickling Filter or RBC Plant:

- Again, Check the filters and RBC's for biomass coating. Trickling filters and RBC's are generally more resistant to wash-out as the biomass is attached to media, although excessive flows may have sloughed the biomass from the media.
- If power has been interrupted to an RBC plant the disc's that are not completely submerged should be checked for wetness. If the portion of the disc that is not submerged is dry, it should be wetted down before starting. If this is not done, there is a chance that the weight imbalance will cause the drive shaft to twist or will shear gears in the gearbox.
- If the electrical system has failed for a reason other than power outage an electrician should check the plant over to ensure that there are no faults or problems
- If no power is available a back-up or stand-by generator should be used
- The chlorine dose rate may need to be boosted to maintain acceptable chlorine levels. Again 0.3-1mg/L of chlorine should be the target level after the contact unit. Due to increased flows the contact unit may not be keeping 30mins residence time. Residence within the contact unit should be assessed and an increase in chlorine dose beyond that required to reach the recommended range may be required.
- Provision of a temporary effluent or raw influent storage may help the plant to overcome short-term high loading, though this will be restricted by the licensing authority's requirements and land availability.

For an MBR System:

- Check process biomass levels. If the plant has not lost too much biomass it is likely to be quick to recover.
- Check the sludge quality, if the plant has turned anaerobic due to lack of aeration it may be difficult to recover.
- If the electrical system has failed for a reason other than power outage an electrician should check the plant over to ensure that there are no faults or problems.
- If no power is available a back-up or stand-by generator should be used.
- The aeration system should be re-started as the first priority if it has failed. This will help re-activate the sludge present.
- An MBR is not tolerant to higher than design flows, due to flux rate limitations. The membranes may be over-fluxed for a period but this will increase fouling rates, increasing backwash and cleaning requirements. Operators will need to be diligent in observing automated cleaning cycles to assess whether the membranes are becoming excessively fouled.
- If operating properly, the membrane should remove the majority of bacteria present, although an increase in the chlorine dose rate may still be required. Again 0.3-1mg/L of chlorine should be the target concentration after the contact unit. Due to increased flows, the contact unit may not be maintaining 30mins residence time. Residence within the contact unit should be assessed and an increase in chlorine dose beyond that required to reach the recommended range may be required.

Whether re-starting from inundation or re-starting the plant up after being cut off, testing should be undertaken immediately to assess compliance with your licence parameters.

Routine testing should be conducted weekly until the plant has returned to specification. The licensing authority should be notified once the plant is back in operation. Records should be kept of all actions taken and a full incident report should also be completed, as required by the licence conditions.

