



Environmental Factor Guideline

Inland Waters

The environmental objective of the factor *Inland Waters* is:

To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected

Purpose

The purpose of this guideline is to communicate how the factor *Inland Waters* is considered by the Environmental Protection Authority (EPA) in the environmental impact assessment (EIA) process.

Specifically, the guideline:

- describes the factor *Inland Waters* and explains the associated objective
- describes how this factor links with other factors
- describes EIA considerations for this factor
- discusses the environmental values supported by or dependent on *Inland Waters*, and their significance
- identifies activities that can impact inland waters
- provides a summary of the type of information that may be required by the EPA to undertake EIA related to this factor
- describes issues commonly encountered by the EPA during EIA of this factor.

What are inland waters?

For the purposes of EIA, the EPA defines the factor *Inland Waters* as:

The occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality).

Inland waters include groundwater, such as superficial and confined aquifers, and surface water, such as waterways, wetlands and estuaries. A 'waterway' is any river, creek, stream or brook, including its floodplain and estuary or inlet. This includes systems that flow permanently, for part of the year or occasionally, and parts of the waterway that have been artificially modified.

How this factor links with other environmental factors

The EPA recognises that there are inherent links between the factor *Inland Waters* and other environmental factors. For example, changes to the quality or quantity of inland waters can affect flora and vegetation, terrestrial fauna, subterranean fauna, benthic communities and habitat, marine environmental quality, landforms, social surroundings or human health. While impacts to these environmental values will be considered under the relevant factor, the EPA will consider the impacts to *Inland Waters* in concert with these other factors, where appropriate, in order to assess impacts on an ecosystem's integrity as a whole.

The environmental objective for the factor *Inland Waters*

The EPA's objective for the factor *Inland Waters* is: "To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected".

This objective recognises the fundamental link between the hydrological regimes and water quality of inland waters, and the environmental values supported by or dependent on them. These environmental values may include water dependent ecosystems, amenity, cultural values, recreation, public drinking water supplies, and agricultural and industry use of water. This objective also recognises the principle of waste minimisation of the *Environmental Protection Act 1986*.

Therefore, the focus of this factor and its objective is:

- the significant impacts the alteration of the hydrological regime will have on water dependent ecosystems and other environmental values
- how the discharge of waste is minimised
- how any discharge of waste, or use of land or water, will significantly impact on water quality, the local hydrological regime, and the environmental values inland waters support.

Considerations for Environmental Impact Assessment

Considerations for EIA for the factor *Inland Waters* include, but are not limited to:

- the current state of knowledge of inland waters of the State
- the baseline hydrological regime and quality, at the proposal or scheme site, and downstream and/or the surrounding water resource
- pathways through which the hydrological regime and water quality may be impacted
- the water dependent environmental values which are potentially impacted
- the significance of the potential impacts on the dependent environmental values in the context of location, regional cumulative impacts, climate, and other relevant issues discussed in this guideline
- whether the impacts to the hydrological regime or water quality are considered in the context of any published water quality criteria or standards, or appropriate criteria or standards are developed
- whether all analyses are undertaken to a standard consistent with recognised published guidance and appropriate accreditation
- application of the mitigation hierarchy to avoid and minimise impacts to inland waters, where possible
- the level of confidence in predicting the residual environmental impacts
- the risk to environmental values should the predictions be incorrect and whether adequate contingency measures have been considered

- whether proposed mitigation and contingency measures are technically and practically feasible.

When considering the significance of potential impacts to inland waters, the EPA may have regard to the various matters outlined in Section 5 of the [Statement of Environmental Principles, Factors and Objectives](#).

Environmental values supported by or dependent on Inland Waters, and their significance

Environmental value is defined under the *Environmental Protection Act 1986* as a beneficial use or an ecosystem health condition.

The ecosystem health values related to inland waters generally include ability to sustain vegetation, aquatic fauna and birdlife and the ecological processes that support them. The beneficial uses include recreation, cultural and aesthetic values, and the use of water for drinking, agriculture and industry.

For the purposes of EIA and in relation to ecosystem health, the EPA is focussed on impacts to significant ecosystems. Significant ecosystems include, but are not limited to:

- Ramsar sites. Wetlands of International Importance as listed under the [Ramsar Convention](#), an international treaty on the conservation of important wetlands
- Conservation category or Resource enhancement management wetlands as mapped in the Geomorphic Wetlands of the Swan Coastal Plain dataset as managed by the Department of Biodiversity, Conservation and Attractions
- wetlands listed in the Directory of Important Wetlands in Australia
- wetlands protected by Environmental Protection Policies under Part III of the *Environmental Protection Act 1986*
- [wild rivers](#), as identified by the Australian Heritage Commission and Department of Water and Environmental Regulation
- wetland types which may be poorly represented in the conservation reserves system
- springs and pools, particularly in arid areas
- ecosystems which support significant flora, vegetation and fauna species or communities, including migratory waterbirds, bats, and subterranean fauna
- ecosystems which support significant amenity, recreation and cultural values
- saline lakes, estuaries and near shore ecosystems reliant on groundwater or surface water inputs
- downstream marine ecosystems.

In relation to beneficial uses, the EPA is focussed on impacts to significant beneficial uses including but not limited to:

- drinking water supplies
- significant current or potential water supplies, such as regional scale aquifers, and fresh, high order surface water systems
- water supplies which support significant non-potable use and commercial activities
- inland waters with high levels of active and passive recreation including multiple use wetlands
- inland waters with significant cultural and aesthetic values.

Impacts

The development activities that have the potential to impact on *Inland Waters* include, but are not limited to:

- dewatering of aquifers where there are potential impacts to groundwater dependent ecosystems
- disposal of mine dewater to surface water systems, where this may significantly alter the hydrology of the streams, with consequent impacts to aquatic or riparian ecosystems
- additional abstraction of groundwater for consumptive uses including water supply and agriculture, which impact on groundwater dependent ecosystems, connected surface water systems and other water values (for example where the movement of the seawater interface is altered)
- drilling of wells which intercept a number of aquifers, without adequate safeguards to prevent breaching of natural seals or connecting aquifers
- construction of dams or other water off-takes on surface water systems, which significantly affect downstream flows, aquatic and riparian ecosystems or create barriers to fauna movement
- diversion of surface water systems, for example to access mineral resources or to divert poor water quality away from water supply dams
- construction or significant modification to drainage systems which intercept groundwater and have consequent impacts for dependent ecosystems, including those where drainage water is discharged
- direct discharge of waste to surface water systems
- discharge of waste to groundwater aquifers via infiltration or aquifer injection
- discharge of waste to storage or evaporative basins, where there is potential for overflow or leakage
- dewatering discharges where the water quality (temperature, heavy metals, carbonates) is a concern
- new or changed land uses which lead to offsite discharge of wastes, such as nutrient generating activities on low nutrient retentive soils
- irrigated agriculture – salinisation and/or contamination by pesticides/herbicides
- the creation of pit lakes after the completion of mining
- any activity which alters the land surface or dewater aquifers and exposes acid sulfate soils or creates acid rock drainage
- any drainage construction directly impacting on wetlands or waterways or which leads to the discharge of drainage water to wetlands or waterways
- any activity that would impact water quality or quantity on water dependent ecosystems, for example where vegetation clearing could lead to erosion or sedimentation and increased turbidity in wetlands and waterways
- the creation of a road or urban related infrastructure that may result in the filling of a wetland, clearing of wetland vegetation or alteration of the drainage into or from a wetland.

Information required for EIA

Where *Inland Waters* has been identified as a preliminary key environmental factor the EPA may require the proponent to provide information or studies, including but not limited to the following:

- description of studies and surveys of surface water and/or groundwater systems and proposed buffers

- characterisation of the surface water and/or groundwater systems, including climatic influences on water availability and, where relevant, location, hydrology, water quality, catchment boundaries, geology, hydrogeology, and connectivity, locally and regionally
- description of the environmental values of the surface or groundwater systems
- information on the water to be used in the proposal or scheme, and other current and potential water use in the area
- description of how excess water is to be disposed of and how this might impact the environment
- characterisation of the waste generated, the pathways for potential contamination, and quantification of how the proposal or scheme will impact water quality, where necessary through the use of models
- modelling the impact of water abstraction and use for the proposal or scheme on water regimes and other users, including the assumptions and uncertainties of the modelling and supporting data
- predictions of the changes to surface and groundwater water regimes as a result of the proposal or scheme
- the potential consequences of any hydrological or water quality changes on downstream waters such as estuaries or the marine environment
- predictions of the likely impacts of water use and changing water quality on water dependent ecosystems and other environmental values
- evaluation of the significance of the potential impacts (direct, indirect and cumulative) of the proposal or scheme on inland waters in a local and regional context
- description of the approach to maintaining well integrity for wells which intercept multiple aquifers
- description of monitoring, mitigation, management, closure and rehabilitation arrangements
- information on the predicted outcome of the proposal or scheme against the environmental objective for inland waters and discuss whether there is likely to be a significant residual impact
- description of the adaptive management and/or contingency planning in the instance that predictions are incorrect.

Issues

The following issues are matters that are commonly encountered by the EPA due to the nature of proposals and schemes that are referred to it. Background on these issues is provided here to help proponents and the community engage with EIA. This issues section will be updated from time to time to reflect new issues as they arise in referrals and EIA.

Identifying and managing buffers in wetlands and waterways in the South West

Many referrals in the South West, including the Swan Coastal Plain, involve an impact on a wetland or waterway. Information received from proponents often lacks detail about adequate buffers. The EPA encourages proponents to clearly outline how they have applied the mitigation hierarchy for any proposal or scheme near a wetland or waterway to avoid environmental impacts. Some impacts can be avoided through maintaining adequate buffers between the proposed activities/ land uses and the wetland or waterway.

The EPA encourages proponents to conduct appropriate buffer studies to justify any proposed buffer. The EPA considers a buffer adjoining a wetland or waterway helps to maintain the ecological and hydrological processes and functions associated with the

wetland or waterway, and aims to protect it from potential adverse impacts. A buffer also helps to protect the community from potential nuisance insects, for example, midges. To maintain wetland and waterway environmental values, it is important to determine, protect and manage an adequate buffer. Buffers should be measured from the geomorphic wetland boundary.

Changing water regimes in the South West

There has been a significant overall downward trend in runoff and recharge in the South West as a result of reducing rainfall over the past 40 years. This has contributed significantly to declining groundwater levels and reduced stream flows. In turn, in-situ values and water availability for use have been significantly impacted.

The EPA will consider impacts on water regimes in the context of the historic, current and predicted future cumulative impact to those systems, and this includes where water regimes have been significantly impacted as a result of changes to rainfall.

Variable knowledge of groundwater and surface water systems

The level of understanding about groundwater and surface water systems and the values they support varies considerably across WA. Where knowledge is good, the impacts from proposals and schemes will be better informed by science, enabling the EPA to have greater confidence through the EIA process.

A key issue for the EPA is the level of understanding about the various sedimentary basins and the aquifer systems which may be impacted by oil and gas development. There is generally a good fundamental knowledge about the Perth Basin as a result of many years of investigative work and monitoring. The hydrogeology of the Canning, Carnarvon and Officer basins are less well understood.

For all proposals and scheme assessments which significantly impact on inland waters, the EPA will take into account the level of knowledge in determining the environmental impacts and risks. While region-wide studies are beyond the capacity of any individual proponent the EPA will encourage cooperative efforts to build information about poorly known systems which may be targeted for future proposals or schemes.

Surplus water discharge to creeks and wetlands

Dewatering is an essential component of many mining operations where mining occurs below the water table. Excess water not used through the mining operation is often discharged to local waterways, which can alter hydrological regimes with consequent changes to ecology and potential destabilisation and erosion of banks.

The EPA considers that disposal of excess water to waterways should only be undertaken after other potential uses have been maximised, including mitigating environmental impacts, fit for purpose on-site activities, meeting the demands of other water users, and aquifer reinjection.

Reduced groundwater and surface water quality due to diffuse source impacts

As a legacy of past land use decision making and ongoing land uses practices, there are a number of areas around Western Australia where water quality has been significantly impacted by diffuse source pollutants.

There are two areas of particular interest to the EPA:

- the impact on waterways, wetlands and estuaries of diffuse source nutrient pollution, which manifests as phytoplankton or macro algae blooms, loss of seagrass, fish deaths, and other signs of eutrophication
- the impact on drinking water supplies from a range of pollutants including nitrates, phosphates, hydrocarbons, and microbiological contaminants.

The EPA supports land uses which are compatible with land capability. Proposals and schemes should consider the pathways through which pollutants may impact on inland water quality.

Creation of mine pit lakes

Mine pit lakes are created when mining is undertaken below the water table and where mine pits are not backfilled at the completion of mining. The water quality of mine pit lakes reflects the surrounding geology, hydrogeology and soils, and is also influenced by rainfall and evaporation rates.

The EPA is primarily concerned with the creation of mine pit lakes in the following circumstances:

- arid environments where introduction of a permanent water supply may give rise to other environmental impacts, such as increased feral predator numbers; and
- where there is a risk of poor pit lake water quality through acid rock drainage, such as toxic concentrations of heavy metals.

The EPA will examine the extent to which the short to very long-term (multi-century) environmental risks associated with the creation of mine pit lakes have been eliminated or minimised.

Waste structures, including tailings storage facilities

Many development activities, including mines, require the storage of large quantities of waste materials. Waste structures, including tailings storage facilities and waste rock dumps can cause impacts to water quality during operations and/or after operations cease.

The areas of particular interest to the EPA include:

- the appropriate siting of waste structures in a catchment (considering surface and groundwater systems, and sensitive receptors);
- the nature of the materials stored in the waste structures, as there is the potential for erosion, oxidation of acid forming materials, and metals and other elements to seep into groundwater and surface water systems;
- the availability of suitable material to encapsulate (and neutralise) waste that could cause contamination; and
- the design, monitoring and management of waste structure to avoid impacts, taking into account appropriate standards.

Aquifer recharge

Aquifer recharge involves the infiltration or injection of water or wastewater into an existing groundwater aquifer. Aquifer recharge can occur for a range of purposes, including:

- as a disposal method for mine dewatering;
- to recharge aquifers to increase groundwater yield for drinking or other water supplies; or
- to recharge aquifers to increase water levels in order to maintain groundwater dependent ecosystems such as wetlands.

Depending on the quality of the recharge water compared to the quality of receiving aquifer water, aquifer recharge has the potential to either improve or degrade water quality. The EPA's focus when considering aquifer recharge is to ensure that there is no significant deterioration of water quality and that there are no significant impacts on associated environmental values.

Growing abstraction in poorly understood regions - irrigated agriculture

Abstraction of water is increasingly becoming an issue through small incremental pressures in the south west and larger proposals in the north. There is increased interest in developing irrigated agriculture proposals in Western Australia, particularly in the north of the state. The size of the proposals can range from several hundred to several thousand hectares. Some of the proposals would require significant water supplies. The EPA considers that the potential impacts of the proposal on water related environmental values come not only from the abstraction of water from the environment, but the discharge of water when irrigation takes place. These impacts include potential for salinisation due to raised water tables and the contamination of water resources from pesticides, herbicides and other chemicals used by the agriculture proposals.

To assist the EPA to understand the implications, the EPA expects proponents of proposals requiring large abstraction of water such as for irrigated agriculture, to provide the EPA with additional hydrological information where knowledge is lacking and to develop comprehensive environmental management plans for their proposals that address the overall management of the proposal to prevent significant environmental impacts.

Potash proposals on salt lake systems

The EPA has received referrals from several proponents looking to abstract potash rich brines from the surface and/or groundwater associated with salt lakes in the more arid areas of Western Australia. These salt lakes can support many unique environmental values, which may be impacted by changes to hydrological regimes.

Issues of particular interest to the EPA are:

- disturbance of the lake surface that may change the flooding regimes leading to inundation of areas outside the lake surface with saline water that are not normally inundated;
- the impacts of the disposal of large amounts of excess salt from evaporation basins, which may be on the lake surface; and
- how this impacts on water quality and surface water flows on the lake in the long term following closure of the proposal.

These are in addition to the normal issues of finding freshwater sources in the arid regions of Western Australia and the management of these water sources to prevent environmental impacts.

Version	Change	Date
1.0	(Initial version) This document replaces the following documents: Environmental Protection Authority 2016, Environmental Factor Guideline: Hydrological Processes, EPA, Western Australia. Environmental Protection Authority 2016, Environmental Factor Guideline: Inland Waters Environmental Quality, EPA, Western Australia.	29 June 2018

Environmental Protection Authority 2018, *Environmental Factor Guideline: Inland Waters* EPA, Western Australia.

This document is available in alternative formats upon request.

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