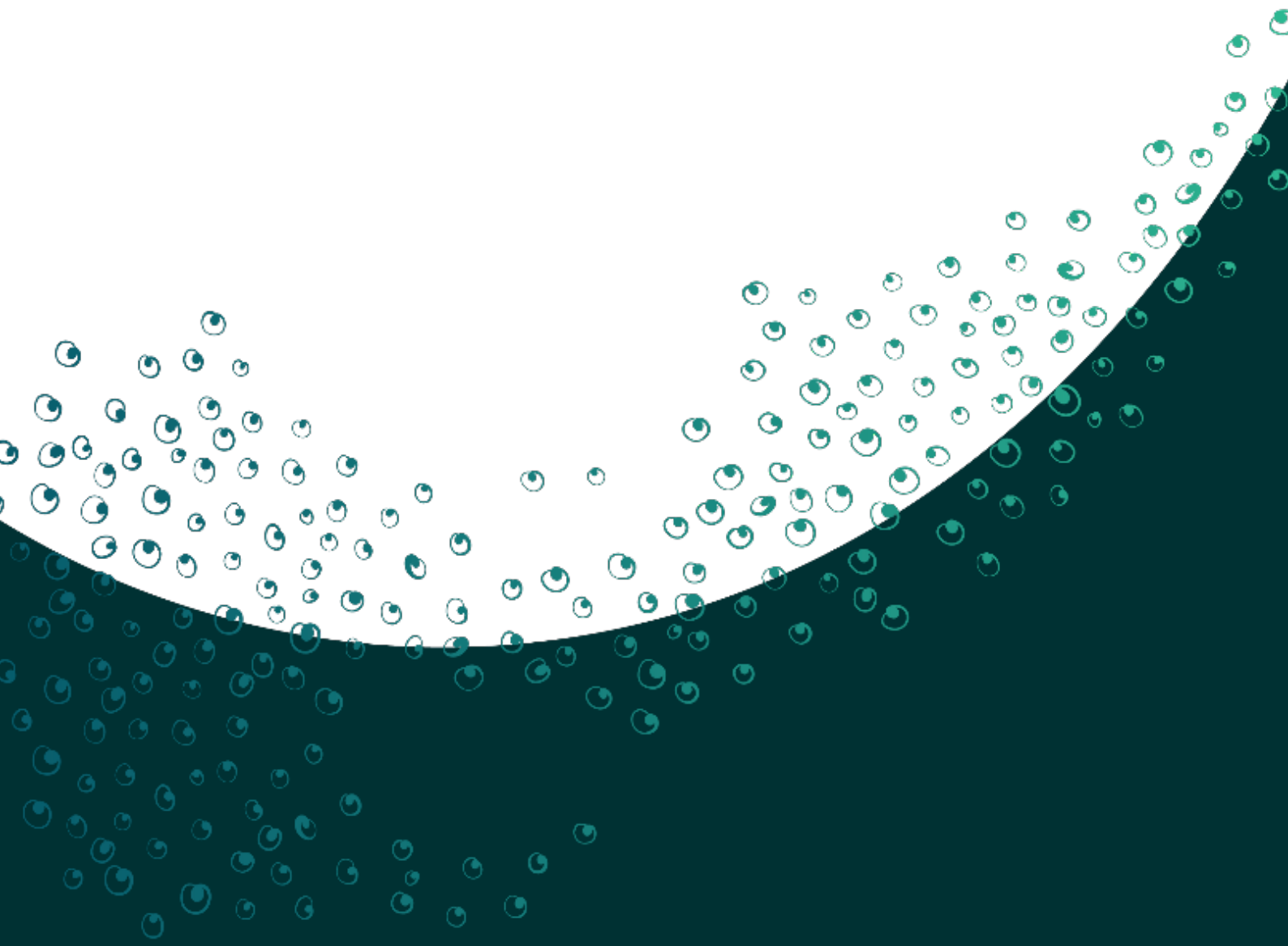

Water

EIS information guideline

Queensland Government

Prepared by: Environmental Impact Assessment, Operational Support, Department of Environment and Science

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Contents

Introduction

This guideline advises proponents about the information and assessment requirements in relation to water resources, water quality, and associated environmental values when preparing an environmental impact statement (EIS).

Legislation and policy

In Queensland, water resources and water quality are primarily regulated under the *Water Act 2000* and its subordinate legislation. The dictionary in the Water Act defines many of the terms that are relevant for an EIS, such as overland flow water, a floodplain, and a levee. The Water Act's subordinate legislation includes many Water Plans for various catchment areas of the state.

However, some aspects of managing water are regulated under the *Environmental Protection Act 1994* and its subordinate legislation, particularly with regard to environmentally relevant activities, including resource activities. An environmental authority for an environmentally relevant activity would typically include conditions for managing water at the activity's site.

The Department of Natural Resources, Mines and Energy (DNRME) administers most parts of the Water Act, while the Department of Environment and Science (the department) administers the Environmental Protection Act and Chapter 3 of the Water Act. Chapter 3 of the Water Act regulates underground water impacts due to resource use. The regulation of underground water rights and obligations under the Water Act and Environmental Protection Act was reformed in December 2016. The rights, obligations and regulation that previously applied to coal seam gas extraction activities have now been extended to mining.

What should be addressed in an EIS?

The following sections describe the typical information requirements for addressing water matters in an EIS. However, this guideline is not exhaustive, and the project's scope and location may require the EIS to provide additional information and assessment. For some projects, some matters outlined below may be irrelevant. If a particular matter is not relevant, the EIS should demonstrate why the matter is not applicable to the proposed project.

The guidelines Application requirements for activities with impacts to water (DES 2017), Requirements for site-specific and amendment applications – underground water rights (DES 2016) and Application requirements for petroleum activities (DEHP 2013) provide additional advice on the scope and detail of information needed by the department when deciding an application for an environmental authority. The EIS must provide that information. Proponents should carefully consider the appropriate level of detail that is needed because an EIS that provides insufficient information will delay the assessment process.

When this guideline requires a matter to be described, use appropriate maps, diagrams, charts, and/or photographs to illustrate the description.

Assessing impacts on water resources will necessarily overlap with assessing aquatic and terrestrial ecology, groundwater dependent ecosystems, and other matters. Ensure the various parts of the EIS holistically assess all impacts related to water and are fully cross-referenced.

Who may assess and prepare an EIS?

If they do not already employ people with the necessary expertise, proponents should engage experienced consultants who understand the complexities of investigating and assessing water resources, water quality, and associated environmental values to help prepare the EIS.

Water sampling, characterisation and monitoring

An EIS for a project that would, or potentially could, impact on water resources typically requires detailed site-specific information on the characteristics of the resources. Obtaining this information may require gathering background information over an extended period of more than a year. It may be that some information is already available from private or government monitoring programs, such as those operating stream-flow gauges, groundwater bores, and/or regular water quality surveys. However, in the absence of readily available and suitable information, proponents must anticipate the needs of the EIS, and be prepared to expend the time and effort

needed to obtain the necessary input information through their own monitoring and investigations. Depending on the circumstances of the site and the proposed project, the effort may include installing stream-flow gauges, cased boreholes, and water quality sampling devices. Monthly water sampling for two years is typically the minimum time needed to understand seasonal variations in water quality.

An essential early step is identifying environmental values of the site and its surrounds, including those that could be impacted by the project's changes to hydrology and water quality. Section 9 of the Environmental Protection Act defines *environmental value*, while the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water and Wetland Biodiversity)), particularly its Part 3, expands on the concept in relation to water resources. Proponents should also use other sources, such as the Australian and New Zealand guidelines for fresh and marine water quality (ANZG 2018), when identifying environmental values.

The next step is to identify the indicators that should be monitored to assess the condition of each environmental value. Section 8 of the EPP (Water and Wetland Biodiversity) states that: 'An *indicator* for an environmental value is a physical, chemical, biological or other property that can be measured or decided in a quantitative way.' There is no single set of indicators that would be suitable for all types of projects. The indicators must be chosen with regard to the environmental values and the potential impacts of the project. The indicators must include a range of physical, chemical, and biological indicators for any waterway, creek, groundwater, or wetland system. This would typically include, but not necessarily be limited to, water quality indicators likely to be affected by the project, such as pH, electrical conductivity, turbidity, suspended sediments, organic compounds, and metals and metalloids in both filtered and unfiltered samples. Depending on the circumstances, in addition to monitoring hydrology and water quality, it may be necessary to monitor ecological indicators of associated environmental values, such as: aquatic and benthic plants, animals, and macroinvertebrates; groundwater dependent ecosystems; and stygofauna. Also, undertake sediment monitoring where the likely impacts of the proposed project could occur. For example, if the project would mine and/or process metal ores, the program would typically monitor toxic heavy metals and metalloids concentrations in sediments from locations that might receive discharge, runoff, or air dispersal of dust from the project. Sediment monitoring should also include characteristics such as particle size distribution and chemical species in the water column that can bind to, or precipitate as, fine sediment.

Proponents must be able to demonstrate that all monitoring programs conform to current best practice. All water sampling must be performed in accordance with the department's Monitoring and sampling manual (DES 2018) or its most current edition. Monitoring programs must have clearly defined objectives related to the changes that may or may not occur when the project is developed and operated. The design of a monitoring program for baseline data must also consider the potential impacts of the project, so that a relevant monitoring program can continue to be used following the start of development to detect impacts (intended and unintended) and assess the effectiveness of impact mitigation measures. The number of samples must satisfy the requirements of the Deciding aquatic ecosystem indicators and local water quality guidelines under the Environmental Protection (Water) Policy 2009 and Australian and New Zealand guidelines for fresh and marine water quality guideline (ANZG 2018). All monitoring programs must have control and/or reference sites that would be unaffected by the project but equally or similarly affected by external influences, such as climate variations. The spatial extent of all monitoring programs should go somewhat beyond the predicted area of effect of the project to provide a margin of error in case the prediction is underestimated.

The number and locations of stream monitoring points must be sufficient to characterise the quantity and quality of the inflows and outflows of the project site. They must also be sited to adequately monitor the potential impacts of any discharges from the project beyond the downstream mixing zone. In addition to creeks and rivers, surface water sampling sites should include such features as ephemeral drainage lines, permanent and semi-permanent water holes, wetlands, known aquatic habitat, weirs, and in-stream dams.

The number and spatial distribution of groundwater monitoring sites must be sufficient to provide an understanding of the following matters: groundwater gradients; flow directions; recharge and discharge processes; water levels in each relevant hydrogeological unit (including any shallow alluvial aquifers); groundwater quality; springs; and wells. Groundwater monitoring bores must be cased to isolate their sampling to the aquifer or geological unit they target. The groundwater data must be suitable for recalibrating the groundwater flow models to predict any impacts, and the monitoring equipment used (e.g. vibrating wire piezometer, standpipe) must be reliable and suitable for providing that required data.

Provide information on the monitoring bores, including drilling logs, spatial coordinates, and information on the targeted aquifer.

The frequency of sampling or data collection of any monitoring program must be sufficient to provide statistically significant results when assessing seasonal variability. The frequency must also be sufficient for the early detection of impacts if the project goes ahead.

Existing water resources and values

Surface water resources

Describe the catchment area in which the site is located—the state's defined catchment areas may be viewed on the DNRME's website. Many catchments and areas of the state have Water Plans as subordinate legislation to the Water Act. Identify the area's Water Plan, outline the water to which the plan applies, and describe the plan's environmental flow objectives, their performance indicators, and any relevant measures.

Describe the surface water resources of the site and the surrounding area to the spatial extent that the project might impact on, or otherwise affect, surface water resources—in some cases, this may be a significant distance downstream. Use the watercourse identification map (Business Queensland 2019), available on the Queensland Globe, to distinguish between surface water features (watercourses, lakes, and springs) and overland flow water (drainage features) on the project site and adjacent land. Describe the regional and local drainage patterns. Provide a map (or maps if needed) of the site and its surrounds that distinguishes the surface water and drainage features. Include all rivers, watercourses, ephemeral drainage lines, wetlands, dams, weirs, waterholes, estuaries and marine waters. To illustrate the directions of stream flow and overland flow, the maps must have contours at appropriate increments, which in areas of low relief should be at 1m spacing.

Describe the significance of the surface waters to the river catchment system in which they occur.

If the site already has a stormwater management system, describe and illustrate it. This should include any farm drains or instances where natural drainage has been changed by earthworks, and any installed stormwater quality improvement devices.

Describe and show on maps any potentially affected locations where water is authorised to be impounded or extracted from surface waters (including overland flow), such as for drinking supply, stock watering, irrigation, and industrial or resource activity uses. Also, describe any potentially affected locations where water is used for recreational purposes, such as boating, swimming, or fishing.

Describe the hydrology of watercourses and overland flow in the project area and any downstream locations potentially affected by the project. For projects that would have a significant impact on surface water, develop a hydrological model of current conditions that would also be capable of modelling the potential impacts. Use the Integrated Quantity and Quality Model (IQQM) model, eWater Source Rivers software, or similar modelling tools with all available hydrological data and appropriate modelling assumptions.

Describe the relevant pre-development streamflow characteristics, illustrated by hydrographs, including first-flush effects, the timing of flows, frequency, duration of flow events, magnitude and rate of change of flows that might be impacted by the activities. Assess whether upstream users have altered the flow regime. Provide plots of flow (cumecs) versus flow duration (per cent) to identify the flow duration of high-flow, base-flow and no-flow event periods. Assess the quality of the data used in the modelling, and comment on the model's sensitivity to inaccurate data.

Provide details and maps of the likelihood and history of flooding, including the extent, levels, and frequency of floods in and around the project site. Flood studies must include a range of annual exceedence probabilities for potentially affected waterways, based on observed data if available, or use appropriate modelling techniques and conservative assumptions if there are no suitable observations. Include the probable maximum flood. The flood modelling assessment should include local flooding due to short duration rain events at contributing catchments, as well as larger scale regional flooding. Include any locations in which flooding might be increased or decreased by the project.

Describe, with supporting photographs, the geomorphic condition of any watercourses likely to be affected by disturbance or stream diversion. The results of this description will form the basis for the planning and subsequent monitoring of rehabilitation of the watercourses during or after the operation of the project.

Identify and describe (in general terms, omitting personal information in the EIS) existing users of surface water resources that might be impacted by the project, including those who have an entitlement that is currently unused.

Describe the monitoring program(s) that provided the data used in the assessment of existing surface water resources.

Groundwater resources

Provide an overview of the aquifers, aquitards, and geology that would be impacted or altered by the project, and particularly mention whether or not the geology is part of the Great Artesian Basin. Use the guideline Using

monitoring data to assess groundwater quality and potential environmental impacts (DSITI 2017) when developing the EIS.

Describe the hydrogeology of the site and any area outside the site that might be potentially impacted or affected by the project. Describe in detail the nature and hydrology of the aquifers of the potentially affected area, including:

- geology, stratigraphy, and geological structures (e.g. faults, folds)
- aquifer type—such as confined, unconfined, karst or perched
- depth to, and thickness of, the aquifers
- the significance of the resource at a local and regional scale
- depth to water level, and seasonal changes and long term trends in levels
- groundwater flow directions (derived from water level contours)
- water quality
- hydraulic characteristics
- connectivity between aquifers
- interaction with surface water, including recharge and discharge (e.g. springs, or bank storage)
- recharge and discharge rates
- interaction with groundwater dependent ecosystems
- interaction with saline water
- vulnerability to pollution
- any routine injection of water occurring to the aquifer.

Identify and describe (omitting personal information in the EIS) existing users of groundwater resources that the project might impact, including those who have an entitlement that is currently unused. Include a survey of existing groundwater supply facilities (bores, wells, or excavations) to the spatial extent of any potential impacts. Include and analyse the following information:

- location of potentially affected bores or wells
- bore details such as depth and aquifer tapped
- hydraulic properties from pumping tests
- drawdown and recharge at normal pumping rates
- seasonal variations of groundwater levels (if records exist)
- use of the bore, and estimate of volumes extracted.

If a groundwater model is used to describe the impacts of the project on groundwater resources, model water balances for each aquifer to establish the pre-development conditions.

Describe the monitoring program(s) and sources that provided the data used in the assessment of existing groundwater resources.

Water quality and environmental values

Describe the quality of surface water upstream, on, and downstream of the project site, including seasonal variations and variations with flow. Integrate the water quality data with stream-flow data from historical records to help interpret the results. Include benthic sediments as well as the water column because the definition of waters in the EPP (Water and Wetland Biodiversity) includes the bed and banks of waters. That is particularly important if the proposed project has the potential to contaminate sediments (e.g. from metal mining, or mineral processing).

Describe the quality of groundwater that might be impacted by the project. Present water quality data in a suitable format for assessment against relevant water quality objectives and trigger values. Physio-chemical indicators should at least be presented as medians and data ranges, and toxicants should also include 95th percentiles. Where there is highly variable flow (e.g. in ephemeral streams), describe the data separately for high and low flow periods rather than using annual statistics and use trend analysis to account for the influence of streamflow on water quality. Report the limit of detection for each analytical method used to test the samples.

Describe the monitoring programs that were used to provide water and sediment quality data.

Describe the environmental values of water that might be affected by the project, such as aquatic ecosystems, groundwater dependent ecosystems, farm supply, stock water, irrigation, human consumption, and recreation. Use a variety of sources to help define the relevant environmental values, including the Environmental Protection Act, EPP (Water and Wetland Biodiversity), and the Australian and New Zealand guidelines for fresh and marine water quality (ANZG 2018). Consult the Queensland government's Wetland*Info* (DES 2019) and Wetland*Maps* (DES 2019) websites and any available Aquatic Conservation Assessments, and report any relevant information about the site and its surrounds. Include estuarine and marine waters if they could be impacted by the project. Describe the condition of the aquatic environmental values of the potentially affected waters. If the waters are to some

degree disturbed, describe how they have been and/or are being disturbed, and assess the degree of disturbance with reference to definitions in the EPP (Water and Wetland Biodiversity) of disturbed waters.

State or develop the management goals and water quality objectives for the relevant waters. A primary reference for the water's goals and objectives is Schedule 1 of the EPP (Water and Wetland Biodiversity). If Column 2 in Schedule 1 of the EPP (Water and Wetland Biodiversity) does not state objectives for the waters that the project might impact then develop a set of water quality guidelines for all indicators that will protect all environmental values for the water (see Part 4 of the EPP (Water and Wetland Biodiversity)). Water quality guidelines are quantitative measures or statements for indicators (including contaminant concentration or sustainable load measures of water) that protect an identified environmental value.

Describe any existing discharges to water at the site, or upstream or downstream of the site, from any source that would have relevance for the outcomes of the project. Provide the latitude and longitude in decimal degrees (GDA2020) of the locations of any existing discharges. Differentiate between point and diffuse discharges, and describe the timing and circumstances in which they occur. Quantify the volumes of existing discharges and the concentrations and overall loadings of contaminants. Assess the present impacts or effects of existing discharges on the relevant environmental values and assimilative capacity of the receiving waters.

Outline any general or specific outcomes stated in the relevant water plan that may be impacted by the project, including any surface water and groundwater outcomes, and social, economic, cultural and environmental outcomes.

Similarly, outline any environmental flow objectives stated in a Water Plan that might be impacted by the project. Also outline the performance indicators for relevant environmental flow objectives.

Potential impacts

Alterations to flow of water

Describe any works including excavations, waste rock dumps, earthworks or constructions for the project that would alter the flow of surface water either in watercourses or as overland flow. Assess where, when, and by how much the flow of water would be changed or impeded. For the purposes of this guideline, earthworks includes levees, road and rail cuttings and embankments, and instream and off-stream storage dams.

Describe and quantify any changes to catchment areas for all watercourses or significant drainage lines, including ephemeral creeks, and particularly address where any subcatchments could be dammed or diverted by earthworks or waste rock dumps.

Describe any temporary or permanent stream diversion, and include scaled plans and cross-sections of the proposed diversion. Assess how the proposed functional design of any stream diversion would address the key principles and achieve each of the outcomes of DNRME's guideline Works that interfere with water in a watercourse for a resource activity—watercourse diversions authorised under the Water Act 2000 (DNRM 2019), or the latest revision of that guideline. Assess the impacts of the stream diversion on aquatic ecosystems and riparian vegetation. Provide sufficient information for the administering authority to decide whether to grant approval for the stream diversion.

Use a hydrological model to predict the significant changes to surface water flows that would occur if the project proceeds. The model should at least address the frequency and duration of flow events, including first-flush, the peak, and the rate of rise and fall of flows for a range of rainfall events at the site and within its wider catchment. Use the model to compare the effects of development options with existing flow patterns. Assess the potential impacts of the changes, not only on flows, but also on environmental values and other values mentioned in the local Water Plan. Evaluate the quality of data and the assumptions used in the modelling, and undertake a sensitivity analysis. For an instream dam, calculate environmental flows, and predict and describe how the environmental flow releases from the dam will be scheduled.

Assess whether the project would impact on the availability of water for existing users and uses, or reduce the amount in reserves of unallocated water.

Assess whether changes to flow patterns would impact on ecological values, such as plants that rely (at least in part) on stream flow for their water, or animals whose breeding cycles are known to rely on stream flow triggers. Assess the impacts on the flow of water of any potential waterway barrier works (DAF 2017) that might impede the free movement of fish, even in ephemeral streams. Cross-reference the description of any potential impacts on ecology with other appropriate sections of the EIS.

Assess how any reduction of groundwater in bank storage might impact on flows in watercourses or other streams or wetlands, and cross-reference this assessment with the section of the EIS that addresses groundwater impacts.

Identify any approval or allocation that would be needed under the Water Act or the *Forestry Act 1959*, and provide sufficient information for the administering authority to decide whether an approval or allocation should be granted.

Refer to the legislative requirements in the relevant water plan to determine what authorisations the project needs to take or interfere with water or undertake other activities covered by the Water Act. Distinguish between requirements for surface water (lakes and watercourse) and overland flow water (drainages). Provide sufficient information for the government to decide whether to grant the authorisations.

Flooding

Assess how the project would affect local and regional flooding for a range of annual exceedence probabilities, including the probable maximum flood. Provide maps showing the extent and depths of any afflux that the project might cause. Also, illustrate any potential reductions of flooding.

Assess the impacts of any changes to flooding on ecological values, and cross-reference to those parts of the EIS (e.g. the aquatic ecology section) that address the impacts in detail. Include low, medium and high flow events.

Subsidence

If underground mining or aquifer dewatering would cause subsidence of the ground surface, use a suitable and adequate model to estimate where and by how much the surface will subside. Provide a detailed description of the estimated subsidence in the Land section of the EIS. In the Water section of the EIS, use a hydrological model to predict how subsidence would alter and/or retain the flow of water under a range of rain events and flow conditions. Assess the significance of the changes to flow caused by subsidence, including: reduction of downstream flow; increased infiltration due to surface cracks and/or pooling; effects on soil salinity (e.g. due to evaporation of pooled water, or shallower water table); and effects on ecology.

Water supply

Describe the options for supplying water to the project, including both industrial, processing and potable uses. Assess any potential consequential impacts of supplying water in relation to the objectives of any water plan and other planning instruments such as water management protocols, resource operations licences and operations manuals that may apply. If a water licence, permit or allocation would be required under the Water Act, provide sufficient information and assessment for the administering authority to decide whether or not an approval should be given.

Describe how any water supplied to the site will be managed. Provide details of the quantities needed, the quality of the supply, and any treatment (before and after use), storage, and discharge or disposal.

Provide a quantitative site water balance illustrated by a schematic diagram.

Project infrastructure

Describe all proposed infrastructure (including dams, weirs, levees, or excavated voids) that would retain water, waste water, or tailings. Provide maps and elevations/cross-sections of the proposed infrastructure, and details of their capacity, the pipework and channels that would control inputs, transfers, and outputs/discharges. Describe each piece of infrastructure's purpose, characterise its intended contents, and outline how it would be managed. Describe any impacts infrastructure might have on surface and groundwater including changes to hydrology and water quality. Similarly, identify and describe any impacts rainfall, flooding, spring flows, or any other water related matters, might have on the proposed infrastructure.

Provide sufficient information for the administering authority to assess whether to grant any approvals required under the Water Act for project infrastructure. Provide similar information if the proposed take of overland flow is not in accordance with the provisions of the Water Act or above the limits set by a water plan.

Discharges and onsite reuse of wastewater

Describe all locations where discharge to surface waters or land may occur during construction, operation or decommissioning of the project. Include all possible sources; for example, stormwater sediment dams, small on-site sewage treatment plants, mine-affected water, or coal seam gas water. Include discharges from regulated structures, such as tailings dams. The Water section of the EIS should focus on matters that affect the nature, timing and impacts of potential discharges from regulated structures, rather than the detail of the structures' design and management. The design and management of any regulated structures should be addressed separately in the

regulated structures section of the EIS. The department's Regulated structures—EIS information guideline (DES 2022) provides advice about this matter.

Describe the timing, volume and quality of all potential discharges with predictions of both the concentrations and overall loadings of contaminants. Categorise the discharges as either point discharges (e.g. end of pipe) or diffuse discharges (e.g. seepage from a waste rock dump), and as controlled discharges (i.e. those that can be turned on and off at will) or uncontrolled discharges (e.g. spillways).

Also, assess the potential impacts of discharges that could occur from accidental spillage or containment failure. Containment failure includes a range of possibilities, such as chemical tank rupture, or the potential for contaminated acid drainage if an isolation cell for sulfidic material in a waste rock dump fails.

Describe any no-release systems and/or limited-release systems that would reuse or dispose of treated or untreated wastewater onsite. Assess the potential impacts of reusing or disposing of wastewater onsite, and assess the management and fate of contaminants for both no-release and limited-release systems.

Describe when discharges would occur in relation to flow in receiving waters, assess the size of the mixing zone(s), and predict contaminant concentrations downstream of the mixing zone(s). Compare the predicted contaminant concentrations to the relevant water quality objectives and trigger values. For controlled discharges, assess the minimum flow in receiving waters that would be necessary for discharges to be permitted, explain how the flow criteria were developed, and assess the potential impacts of the discharges on the downstream environment during flow events that would meet the permissible discharge criteria. For uncontrolled discharges, assess the potential impacts of the discharges on the downstream environment under a range of flow conditions, including worst-case. Ensure the assessments address the identified environmental values of the potentially impacted waters. Also, address both acute and chronic impacts of discharges.

If the project would involve excavation within the bed and banks of a stream, assess the potential impacts of any sediment plume(s). Include any situation where works in a dry ephemeral stream might loosen material that could be subsequently mobilised when flow occurs.

Assess the capacity of the receiving waters to assimilate discharges from the project cumulatively with any other existing discharges. Also, assess how much remaining capacity the receiving waters would have to assimilate contaminants from other sources in addition to those of the project and existing discharges.

Assess the residual impacts of discharges on receiving waters and associated environmental values that might remain after management measures are applied.

Bank stability and riparian vegetation

If the project would involve excavation in, or within 40m of, the bed and banks of a watercourse, assess the potential impacts on bank stability and riparian vegetation. Determine if the project is exempt from requiring a riverine protection permit (see DNRME's guideline Riverine protection permit exemption requirements, 2018). If not, provide sufficient information for the administering authority to assess whether to grant a riverine protection permit under the Water Act. Otherwise, describe how the proposed activity meets the minimum exemption requirements.

Voids

Describe how open, operational pits would be developed during the various stages of mining, and assess the potential impacts of flooding on the pits, including with respect to the probable maximum flood level.

The rehabilitation section of the EIS should address the potential water quality impacts of any residual void associated with final landforms (see Rehabilitation—EIS information guideline, DES 2022).

Acid producing material

Assess the potential impacts of any seepage from sulfidic waste rock that has the potential to produce acid, or acid sulfate soils that the project would disturb.

Groundwater resources

Describe where groundwater would be taken by the project, whether directly from one or more bores, or by other means such as intersecting an aquifer by open or underground mining operations. Quantify the volume of water that would be taken and the timeframe over which the take would occur. In this sense, 'taken' includes any groundwater that would otherwise remain in the ground irrespective of how the project reuses, discharges or disposes of the groundwater.

Assess how any changes to stream flow, overland flow, or subsidence may impact on groundwater recharge or discharge.

Use a suitable groundwater model to make quantitative predictions of the 'cone of depression' or drawdown that would occur in any potentially impacted aquifers during the various stages of the project. Outline the model's key assumptions and limitations. Specifically address whether or not the project would take water from, or affect recharge to, aquifers of the Great Artesian Basin. Assess all potentially affected aquifers individually and cumulatively. Include the inflows of groundwater to any void(s) both during and after mining operations. Assess and illustrate the significance of the predicted drawdown, and highlight where drawdown would significantly impact on current users of groundwater resources. Provide information on the time to maximum drawdown, and time for recovery equilibrium to be reached. Also, model the potential impacts on yields of groundwater in all potentially affected aquifers and bore supplies. Include any allocations that are not currently being used.

Assess the suitability of potentially impacted groundwater for its current and foreseeable uses. Identify and assess the potential impacts of any aspects of the project that could contaminate groundwater.

Assess any residual impacts that would remain after mitigation measures are implemented. Describe the options for 'make good' provisions, and assess how they would apply to any water users that may be adversely affected by the project.

Assess any potential impacts on groundwater dependent ecosystems. Provide a detailed assessment in the ecology section of the EIS, while in the Water section summarise any significant impacts and describe in detail what management measures would be used for the project to mitigate those impacts. Additional advice about this requirement is provided in the department's Groundwater dependent ecosystems—EIS information guideline (DES 2022).

If the project is a controlled action, ensure the assessment of impacts is in accordance with the Independent Expert Scientific Committee's guidelines, which provide direction for groundwater assessments. These can be found at Publications and resources (IESC 2019) and include:

- *Information guidelines for proponents preparing coal seam gas and large coal mining development proposals*
- *Information guidelines explanatory note—Uncertainty analysis*
- *Information guidelines explanatory note—Assessing groundwater-dependent ecosystems*.

Discharges to groundwater

If the project includes a proposal to discharge waste directly to groundwater, the EIS must assess in detail the following matters:

- whether the aquifer that would receive the waste is a confined aquifer
- whether the release of the waste would adversely affect a surface ecological system
- whether the waste is likely to result in a deterioration in the environmental values of the receiving groundwater.

Those matters relate to r. 41 of the Environmental Protection Regulation 2019, which regulates decisions about proposals to discharge waste (including contaminated water) directly to groundwater. The EIS must be clear whether or not the proposal to discharge directly to groundwater relates to an application for an environmental authority for a petroleum activity, particularly if the proposal is to obtain a beneficial reuse of coal seam gas water by direct injection into depleted aquifers for recharge purposes (see also the following section of this guideline regarding coal seam gas water).

Coal seam gas produced water

The department's Coal seam gas water website (DES 2020) provides a wide range of information about the policies and issues the government considers when it decides whether to approve coal seam gas activities, including hydraulic fracturing or 'fracking', and the management of coal seam gas water.Develop a CSG water management plan consistent with the CSG water management criteria and salt management criteria in the Coal seam gas water management policy (EHP 2012).

The EIS for a coal seam gas project must address the following relevant departmental advice documents:

- Guideline: Baseline assessments (DES 2017)
- Guideline: Bore assessments (DES 2017)
- Guideline: Quick guide—Make good obligations (DES 2017)
- Guideline: Underground water impact reports and final reports (DES 2017)

- Information sheet: Integrated laws to manage water impacts (DES 2013)
- Policy: Coal seam gas water management policy 2012 (DES 2012).

Cumulative impacts

Assess the cumulative impacts on water resources and values that could potentially occur because of the impacts of the proposed project added to the past, present and reasonably foreseeable impacts of other activities in the region. Assess cumulative impacts at a local, subregional and bioregional scale and over time.

Avoidance and mitigation measures

Describe in practical terms the day-to-day actions that would be taken by workers at the site to ensure that impacts of the project on surface water and groundwater resources are avoided or minimised. The section will have two main purposes:

- to provide the detail of actions that will be incorporated into the project's environmental management plan (or whatever the site's action plan is to be called)
- to provide the detail of objectives, trigger values, and actions that may be adopted by the administering authority to develop conditions for the project's environmental authority.

Ensure that all the proposed actions are measurable and auditable.

Explain why the preferred mitigation measures were chosen (e.g. by comparing the environmental, economic and engineering aspects).

State the management goals for the relevant waters.

Describe (with appropriate tables) the water quality objectives to protect the environmental values of the potentially impacted waters. State values for indicators of water quality and environmental values that would trigger an action (usually a monitoring and/or corrective action).

Describe how mine-affected water would be managed during mining operations until surrender of the environmental authority.

Describe the management and monitoring measures that would be used to minimise the impacts of discharges on receiving waters in all circumstances when discharge might occur. Fully describe the water release strategy, including:

- the minimum flow requirements in receiving waters at discharge points
- quality criteria for permissible discharges
- volumes that may be discharged
- timing of discharges.

Provide the locations of all discharge points, spillways, and monitoring sites in decimal degrees of latitude and longitude (GDA2020), and show the locations on a map.

Describe in detail the proposed system for directing, managing, and treating stormwater on the site and discharging it from the site. In particular, describe erosion and sediment control measures, and show how the maximum amount of stormwater/runoff would be kept separate from disturbed areas to avoid contamination. Describe how any contaminated stormwater would be collected, effectively treated (e.g. in sediment ponds and/or by stormwater quality improvement devices), and monitored before being discharged or reused onsite.

Describe how any sediment plume(s) would be managed to avoid significant impact on environmental values.

Describe how bank stability and riparian vegetation will be preserved and/or restored. Include any stream diversions.

Describe measures that would be used to mitigate the impacts of subsidence on water flow and infiltration, and assess any residual impacts.

Conduct a risk assessment of potential uncontrolled discharges, including containment failure, and develop appropriate risk control measures.

Propose how cumulative impacts will be managed and monitored, including actions that would be taken if monitoring indicates an undesirable impact has occurred or is likely. Propose ways in which cumulative impacts could be minimised in association with the project's neighbours, the local community, and/or the local government.

Monitoring and corrective actions

Use an adaptive management approach to ensure that all management measures can be reviewed and updated as necessary as the project proceeds. The adaptive management approach must include comprehensive monitoring for all foreseeable potentially significant impacts, with triggers, strategies, and actions to be taken as monitoring and repeat modelling progresses.

Describe how monitoring would be used to demonstrate that objectives are being assessed, audited and met. For example, provide measureable criteria, standards, and/or indicators that are being, and will be, used to assess the condition of the ecological values and health of surface water environments.

Propose corrective actions to be used if there is the potential that objectives will not be met.

Commitments and conditions

Provide a consolidated description of commitments in regard to water management (including monitoring programs and management plans).

Propose conditions for water management that may be placed on the environmental authority and any other required approvals or licenses. Base the proposed conditions on the department's existing model conditions and eligibility criteria. Where necessary, modify the model conditions, or develop new conditions, to suit issues that are specific to the site and the proposed project. Use the department's guidelines Model mining conditions (DES 2017) or Streamlined model conditions for petroleum activities (DES 2016) as the basis for writing this section of the EIS.

References

Note: These references were correct at the time of publication. Where more recent versions are available, these must be used. For all Department of Environment and Science publications, the latest version of a publication can be found by using the publication number as a search term at the Queensland Government website <www.qld.gov.au>.

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