The Queensland Water Directorate

Sewerage Infrastructure Buffer Zones (existing) – Information for Planners
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1. Background

Sewerage collection and treatment services are essential services provided to the community and rely on key infrastructure including networks, pump stations and sewage treatment plants (STPs). As the competition for land and development activities increases, instances of encroachment by sensitive land uses within buffer zones around these assets have become more common. This can pose significant risks to a service provider’s ability to meet its regulatory and environmental requirements as well as risks to the surrounding community from odour and proximity to hazardous materials. Development within existing buffer zones, in particular sensitive land use developments, can also limit the potential to modify existing plants or build new plants to meet future population needs.

While there may be immediate financial advantages to the re-zoning (and sale) of land surrounding existing sewerage infrastructure, there are potential risks which can be very expensive to mitigate making such decisions less beneficial. There are, anecdotally, numerous industry case studies that demonstrate the significant costs involved in upgrading plant facilities to meet stringent and sometimes unachievable odour reduction targets involved.

2. Purpose

The following information has been developed to assist planning authorities regarding development of land near or within sewerage infrastructure buffer zones.

The intention is to prevent development encroaching inappropriately into sewerage infrastructure buffer zones and promote the provision of appropriate buffer zones around sewerage infrastructure in order to minimise the impact of odour, noise, and hazards on nearby sensitive receptors and ensure that sewerage infrastructure is protected for future growth. Where encroachment is inevitable, the intent is to ensure that the real costs of plant upgrades and mitigation measures are appropriately considered in making that planning determination.

The information provided specifically relates to existing sewerage infrastructure and development around those plants, not proposals for development of new plants. New plants are subject to additional approval processes, e.g. those relevant to Environmentally Relevant Activity (ERA 63) under the environmental legislation.

The buffer zone requirement for sewerage infrastructure will be influenced by a number of factors including the nature and size of the plant, the topography, micro climate and the sensitivity of neighbouring land uses. Although this resource provides a general framework for collaborative decision making between planning authorities and service providers, a standard solution will not be possible for all sewerage infrastructure.
3. Best Practice Guidelines for Buffer Zones around sewerage infrastructure

While measures to avoid and minimise the creation of odours from sewerage infrastructure must precede reliance solely on a buffer zone, the use of buffer zones for unavoidable or unexpected amenity issues and protecting the community in unforeseen events is still an essential risk management factor for sewerage infrastructure.

The Queensland Department of Environment and Heritage Protection (EHP) has released a Guideline For Odour Impact Assessment from Developments. The Guideline promotes the use of proper land use planning to avoid incompatible land uses in close proximity to odour causing industries. For the purposes of the guideline, EHP adopts the current Victorian EPA approach on buffer distances (i.e. that they are provided as a risk management tool to manage unexpected, non-routine or accidental emissions) and the Victorian EPA’s Recommended Buffer Distances for Residual Air Emissions, Publication No. AQ 2/86 is to be adopted as the interim guideline on buffer distances. The service provider is likely to have already undertaken the relevant assessments using the Guidelines and therefore should hold the necessary information on the appropriate buffer distances for individual plants.

Although the above buffer zone guidelines are generally accepted as industry best practice, in reality, there may be circumstances where some development within the buffer zone is acceptable. Whilst reductions of the buffer zone could be considered, appropriate modelling, odour investigations and risk analysis should first be carried out.

The Victorian EPA’s Recommended Buffer Distances for Residual Air Emissions, Publication No. AQ 2/86 states that the following criteria should be satisfied before detailed consideration is given to site-specific variation of the guideline distances provided:

(a) The plant has a standard of emission control technology significantly greater than the good level of control assumed in the preparation of this document. Best Available Technology would normally be necessary.

(b) An environmental audit of residual emissions has been completed.

(c) There is no history of complaints arising from residual emissions (in the case of an existing plant).

(d) The plant is significantly larger or smaller than those on which the recommended distance is based, to an extent which will substantially affect residual emissions performance.

(e) There are exceptional topographic or meteorological characteristics which will affect dispersion of residual air emissions.

Before considering any encroaching development applications including changes to existing buffer zones, planning authorities should work with the sewerage service providers to determine whether the guideline criteria set out above have been met.
4. Key issues with encroachment on sewerage infrastructure buffer zones

The rezoning of land surrounding sewerage infrastructure to ‘residential’ is the most common issue and puts the service provider in a position where they may be unable to meet their regulatory obligations or provide for future upgrades due to community growth.

4.1 Environmental obligations and license requirements

The Department of Environment and Heritage Protection (EHP) requires that any new sewerage infrastructure development proposals must meet the following condition - “any release of noxious or offensive odours will not cause a nuisance at any odour sensitive place” (DEHP, p.1). Whilst EHP has no stated role in relation to approvals for development within existing sewerage infrastructure buffer zones, the requirement to ensure that “offensive odours will not cause a nuisance at any odour sensitive place” still exists.

Sewerage infrastructure must meet the requirements for environmental legislation including the Environmental Protection Act 1994 and Environmental Protection Regulation 2008. The Environmental Protection Act 1994 (EP Act) provides for the granting of environmental authorities for sewage treatment activities (ERA 63). Conditions in a plant’s environmental authority will generally state what is and what is not permitted as part of the activity. This will include information on discharges as well as odour and noise. The ability of the WSP to meet its environmental obligations under the authority, in particular in relation to odour, is a key consideration in approval of developments near or within sewerage infrastructure buffer zones. While each plant will have different license conditions, there is always a General Environmental Duty to avoid environmental harm and environmental nuisance which includes odour impacts on sensitive receptors. If the WSP does not meet its environmental duty or requirements set out in an environmental authority, they may be fined under the Act or face other penalties.

Service providers have reported that expensive odour control upgrades don’t guarantee 100% compliance with requirements. Regulatory compliance actions are typically motivated by complaints and adequate distances from sensitive receptors are essential to avoid penalties.

Planning authorities should therefore be aware of the conditions in the STP environmental authority and any penalties for not meeting these conditions.

4.2 Obligation to provide services to the community/capacity for future upgrades

In many circumstances, particularly in larger regional centres and city locations, it is reasonable to expect that population growth and other factors will lead to the requirement for sewerage infrastructure upgrades. Any encroachment into an existing buffer zone is likely to impact the ability to upgrade the plant and this is a key consideration that should warrant discussion with the relevant sewerage service provider. While current odour modelling may demonstrate limited impact from the plant, future planned and expected upgrades must also be taken into account. Encroachment into the established sewerage infrastructure buffer zone that impairs the ability for an upgrade may impact the ability of the service provider to deliver a key service to the community economically.
Unfortunately, modelling information on planned or expected upgrades is not always available. This may be because the upgrade is planned several years’ ahead and the specific technology and sewage infrastructure capacity has not yet been finalised. For high growth regions in particular, future sewerage infrastructure upgrades should be expected and this would ideally be taken into consideration regardless of whether specific modelling is available.

4.3 Cost of mitigating any odour issues due to encroachment

The overall cost of mitigating any potential odour issues through upgrades to the plant facilities should be carefully considered. Any immediate benefit from sale of land may be outweighed by the high cost to retrofit upgrades to meet licence conditions due to the encroachment, and the capacity to apply the costs of upgrades to development activities is typically limited.

While new technology and innovations can enable water service providers to limit odour impacts, it is unrealistic to expect that odour can be eliminated in all circumstances. If odour modelling indicates that odours will be an issue within the proposed development area, the cost to upgrade a STP to meet requirements to contain the odour can be significant particularly when they must be retrofitted to an existing plant.

The overall cost of control is related to the distance from the nearest sensitive receptor, however there are other factors which are specific to the sewerage infrastructure in question. These factors can include whether the system is gravity-fed (meaning fresh sewage) or pumped (meaning stale), and the presence of noxious gases which impact the cost of Workplace Health and Safety controls. Hydrogen Sulfide (H₂S) is the most significant issue. It occurs commonly in sewers through anaerobic digestion, or the break-down of organic matter in the absence of oxygen, and is common in regions with stormwater infiltration issues, and long lengths of pipe. The gas itself is pungent, poisonous, corrosive and explosive.

Further, while odour modelling may indicate limited impact, it may not necessarily take into consideration emergency and extreme events. In these circumstances, the service provider is not exempt from meeting its environmental obligations under the authority to operate the plant and may receive penalties for any odour nuisance.

5 Provision of Buffer Zones in Planning Instruments

To assist in proper land use planning in relation to sensitive receptors, planners are encouraged to work with sewerage service providers to ensure that all sewerage infrastructure (and associated buffers) is appropriately coded in the Local Planning Scheme. This may include using the “Special purpose Zone” (as per Schedule 2 of the Planning Regulations 2017) that provides for public facilities and infrastructure and aims to ensure that incompatible uses do not encroach. The entire buffer zone around the STP (determined by the service provider as per the best practice guidelines above) should be taken into consideration.
5.1 Compatible/Incompatible Buffer Zone Land Uses

When developing draft planning instruments, rezoning and development proposals, planning authorities and service providers should work together to consider compatible development whilst avoiding residential and most commercial development within the buffer zone.

Compatible buffer land uses are generally those which do not warrant a high level of protection from any residual air emissions or other adverse impacts from the sewerage infrastructure and may include open space, some types of recreation areas, public roads, drainable basins, natural bush/forest, constructed wetlands, flora and fauna reserves, certain industries, and agricultural use.

Other land uses may be considered compatible in certain circumstances and individual cases will need to be assessed on their merits. This should specifically take into account site-specific considerations.

6. Other Key Considerations

6.1 Individual modelling (e.g. odour models)

If the sewerage infrastructure and associated buffer is within the zone of a development proposal, it would generally be the responsibility of the proponent of the encroaching development to request a variation to the existing buffer zone, and to undertake any investigations necessary to support its assessment of the impacts of the development on the sewerage service operations. These investigations could include studies on odour, noise, risk analysis and visual impact.

Modelling is however an imprecise science. Modelling can be misused in designing installations, and service providers report that it is commonly a point of contention when developers engage consultants whose modelling produces a contrary outcome to the service provider’s to ultimately lead to buffer reduction. There are one-dimensional and three-dimensional models with different associated costs, and the latter are considered more appropriate in dealing with a range of scenarios including low wind velocities with temperature inversions.

The potential issues with odour modelling and any discrepancies that arise should be discussed between planning authorities and service providers. Where possible, planning authorities are encouraged to rely on the modelling provided by the service provider, whose interests are managing the infrastructure efficiently to minimise hazards and costs to the broader community. Plant modelling (from the initial development) may already exist but may need to be updated to be relevant to current conditions. This can be an expensive and time-consuming process.

It is important to also factor into the modelling assumptions any longer term upgrades to the sewerage infrastructure, to ensure that the modelling does not manipulate a short term outcome without considering the longer term requirements.
6.2 Provision of Information for Land Owners/developers

Planning authorities are encouraged to make end purchasers, potential developers and owners aware of potential odour problems which might occur as a result of their proximity to sewerage infrastructure. This advice should be given at the planning stage (rezoning and subdivision) and/or when land within a buffer zone is sold to a new owner.

Whilst such a strategy would ensure prospective purchasers were not taken by surprise, it would not be a substitute for having appropriate buffer zone requirements and it would not absolve any responsibility under the Environmental Protection Act including requirements of the STP environmental authority. For example, there have been instances in which a developer has offered a Deed of Covenant indemnifying the council from odour complaints by occupants. However, this approach does not preclude the risk of complaints from visitors, and does not bind future owners not negate the service provider’s responsibilities under the Act.
References


Appendix A. Case Studies on water service provider response to STP encroachment proposals

Case Study A

Overview of the Sewerage Infrastructure:

A Wastewater Treatment and Recycling Facility located in regional Queensland that services an estimated population of around 68,000 people. During dry weather the facility provides local cane growers with quality recycled water for irrigation purposes. During the wet the facility discharges to a local creek.

The treatment plant was first built in 2003 and then underwent a major upgrade in 2008 at which point the recycling facility was added.

The facility operates 4 sequence batch reactors (SBRs) (processing tanks) to treat the wastewater. The SBRs are aerated by racks of pipe mounted diffusers as part of the treatment process. Prior to discharge for reuse the final effluent is filtered through sand filters then disinfected using sodium hypochlorite. If the final effluent is being discharged to the Creek it is disinfected using ultra violet radiation. Waste activated sludge (WAS) is transferred from the SBRs to aerated digesters during the settling period. Decanting of excess water occurs in the digesters and thickened sludge is delivered to the centrifuge for final dewatering. Centrifuge cake is taken by truck to a dry storage area this cake is then applied to agricultural land for beneficial reuse.

An odour system was installed at the new recycling facility which consisted of covering inlet works and bioselectors, and extracting and treating the odorous air through a two-stage biotrickling-filter/activated carbon odour control unit.

Odour Modelling:

Modelling was first undertaken for the new upgraded recycling facility in early 2006 as part of the upgrade tender submission. The modelling was further refined through the design development phase with a final report submitted at the end of 2007.

The report concluded that compliance with the Queensland environmental regulator odour criteria at the nearest (existing) receptor was very likely but could not be verified until actual emission rates from the new plant were collected. Emission data was collected upon commissioning of the plant to determine the predictive odour model and confirm compliance with the required odour criteria.

The original modelling recommended a buffer zone for sensitive receptors of 1700m. This was reduced to 1000m in future planning scheme revisions.

The surrounding land use was rural but included several farm houses located on the rural lots (at 600m from the facility).

Development Proposal:

In 2007, the Council received advice that a Development Application for a large residential development within the buffer zone area would be submitted.
The development involved a material change of use for an area of existing land within the buffer zone which involved reconfiguration of a lot for a residential subdivision.

The developer’s consultant argued that because farm houses on the rural land were currently located at 600m of the facility, further residential development at the 600m radius would be unlikely to cause issue and the 1700m buffer was therefore not required.

It was further argued that because the environmental regulator had approved the proposed plant upgrade to the new recycling facility with the farm houses within the 600m that the environmental impact statement of the development had satisfied the regulator (thus again confirming the consultant’s assumption that 600m is an adequate buffer).

The assumption ignored the fundamental differences (additional receptors) between rural land with a farm house and residential land with the proposed 34 lots.

**Court Appeal – Planning Report:**

There were a number of issues with the proposed development (in addition to the buffer zone encroachment) and the application and was initially refused. The developer then lodged an appeal through the courts.

The planning report for the court appeal stated that the development conflicted with a number of planning codes including removal of rural and good quality agricultural land but also that it was to be located in an area affected by nearby activities such as the wastewater and recycling facility.

The report stated in relation to specific amenity issues regarding air quality, odour and noise and whether the specified buffer distance was appropriate that the matters would be best dealt with by other experts in the appeal.

The report further stated that the proposal was in conflict with relevant planning provisions and should only be considered favourably if:

i) An overriding community need for the residential land can be demonstrated;

ii) It can be demonstrated that such a need should/must be satisfied, at least in part, on the subject site; and

iii) The community advantages in doing so would outweigh (override) the planning advantages of maintaining the site for rural land uses, as intended by the Planning Scheme, given its good quality agricultural status.

**Development Application Outcome:**

Despite the planning report, and the fact that the court appeal was not successful, the development was eventually approved by Council, with no consultation with the water business.

Since the approval, there have been odour complaints in the area and the Council has fielded complaints related to the wastewater treatment and recycling facility in question. However, these odour complaints were determined to be attributed to mill ponds from the sugar company and Council modelling has indicated no issues from the actual wastewater and recycling facility.
Future Implications:

The development approval, which subsequently encroached on the existing buffers, represents a poor amenity outcome for the area. It also presents a significant risk of future pressure to retrofit / upgrade odour controls at the facility to deal with odour complaints. The cost for such upgrades would likely be significant. Further, the development may compromise the ability to undertake future proposed plant upgrades to cater for an increasing population.

Case Study B

Overview of sewerage infrastructure

The Wastewater Treatment Plant was first commissioned in 1972. It received a major upgrade in 2011 to increase its capacity. It is designed to service up to approximately 106,500 Equivalent Population (EP).

The wastewater is discharged into a local creek as well as used by a nearby golf course for irrigation. It is also re-used as service water onsite.

The wastewater is undergoes primary screening and grit removal before a bioreactor (anaerobic, anoxic and aerobic) treatment process and then passes through a clarifier. Effluent for discharge is treated with UV and effluent for irrigation is treated via dissolved air filtration flotation and chlorination. Sludge is broken down through an aerobic digester before it passes through the belt press.

The flow balancing tank and inlet area is covered and the gases are extracted and passed through an odour control system. The air from the inlet goes through a filter where odours are removed by bacteria and or activated cabon. The liquid within the filter is circulated to keep bacteria in a moist environment.

Buffer distances

The Victorian EPA’s recommended separation distance for industrial residual air emissions (Table 6: Separation distance for sewage treatment plants (in metres)) was used to determine the appropriate buffer distance for the plant.

The Wastewater Treatment Plant at the time was sized for a population of 106,500 EP with capacity to upgrade to 150,000 EP by approximately 2020.

The separation distance for the 106,500 EP was determined as 1628m and 1936m for the upgraded capacity by 2020.

Development Proposal

The council received a development application for a luxury single dwelling house in an industrial estate on a property adjoining the Wastewater Treatment Plant site. The lot was previously zoned as green space in the City Plan (allowing a caretaker’s residence) and rezoned to conservation zone in the subsequent city plan, allowing a single dwelling house or caretaker’s accommodation.
Odour modelling conducted during the design phase of the plant indicated that the proposed dwelling would be within the 1 hour 95%-ile 2.5 Odour Units (OU) contour boundary and thus the odour level would be too high for the proposed dwelling considered as a sensitive receptor.

Although the applicant offered a Deed of Covenant, indemnifying council from any odour complaints by the occupants, the risk of receiving odour complaints from potential future owners or visitors to the property was still considered too high by the water and sewerage service provider.

**Investigations**

The service provider recommended that the applicant undertake additional investigations to demonstrate no adverse impact on the existing WWTP for moving a sensitive receptor closer to the plant. However, the council planning department believed that the applicant had a right to construct the residence and that it was the service provider that needed to prove the odour issues created an inappropriate risk.

The following options were therefore considered:

- Resuming the portion of land within the 2.5OU contour
- Registration of a volumetric easement
- Upgrade of odour control at WWTP
- Remodel odour of the as-constructed WWTP

**Outcome**

The remodelling conducted by the service provider confirmed that odour levels for sensitive receptors did not extend beyond the WWTP boundary. The application was subsequently approved. After negotiation with Council the owner still provided a volumetric easement for noise, dust and odour over the entirety of their property including a Deed of Covenant to mitigate the risk of complaints and subsequent regulatory action.

Clearly the Planning Scheme holds the key to securing buffer distances if appropriately zoned and not rezoned over time.

Should the existing odour control processes at the plant cease to be effective leading to complaints, additional upgrades will be required to cover the anaerobic and anoxic treatment zones at an estimated cost of $5M.