EMISSION LIMIT GUIDELINES FOR SEWAGE TREATMENT PLANTS THAT DISCHARGE POLLUTANTS INTO FRESH AND MARINE WATERS

DEPARTMENT OF PRIMARY INDUSTRIES, WATER & ENVIRONMENT

Regulatory authorities should ensure that emission limits set for the point source discharge of pollutants to surface waters from new or existing sewage treatment plants are set in accordance with these guidelines unless the regulator considers that site-specific circumstances preclude their use. The advice of the Board of Environmental Management and Pollution Control must be sought where the use of the guidelines is not considered appropriate.

1. Introduction

The Board of Environmental Management and Pollution Control (the Board) is required under the *State Policy on Water Quality Management 1997* (the Policy) to publish emission limit guidelines (ELGs) for a number of common activities which are likely to give rise to point source discharges of pollutants to surface waters. Point source pollution is pollution which is emitted at a discrete, identifiable location, usually via a discharge pipe or outfall, and which can be readily measured.

This document contains ELGs applicable to all new and existing sewage treatment plants that discharge into fresh or marine waters with wastewater flows of less than 500 kL/day Average Dry Weather Flow (ADWF). Emission limits will be set on a case-specific basis for plants above this threshold.

For new plants of up to 2 kL/day ADWF, discharge to surface waters is not acceptable and on-site treatment and disposal is required. This is expected to cover most 'domestic' situations [1]. For existing plants of up to 2 kL/day ADWF which discharge to surface waters and where on-site disposal is not an option, the emission limits for wastewater treatment systems of 2-10 kL/day ADWF shown in Table 1 will apply.

Regulatory authorities must set discharge limits in accordance with these guidelines unless the regulator considers that site-specific circumstances preclude their use. The advice of the Board must be sought where the use of the guidelines is not considered appropriate.

The emission limits specified in these guidelines are derived from an extensive review of accepted modern technology (AMT) within the wastewater industry. They represent a treatment standard that is economically viable and achievable using accepted modern technology.

2. Policy Background

Under the Policy, protection of surface water and groundwater quality is achieved by determining the range of existing values and uses for specific bodies of water, which then provide the basis for setting water quality objectives (WQOs). Any number of the protected environmental values (PEVs) listed below can be assigned to a specific water body:

- Protection of aquatic ecosystems (pristine or modified)
- Recreational water quality and aesthetics
- Raw water for drinking water supplies
- Agricultural water uses (irrigation, stock watering)
- Industrial water supply

The nomination of PEVs is a community-based consultative process involving users, stakeholders and other interest groups. The PEVs for regional waterways will be shown in local government planning schemes or equivalent planning instruments. Once PEVs are assigned to a body of water, the Board will determine the water quality guidelines for key indicators to achieve the specific PEVs. The most stringent set of guidelines are the WQOs for that body of water.

Activities that discharge point source pollutants to surface waters are a potential obstacle to the achievement of WQOs for regional waterways. Local councils are responsible through the Resource Management and Planning System for the prevention or control of pollution in surface water and groundwater by activities within their jurisdiction which are not level 2 or level 3 activities (level 1, 2 and 3 activities are defined under the *Environmental Management & Pollution Control Act 1994*). This role may be shared with other authorities in some areas (e.g. national parks, other crown land). The Board regulates larger scale, level 2 industrial activities such as those in the food-processing, mineral and extractive, and waste disposal sectors.

Limits (including zero discharge restrictions) are to be set on the permissible concentrations and/or loads of pollutants discharging from point sources into the waterway to ensure that the achievement of WQOs will not be prejudiced. The emission limits for sewage treatment plants specified in these guidelines are based on acceptable modern technology and should allow achievement of the recognised WQOs.

The guidelines are primarily intended for use by local government to assist with planning decisions and with the maintenance of WQOs. They will also assist plant managers and engineers in ensuring the use of appropriate technology when designing or upgrading sewage treatment plants.

[1] The operating requirements of these smaller systems are outlined in Standard *AS/NZS 1547:2000 On-site domestic-wastewater management*, the *Code of Practice for On-Site Wastewater Disposal* (Australian Institute of Environmental Health) and the *Tasmanian Plumbing Code*. Premises with wastewater flows of up to 100 kL/day ADWF require accreditation under the *Tasmanian Plumbing Code.*

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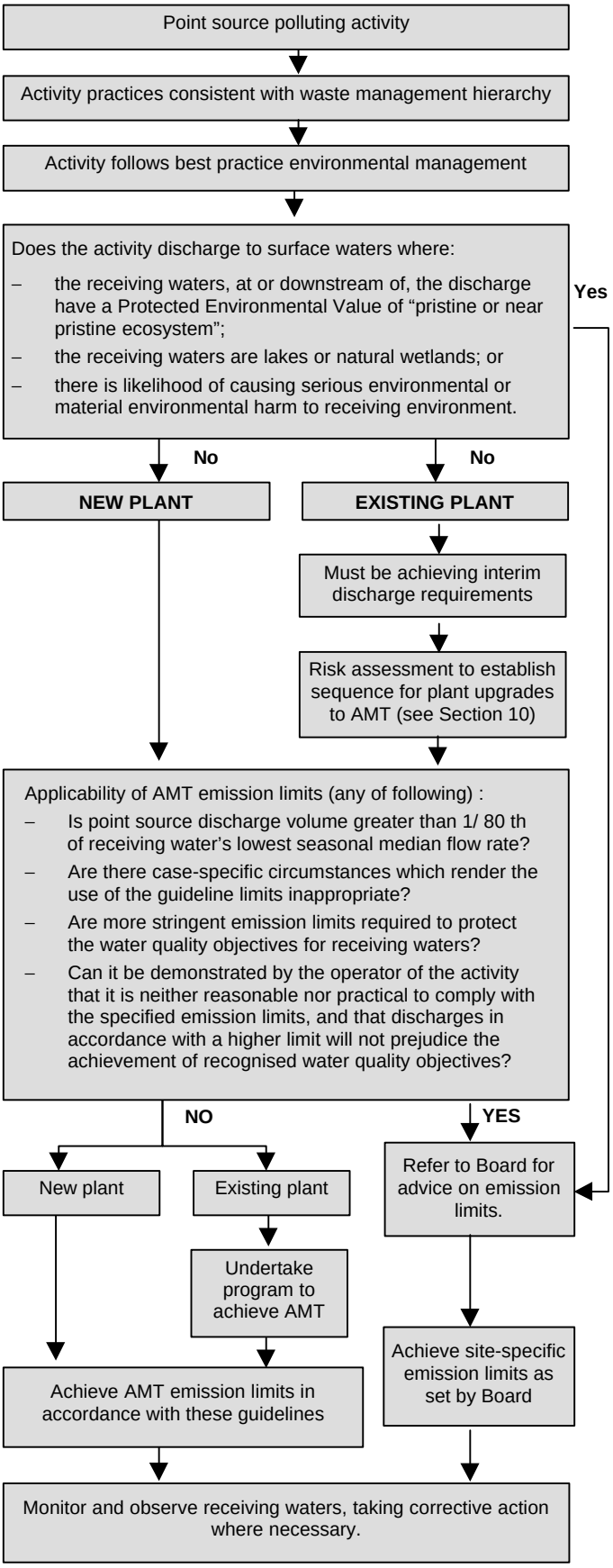
3. When to use the Guidelines?

The decision when to use these emission limit guidelines (ELGs) for effluent discharges to surface waters is based on a number of considerations outlined in the flow chart below. Satisfying these requirements is necessary before adopting the emission limit guidelines.



4. Key Principles for Wastewater Discharge

Both regulator and operator should ensure that activities discharging into waterways are:

- Operating in accordance with waste management hierarchy principles;
- Using best practice environmental management;
- Taking into account the characteristics of the waterways into which they are discharging; and
- Utilising accepted modern technology.

Adoption of all of these principles (Sections 5-9) should ensure the circumstances in which WQOs of receiving waters will not normally be prejudiced and the potential for environmental harm from STPs is minimised. The discharge of effluent from STPs into waterways has a range of potentially harmful impacts linked to contaminants that include high nutrient loads, oxygen depleting substances, pathogenic micro-organisms, elevated salinity levels and toxic concentrations of ammonia, surfactants, heavy metals and biocides.

5. Waste Management Hierarchy

The Policy requires that limits placed on the discharge of pollutants from point sources are consistent with the following hierarchy of waste management, arranged in decreasing order of desirability:

1. waste avoidance;
2. recycling/reclamation;
3. waste re-use;
4. waste treatment to reduce potentially degrading impacts;
5. waste disposal.

It follows, therefore, that before an activity is permitted to discharge effluent to surface waters, regulatory authorities must require the managers of the activity to first demonstrate that the above waste management options have been considered in the order specified and that all reasonable and practical pollutant reduction measures are implemented.

6. Best Practice Environmental Management: Wastewater

Regulatory authorities are to ensure that all activities discharging effluent to surface waters conform to best practice environmental management. Outlined below are a number of measures for possible improvements in the environmental performance of wastewater treatment plants, especially in relation to management of waste streams, the enhancement of effluent quality, and use of alternative re-use/disposal methods.

Effluent Minimisation

Regulators must not permit the discharge of effluent to surface waters unless it is demonstrated that all reasonable and practical measures have been taken to avoid, reduce, recycle and reclaim wastes within the effluent stream.

A detailed examination of the entire sewerage system including all by-products and waste streams will identify possible waste reduction options. The recovery, reuse or recycling of effluent, or materials within the effluent, at different stages in the system should allow positive environmental outcomes through volume reduction or improved effluent quality.

Industrial and domestic wastewater are not to be discharged to surface waters where reticulated sewerage is available, unless the acceptance of wastewater into the sewerage system would compromise the performance of the system's treatment plant(s). Wastewater discharged to a sewer may require pre-treatment to a level where the wastewater quality does not adversely impact on the performance of the sewer network or the sewage treatment plant. A number of codes of practice are available to assist with these and other design considerations. These include the *Code of Practice for Small Wastewater*

Treatment Plants (Environment Protection Authority, Victoria), the *Australian Guidelines for Sewerage Systems – Effluent Management 1997 (*ARMCANZ & ANZECC) and *Guidelines for the Acceptance of Liquid Wastes to Sewers* (DPIWE). Options for improvement of the sewerage system may include:

- Reduction of contaminants and wastewater flows at source – whether industrial, commercial or domestic - achieved by a mix of regulation, education and financial incentives.
- Management of sewerage system to minimise infiltration of stormwater and minimise leakage out of system.
- Design and operational specifications of treatment plants based on detailed analysis of effluent and sludge management requirements.
- Training for plant employees in quality assurance and continual improvement procedures and in relative competencies (e.g. Burnie TAFE Water Industry Operations Certificate).
- Implementation of environmental management systems.

Plant Malfunctions

Discharges occurring during plant malfunctions have the potential to impact adversely on effluent quality, and may result in non-compliance with specified emission limits and cause environmental harm to receiving waters.

Action plans must be developed to ensure that the frequency of overflows due to plant malfunctions (power supply problems, operator error, equipment failure etc.) is reduced and that their impact is minimised. Measures to consider include inflow and infiltration investigations, telemetry for early warning, the construction or extension of retention basins and use of pumping trucks to contain and safely dispose of sewage.

In addition, appropriate contingency plans must be developed to ensure that spills which occur are appropriately dealt with to minimise both environmental impacts and risks to public health. Essential parts of such plans include:

- Clear delegation of roles and responsibilities in the event of plant malfunctions during, and outside of, business hours;
- The setting up of communication protocols both internally and externally (e.g. with DPIWE, Public & Environmental Health Service, Tasmanian Shellfish Quality Assurance Program); and
- The development of a clear strategy to protect public health, including the following: appropriate warning signs and water sampling kits accessible by relevant staff; transport and analysis arrangements for water samples; a comprehensive public information strategy.

Plant Maintenance

Discharges during ongoing plant maintenance operations also have the potential to result in non-compliance with the specified emission limits and cause environmental harm to receiving waters. This risk can be minimised by ensuring that plants are designed and operated with paired parallel processes for as many of the major components of the treatment system as possible. This allows one of the paired components to be operational during routine maintenance.

Where paired systems are unavailable, adequate effluent storage facilities should be included to enable subsequent treatment of effluent received during maintenance periods.

Seasonal Start-up Management

Fluctuations in effluent quality during seasonal start-up may be managed using methods similar to those employed during plant maintenance. Where this is not possible, systems designed to retain capacity should be utilised so that shock loads can be treated without adversely affecting effluent quality (e.g. effluent re-circulation or carbon source addition processes).

Effluent Treatment and Re-Use

Land irrigation of treated effluent is the preferred option in many situations. The discharge of effluent to surface waters should not be permitted unless it is demonstrated to the satisfaction of the regulatory authority that effluent application to land is not practical or would result in a higher net environmental risk.

The factors governing this "beneficial re-use" approach are described in the draft document *Environmental Guidelines for the use of Recycled Water in Tasmania*. Presently available as a working draft, this document will replace the 1994 DELM publication *Guidelines for Reuse of Wastewater in Tasmania*. The main considerations associated with land irrigation are:

- treated effluent quality;
- application rate;
- soil properties;
- odour generation;
- buffer zones;
- storage requirements for wet weather;
- susceptibility of nearby surface water bodies and groundwater resources.

7. Discharge Restrictions due to Receiving Waters

Discharges to surface waters should not prejudice the achievement of recognised WQOs for local waterways. Generally discharges should not be permitted where:

- the receiving waters at, or downstream of, the discharge point have a Protected Environmental Value of "pristine or nearly pristine ecosystem"; or
- the receiving waters are lakes or natural wetlands; or
- there is likelihood of causing material environmental or serious environmental harm to receiving waters.

Regulatory authorities should refer to the Board for advice in the above circumstances.

Due consideration should also be given to the suitability or otherwise of any proposed STP discharge point, particularly in relation to the potential for a given discharge point to detrimentally impact upon established downstream or local estuarine uses such as drinking water offtakes, recreational water sites and aquaculture activities.

Even where activities are permitted to discharge effluent to surface waters, there may be periods during which discharges must not take place. Discharges must not occur at times when the receiving water's flow rate is less than 80 times the effluent flow rate. To cater for situations where only seasonal or intermittent discharges are appropriate, plants should have additional effluent storage capacity, consider land use options or utilise alternative methods of disposal such as evaporation.

8. Where the Guidelines are not Applicable

Regulators should ensure the emission limits based on AMT are adopted, unless:

- the receiving water's flow rate (minimum median seasonal flow rate over the period of record [2]) is less than 80 times the effluent flow rate for plants achieving AMT figures; or
- there are case-specific circumstances which are identified as inappropriate for the use of the guideline limits – e.g. adoption of waste reduction programs and effluent minimisation practices such as evaporation ponds may, while reducing overall pollutant loading, occasionally result in discharge concentrations above these limits; or
- the limits specified in the guidelines will not be adequate to protect the WQOs for the receiving waters; or

[2] Data available from Water Resource Assessment Branch, DPIWE.

- it can be demonstrated by the operator of the activity that it is neither reasonable nor practical to comply with the specified emission limits and that discharges in accordance with a higher limit will not prejudice the achievement of recognised WQOs.

Advice on emission limits must be sought from the Board where the guidelines are not deemed to be applicable.

9. Emission Limits Guidelines - New Plants

Regulators should ensure that new sewage treatment plants permitted to discharge point source effluent to surface waters comply with AMT emission limits (see Table 1). These limits are achievable using accepted modern technology which is economically viable and incorporates both disinfection and nutrient removal. Dilution of the final effluent stream with fresh water to achieve these emission limits is unacceptable.

Table 1: Emission limits – Accepted Modern Technology (Applicable to New and Upgraded Plants)

PARAMETER	FRESH WATERS (MARINE*)		
	50% ile	90% ile	Maximum
BOD (mg/L)	5 (10)	10 (15)	15 (20)
Non-Filterable Residue (mg/L)	10	15 (20)	20 (30)
Thermotolerant Coliforms # (colony forming units / 100mL)	(200)	(500)	200 (750)
Oil and Grease (mg/L)	2	5	10
Total Nitrogen (mg/L) ^	7	10	15
Ammonia – Nitrogen (mg/L) ^	1	2	5
Total Phosphorus (mg/L) ^	0.5 (1)	1 (3)	3 (5)
pH			6.5-8.5

n % ile = n % of samples must be less than the specified limit.

* Emission limits for marine waters (near-shore coastal, bay and estuarine waters) are the same as for fresh waters except where alternative values are specified in brackets. Advice on emissions from marine deep-water outfalls should be sought from the Board.

A maximum faecal coliform count of 200 cfu/100 mL satisfies the requirements for the protection of fresh water environmental values.

^ Plants from 2–10 kL/day ADWF are expected to undertake on-site treatment and re-use. If it is demonstrated to the regulator that all reasonable and practical waste management measures have been taken and discharge to waterways is still required, then AMT nutrient requirements do not apply. However, while numerical limits are not set, there is to be a requirement for additional nutrient reduction measures prior to discharge. Examples of such nutrient treatment devices include modified absorption trenches, intermittently dosed and/or high-pressure dispersion fields, constructed wetlands and sand filters.

While all new sewage treatment plants must be capable of meeting the AMT limits, emission limits specified in new permits should, where possible, reflect the operational capabilities of the individual wastewater treatment system (see Appendix 1).

Regulators should ensure that operators of sewage treatment plants that receive significant volumes of industrial wastes have a trade waste policy to regulate the acceptance of these wastes. The Policy requires trade waste policies to be consistent with the *Guidelines for the Acceptance of Liquid Wastes to Sewers* (DPIWE) and the *Tasmanian Plumbing Regulations 1994* or subsequent reviews of these documents.

10. Interim Discharge Requirements - Existing Plants

Regulators should ensure that existing treatment plants move towards discharge levels equivalent to those achievable using accepted modern technology (refer Table 1). Interim discharge requirements (Appendix 2) are to apply to existing plants over the period set for upgrade to AMT levels. These requirements reflect the performance capabilities of various plant types providing differing levels of treatment.

The timeframe for upgrade is to be case specific and dependent on the environmental effects of the discharge and the practicalities of reducing emissions. While the timeframe for reductions in waste discharges from individual plants is to be determined by the regulatory authorities in consultation with the plant operators, a broad goal is for all plants discharging to waterways to achieve the AMT emission limits within five years.

Waste discharges from existing plants are to be reduced in accordance with the principles set down in the Policy. Regulators should undertake a risk-based assessment of the environmental effects of all existing plants. Those plants with the highest level of risk should be the initial focus of programs to achieve discharges complying with the AMT emission limits.

Aspects to consider in the assessment may include:

- Visual impacts on waterway such as algal blooms or slicks.
- Assimilative capacity of waterway - e.g. relative dilution of discharge, estuarine flushing rates, etc.
- Resident complaints regarding odour or water quality.
- Cumulative impacts of multiple discharges.
- Downstream or adjacent coastal use – e.g. drinking water offtakes, primary contact, aquaculture, etc.
- Site specific information from catchment management plans, endangered species recovery plans, etc.
- High levels of mass loadings of metals or pesticides in plant influent.
- High risk discharge situations (described in Section 7).

The cost-effectiveness of any upgrade or series of upgrades should be compared with the cost of replacement with a plant incorporating accepted modern technology.

Regulators should also ensure that existing plants receiving significant volumes of industrial and trade wastes have a trade waste policy to regulate the acceptance of such waste.

11. Monitoring Plant Performance

Monitoring of discharge helps optimise plant performance and assesses compliance with permitted emission limits. Intensive monitoring will be required during and immediately following commissioning in order to assess a plant's performance against design criteria and to establish optimum operating conditions. Intensive monitoring should continue until plant performance has been evaluated over a range of operating conditions, e.g. seasonal variations in effluent loading, climatic variations. Intensive monitoring will also assist with the refining of plant maintenance schedules.

The frequency of monitoring will be less intensive during the operating life of the plant and may vary in response to:

- situations where plant design capacity is being exceeded;
- change in the receiving waters flow characteristics or water quality; and
- plant performance not meeting design expectations.

For smaller plants, with a design capacity to treat an average dry-weather flow of less than 100 kL/day of sewage, the monitoring regime will be determined by the responsible Council on a case-specific basis. As a general guide,

monitoring should be conducted in accordance with the requirements listed in Table 2. For most parameters quarterly monitoring of the discharge will usually suffice, provided the plant is operating normally and within its design expectations, and provided the achievement of WQOs for the receiving waters is not at risk. If these provisos are not met, as in the case of plant malfunctions, more frequent sampling may be necessary (i.e. perhaps weekly initially and then monthly until optimal performance objectives are achieved). Additional parameters will be monitored (i.e. metals, pesticides) where plants accept trade wastes.

Table 2: Effluent Monitoring Requirements

PARAMETER	FREQUENCY	SAMPLE METHOD**
Flow	Weekly	
BOD* (mg/l)	Monthly / quarterly	Grab
Non-Filterable Residue (mg/l)	Monthly / quarterly	Grab
Thermotolerant Coliforms (cfu/100ml)	At least monthly	Grab
Oil and Grease (mg/l)	Monthly / quarterly	Grab
Total Nitrogen (mg/l)	Monthly / quarterly	Grab
Ammonia – Nitrogen (mg/l)	At least quarterly	Grab
Total Phosphorus (mg/l)	At least quarterly	Grab
pH	Weekly	

* COD can be used where the relationship between COD and BOD has previously been established. This would involve a more intensive monitoring period involving both parameters.

** Composite sampling may be required in high-risk situations, i.e. achievement of WQOs is at risk. 24-hour flow proportional composite sampling is advised for highly variable mass pollutant load discharges, time composite sampling is sufficient for constant mass pollutant loads.

For larger plants, with a design capacity to treat an average dry-weather flow of 100 kL/day or more of sewage, a more intensive monitoring program will be required to address the higher risks associated with these plants. These activities are scheduled as 'level 2' activities under the *Environmental Management and Pollution Control Act* 1994 and the monitoring regime will be set by the Board on a case-specific basis. While it is generally recommended that the plant operator monitor emissions, in some situations the responsible authority may determine this to be inappropriate.

12. Monitoring of Receiving Waters

Authorities responsible for resource management and environment protection should ensure that adequate monitoring of receiving waters is carried out to determine whether WQOs are being achieved. As an example, monitoring upstream and downstream of the discharge of the parameters shown in Table 2 by the point source operator would assist in the long-term achievement of regional WQOs.

The Policy designates a shared responsibility for monitoring involving water resource managers, point source operators, contributors to diffuse source pollution and community-based monitoring organisations.

13. Review of the Guidelines

The current guidelines will be on the DPIWE website. These guidelines will be reviewed periodically and updated to reflect advances in wastewater technology and the trend towards more affordable processes. Emission limits are likely to become more stringent as emerging technologies become more affordable and their usage more widespread. Any comments for consideration at the next review should be sent to:

Environmental Policy Section (Water Quality Management)
Environment, Planning and Scientific Services Division
Department of Primary Industries, Water and Environment.
GPO Box 44, HOBART TAS 7001.

14. Definitions

Accepted modern technology: technology which has consistently demonstrated achievement of the desired effluent pollutant levels in economically viable situations, takes account of engineering and scientific developments in economically viable operations and pursues opportunities for waste minimisation. (National Water Quality Management Strategy '*Policies and Principles: Reference Document*').

Activity: the environmentally relevant activity (as defined in Section 3 of EMPCA) to which these guidelines relate.

Best practice environmental management: management of an activity to achieve an ongoing minimisation of the activity's environmental harm through cost effective measures assessed against current international and national standards applicable to the activity. (as defined in Section 4 of EMPCA).

Environmental harm: any adverse effect on the environment (of whatever degree or duration) and includes environmental nuisance.

Environmental nuisance: the emission of a pollutant that unreasonably interferes with, or is likely to unreasonably interfere with, a person's enjoyment of the environment.

Level 1 activity: an activity which may cause environmental harm and in respect of which a permit is required under the *Land Use Planning and Approvals Act 1993* but doesn't include a Level 2 or 3 activity.

Level 2 activity: an activity specified in Schedule 2 of EMPCA.

Material environmental harm: specified in Section 5 of EMPCA:
(i) it consists of an environmental nuisance of a high impact or on a wide scale; or

(ii) it involves an actual adverse effect on the health or safety of human beings that is not negligible; or

(iii) it involves an actual adverse effect on the environment that is not negligible; or

(iv) it results in actual loss or property damage of an amount, or amounts in aggregate, exceeding the threshold amount.

Reasonable and practical: In deciding what is deemed to be reasonable and practical, consideration should be given to:
(i) The severity of the environmental risk in question and the environmental benefits of removing or mitigating that risk;

(ii) The state of knowledge of the environmental risk and options for removing or mitigating that risk;

(iii) The availability, efficiency and suitability of options to remove or mitigate that risk;

(iv) The financial & social costs of removing or mitigating that risk.

Serious environmental harm: specified in Section 5 of EMPCA
(i) it involves an actual adverse effect on the health or safety of human beings that is of a high impact or on a wide scale; or

(ii) it involves an actual adverse effect on the environment that is of a high impact or on a wide scale; or

(iii) it results in actual loss or property damage of an amount, or amounts in aggregate, exceeding ten times the threshold amount.

15. References

AS/NZS 1547:2000 On-site domestic-wastewater management. Joint Standards Australia/Standards New Zealand Committee.

Australian Guidelines for Sewerage Systems – Effluent Management. Agriculture and Resource Management Council of Australia & New Zealand and Australian & New Zealand Environment and Conservation Council. Canberra. 1997.

Code of Practice for Small Wastewater Treatment Plants. Environment Protection Authority, Victoria, Pub. 500, June 1997.

Code of Practice for On-Site Wastewater Disposal. Australian Institute of Environmental Health (Tasmanian Division).

Environmental Guidelines for the use of Recycled Water in Tasmania. DPIWE. Working Draft in Progress.

Guidelines for the acceptance of liquid wastes to sewer. DPIWE. 1994.

Guidelines for Re-Use of Wastewater in Tasmania. DPIWE. 1994.

Load Calculation Protocol for Sewage Treatment Plants. NSW Environment Protection Authority. 1999

State Policy on Water Quality Management, DPIWE. 1997.

Tasmanian Plumbing Code. DIER. 1994.

Appendix 1: Operational Capabilities for New and Existing Wastewater Treatment Systems

While regulators are to ensure that all new wastewater treatment activities are capable of meeting the AMT requirements listed in section 9, the limits specified in new permits should, where possible, reflect the operational capabilities of the individual wastewater treatment plant. The table below lists some technology based performance limits for new wastewater treatment plants. While these satisfy the AMT guideline requirements for plants that discharge to marine waters, it should be noted that emission limit guidelines for the discharge of total phosphorus to inland waters are not achieved by all plant types.

Plant Specific AMT Emission Limit Maximums (adapted from 1999 *Load Calculation Protocol for Sewage Treatment Plants,* NSW EPA)

PLANT TYPE	BOD mg/L	NFR mg/L	Total N mg/L	Total P mg/L
Activated Sludge Plants Extended Aeration (EA) + Biological Nutrient Removal	15	20	10	5
EA + Ponds* + Chemical P Removal	10	15	5	<1
EA + Ponds + Bio P Removal	10	15	5	5
EA + Ponds + Chemical P Rem + Filtration	5	5	5	0.5
Hybrid Plants Trickling Filters + EA + Ponds + Chemical P Removal	10	15	5	1
Conventional Activated Sludge + EA + Ponds + Bio P Removal	10	15	5	5

* 'pond' refers to detention of effluent for more than 10 days in a form of open effluent impoundment.

Appendix 2: Interim Discharge Requirements for Existing Plants

Interim Discharge Requirements (Maximums) Applicable to Existing Plants in the Process of Upgrading (adapted from Tasmanian plant performance data and *1999 Load Calculation Protocol for Sewage Treatment Plants,* NSW EPA)

Parameter / Plant Type	Bio-chemical Oxygen Demand * (mg/L)	Non-Filterable Residue * (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Oil & Grease (mg/L)	Total Residual Chlorine** (mg/L)	pH	Thermotolerant Coliforms freshwater (marine) (colony forming units/100 mL)
Activated Sludge Plants Conventional activated	15	20	10	40	10	1	6.5-8.5	200 (1000)
Extended Aeration (EA)	15	20	10	20	10	1	6.5-8.5	200 (1000)
EA + denitrification	15	20	10	10	10	1	6.5-8.5	200 (1000)
EA + Ponds	10	15	8	5	10	1	6.5-8.5	200 (1000)
EA + Filtration	8	8	8	20	10	1	6.5-8.5	200 (1000)
EA + Chemical P Removal	15	15	1	20	10	1	6.5-8.5	200 (1000)
EA + Chemical P Rem + Filtration	5	5	0.5	20	10	1	6.5-8.5	200 (1000)
Trickling Filter TF + EA with denitrification	15	20	10	15	10	1	6.5-8.5	200 (1000)
TF + filtration	20	20	15	30	10	1	6.5-8.5	200 (1000)
Lagoons Oxidation ponds	50	50	10	40	10	1	6.5-8.5	2000 (5000)
Oxidation Ponds + Ponds	30	40	10	40	10	1	6.5-8.5	2000 (5000)
Aerated Lagoon	40	40	10	40	10	1	6.5-8.5	2000 (5000)
Aerated Lagoon + Ponds	20	30	10	20	10	1	6.5-8.5	2000 (5000)

* Some plants may have been designed to produce an effluent quality based on the *1974 Environment Protection (Water Pollution) Regulations* and are at maximum load. These plants may adopt a permitted performance of BOD 20 mg/L and NFR 30 mg/L (or BOD 40 mg/L and NFR 60 mg/L where a 50:1 dilution requirement is met).

** Chlorination of effluent is not considered best practice within the definition of accepted modern technology.