Guideline

Stormwater and environmentally relevant activities

Queensland Government

Prepared by: Environmental Services and Environmental Regulatory Practice (non-Mining), Department of Environment, Science and Innovation

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Version history

Version	Date	Description of changes
1	17 February 2014	Original publication
1.01	15 August 2016	Minor rebranding and reformatting
1.02	03 July 2017	Updated reference from *Sustainable Planning Act 2009* to *Planning Act 2016*.
1.03	09 October 2019	Updated for the commencement of Environmental Protection Regulation 2019
1.04	24 February 2021	Updated references to the Department of Resources
1.05	13 February 2024	Document rebranded to align with machinery of government changes.

Contents

Purpose

This document has been prepared to assist applicants applying for an environmentally relevant activity (ERA) as defined in section 17 of the Environmental Protection Regulation 2019 (the regulation) and includes each activity to which schedule 2 of the regulation applies i.e. prescribed ERAs. However it will only be relevant to prescribed ERAs where the activity will be managing stormwater. This guideline does not apply to activities defined as resource activities in schedule 3 of the regulation, i.e. mining or petroleum activities.

Information included in this guideline will also be applied by the Department of Environment, Science and Innovation (the department) to:

- standardise assessment and inspections of stormwater management on ERA sites; and
- assist in the decision making process for applying enforcement provisions under the *Environmental Protection Act 1994* (EP Act).

Some terms and/or phrases used in this document are defined in the definitions section and are bolded and underlined throughout this document.

Introduction

This guideline includes criteria to help protect receiving water environmental values from potential environmental impacts arising from poor stormwater quality and altered stormwater flow. In addition, this guideline provides ways to better manage environmental impacts associated with undertaking ERAs.

In this guideline, *Section 1—Guidance material for applicants applying for an approval to carry out an ERA* provides a reference point for both applicants and the department assessing the stormwater component of applications for an ERA. *Section 2—Assessing compliance with stormwater and erosion sediment control conditions* provides additional information to assist the department applying enforcement provisions under the EP Act. This section will also be helpful for applicants in understanding how the department will approach enforcement.

When implemented, the practices described in this guideline are consistent with 'industry best practice', current as at the time of publication, and will help enhance or protect the environmental values by considering the water quality objectives and management goals for receiving waters. These water quality objectives require industrial development that constitutes an ERA, to be planned and executed such that the below dot points are achieved progressively over the long term within the wider catchment:

- the environmental values of waters are enhanced or protected; and
- the water quality objectives and management goals of waters are achieved.

This guideline does not limit, amend or change in any way, any other requirements to be complied with under licence conditions, legislative instruments and/or regulations for the design or operation of a dam or levee structure.

Applicants are advised to consider the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635) as there may be separate requirements under the EP Act placed on regulated structures that are outside the scope of this guideline.

Legal requirements

Stormwater runoff from industrial and development sites has a high potential to cause water contamination and/or environmental harm and is regulated under the EP Act. Some of the key legal requirements and offences have been summarised below:

- Where stormwater conditions appear on an environmental authority, it is an offence under s.430 of the EP Act, to not comply with the conditions of approval. This includes anyone operating under the environmental authority e.g. contractors, consultants etc.
- Causing serious or material environmental harm is an offence under s.437 and s.438 of the EP Act respectively. Material environmental harm has the meaning as defined in s.16 of the EP Act. In summary, material environmental harm is environmental harm that costs more than $5,000 to clean up, or that causes (or has the potential to cause) more than $5,000 worth of damage to property. Serious environmental harm is defined in s.17 of the Act. In summary it is harm that is irreversible; has a high impact or widespread effects to the environment; is caused to an area of high conservation significance; or causes clean-up costs or property damage worth more than $50,000.

- It is an offence to cause an environmental nuisance under s.440. Environmental nuisance is unreasonable interference with an environmental value. It may also include an unhealthy, offensive or unsightly condition because of contamination.
- Under s.440ZG it is an offence to unlawfully deposit a prescribed water contaminant to waters. A full list of prescribed contaminants are listed in Schedule 10 of the regulation. The most common prescribed contaminants resulting from poor stormwater management of ERA operations are:
  - chemical, or chemical waste
  - ashes, clay, gravel, sediment, stones and similar organic or inorganic matter
  - building and construction materials
  - building , construction and demolition waste
  - industrial waste
  - oil
  - putrescible waste
  - waste water.
- Under s.319 an obligation is placed upon all persons in Queensland who are carrying out activities which may cause environmental harm to comply with the 'general environmental duty'. This requires that all reasonable and practicable measures must be adopted to prevent and minimise environmental harm. Although not being able to demonstrate compliance against the general environmental duty is not an offence, demonstrating that all reasonable and practicable measures have been adopted is a defence for offences such as water contamination.

  For instance, under s.493A of the EP Act, where a person deposits a prescribed water contaminant to waters or causes unlawful environmental harm, it is a defence to demonstrate compliance with the general environmental duty. Demonstrating that all reasonable and practicable measures have been implemented should encompass:

  - thorough and ongoing site assessments; and
  - consideration of, and adaptation for site specific erosion risk factors including topography, soil type, climate and season; and
  - incorporation in the design, installation, operation, management, maintenance and monitoring of control measures which are consistent with the measures set out in this guideline[1].

  The administrating authority must make reference to s.493A of the EP Act when making a decision about the unlawfulness of water contamination, for instance where the release is authorised under a condition of an environmental authority (EA), development approval (DA), transitional environmental program, or temporary emissions licence.

The Environmental Protection (Water and Wetland Biodiversity) Policy (2019) (EPP Water) also provides a process for protecting Queensland waters by establishing environmental values and water quality objectives for many waters (see Schedule 1 of the EPP Water). For waters not included in Schedule 1, the EPP Water provides a process for determining the environmental values and water quality objectives.

Note: The administering authority will consider the water quality objectives in the EPP Water when undertaking an assessment of the application for an environmental authority against the standard criteria. However the water quality objectives of the EPP Water will not always be appropriate to be applied as default limits once all the standard criteria have been considered as a whole.

Management principles

The EPP Water establishes a hierarchy of preferred management options for wastes, including water contaminants, which when applied, protects or enhances the environmental values of waters. This document applies the management hierarchy in establishing the environmental performance standards which are necessary to help enhance or protect the environmental values of waters from the impacts of industrial sites with ERA's in operation.

[1] This document is a guideline only. It is recognised that for some operations, additional measures may be required in order to prevent environmental harm from being cased as a result of stormwater, and to satisfactorily comply with the general environmental duty.

Stormwater management should be based on the following hierarchy of control mechanisms:

- **Preservation**—preserving existing valuable elements of the natural stormwater system, such as natural channels, wetlands and riparian vegetation.
- **Source control**—appropriate management of the quantity and quality of stormwater, at or near the source of potential contaminants, or changes to flow by using stabilisation or avoidance principles and/or erosion controls.
- **Structural control**—using structural measures, such as treatment techniques or sediment basins, to improve water quality and control runoff. Applying structural treatment measures on site before the runoff enters a waterway is required to capture mobilised pollutants, and mitigate geomorphic stream damage.
- **Receiving waters management**—as a last line of control, the receiving water should be managed to avoid any residual impacts from stormwater pollutants or flows.

All reasonable and practical efforts must be made to firstly preserve existing valuable elements and implement source controls. Where these actions cannot occur, or can occur only in part, *Section 1—Guidance material for applicants applying for an approval to carry out an ERA* of this guideline will assist applicants in ensuring that structural control(s) and management of receiving waters, is applied.

Section 1—Guidance material for applicants applying for an approval to carry out an environmentally relevant activity

How does the administering authority assess applications?

The administering authority will assess applications on a set of criteria, including:

- regulatory requirements; and
- standard criteria.

When the department is the administering authority, the application for an environmental authority will also be assessed in line with the Regulatory Strategy. A copy of the Regulatory Strategy is available at www.des.qld.gov.au using 'regulatory strategy' as a search term.

Further information on assessment can be found on the Business and Industry portal (www.business.qld.gov.au), using 'environmentally relevant activity' as a search term.

Information to be provided with an application

Accurate and complete information must be provided with the application addressing the relevant requirements below. The information must be provided in the form of a stormwater management plan specific for the site (e.g. inclusive of all relevant site plans, calculations for drainage structures and stormwater treatment devices (including sediment basins) and must be prepared by an **appropriately qualified person**.

Applicants are encouraged to hold pre-lodgement meetings so that they can fully understand the information that they must provide.

The following section is broken into two parts:

- Part 1 High erosion hazard sites
- Part 2 Low erosion hazard sites.

Most sites across Queensland will be considered a high erosion hazard sites i.e there is limited hardstand or protective groundcover, and soil erosion is expected.

Sites will only be considered low erosion hazard sites if they contain significant areas of hardstand or protective groundcover (i.e. greater than 95% of the site is effectively stabilised and the area that is not stabilised does not exceed 2,500m^2) and soil erosion is not expected to exceed 10tonnes/hectare/year from disturbed areas.

Sites that are assessed as having both low erosion hazard and high erosion hazard areas should have regard to Section 1, Parts 1 and 2 of this guideline. These requirements should be reflected in the site stormwater management plan. For example, if the operational area of a landfill is assessed as having a high erosion hazard, it should meet the requirements of Section 1, Part 1 of this guideline. However, if the site office, staff car park and outdoor staff area sit within their own sub catchment and have been assessed as having a low erosion hazard, the requirements of Section 1, Part 2 should be applied to the sub-catchment.

ERA sites where the contaminant(s) of concern are not capable of being treated by conventional sediment basins (Part 1 high erosion hazard sites) or stormwater quality improvement devices[2] (Part 2 low erosion hazard sites), are considered outside the scope of this guideline. For example, conventional sediment basins are not suitable for the treatment of metals and pesticides and specialised treatment methods will be required. In these circumstances reference should be made to the Queensland Water Quality Guidelines[3]. Note that this guideline makes reference to the Australian Water Quality Guidelines[4] (AWQG) in relation to specific detail of water toxicants.

In particular, for toxicants in water, refer to AWQG section 3.4 'water quality guidelines for toxicants' (including

[2] Operational phase stormwater quality improvement devices may include, swales, manufactured devices (including GPT's), sediment basins, bio-retention systems, water harvesting and treatment wetlands.

[3] Department of Environment and Resource Management 2009, *Queensland Water Quality Guidelines*, Version 3 (or later version).

[4] Australian and New Zealand guidelines for fresh and marine water quality, Agriculture and Resource Management Council of Australia and New Zealand 2000.

Tables 3.4.1, 3.4.2, and Figure 3.4.1) and for toxicants in sediments: refer to AWQG section 3.5 'sediment quality guidelines' (including Table 3.5.1, Figure 3.5.1).

Additional information can also be found in the Technical guideline: wastewater release to Queensland waters available at www.qld.gov.au using the publication number ESR/2015/1654 as a search term.

Relevant requirements

The relevant requirements contained in this guideline have been developed, and are consistent (at the time of publication) with best practice environmental management as defined by section 21 of the EP Act as well as the current versions of the following technical publications:

- Australian Runoff Quality, A Guide to Water Sensitive Urban Design, Engineers Australia, 2006
- Water Sensitive Urban Design, Technical Design Guidelines for South East Queensland, SEQ Healthy Waterways, 2006
- Urban Stormwater Quality Planning Guidelines, Department of Environment and Resource Management 2010
- Queensland Water Quality Guidelines, Department of Environment and Resource Management 2009
- Best Practice Erosion and Sediment Control, International Erosion Control Association (Australasia) 2008
- Queensland Urban Drainage Manual, Department of Natural Resources and Mines 2007[5]
- Water by Design. MUSIC Modelling Guidelines. SEQ Healthy Waterways Partnership. Brisbane Queensland 2010
- Water by Design. Technical Design Guidelines for South East Queensland. SEQ Healthy Waterways Partnership. Brisbane Queensland 2010.

Part 1 High erosion hazard sites

The following list of design and management measures are considered appropriate for high erosion hazard sites. Most measures are suggestions to assist in meeting the general environmental duty. However, where a measure must be implemented to prevent environmental harm, it has been stated as such.

(a) Erosion protection and sediment control measures should be installed and maintained for all stages of the activity to minimise erosion and the release of sediments.
(b) All areas of soil disturbed and exposed should be managed to minimise the loss of sediment through revegetation and/or use of other stabilisation techniques.
(c) All concentrated stormwater flows (including 'clean' stormwater and 'dirty' stormwater) should have concentrated flow paths, such as drainage lines, diversion drains, channels and batter chutes (where applicable) which have been designed, constructed, effectively armoured and maintained to convey the runoff from events up to and including the average recurrence interval (ARI) of:
    i. 1 in 10 critical duration ARI storm event without causing water contamination, sheet, rill or gully erosion, sedimentation, or damage to structures or property. This excludes sites being operated as a quarry.
    ii. 1 in 5 critical duration ARI storm event without causing water contamination, sheet, rill or gully erosion, sedimentation, or damage to structures or property for sites being operated as quarry.
(d) Stormwater runoff from external or undisturbed catchments should be diverted around or away from disturbed areas as much as possible.
(e) Sediment basin(s) should be installed and maintained to collect and treat stormwater runoff from all disturbed areas of the site(s) approved as part of the ERA application, and areas in which any earthen material is stored. ***Note**: allow provision of pits/drop cuts to be utilised for contaminated water storage.*
(f) For events up to and including a **24 hour storm event with an ARI of 1 in 10 years** (or a **24 hour storm event with an ARI of 1 in 5 years**[6] for quarries[7]), the following must be achieved
    i. a sediment basin must be designed, constructed and operated to retain the runoff at the site(s) approved as part of the ERA application;

[5] Regard should be given to the requirements in the draft version of this manual.

[6] An alternative basin design to the relevant 24 hour storm event with an ARI of 1 in 10 years/24 hour storm event with an ARI of 1 in 5 years, may be accepted provided the contaminant load released to the receiving environment for the life of the design is not increased.

[7] Activities that meet the definition for ERA 16—extractive and screening activities in Schedule 2 of the regulation.

ii. the release stormwater from these sediment basins must achieve a total suspended solids (TSS) concentration of no more than 50mg/L[8] for events up to and including those mentioned above.

For events larger than those stated above, all reasonable and practical measures must be taken to minimise the release of prescribed contaminants.

Note: a number of contemporary erosion and sediment control guidelines include basin design standards that are much smaller than those listed in item (f) above. For temporary land disturbance works, those standards are considered appropriate, however for ERA activities that typically have a long operational life and subsequently a lengthy period of land disturbance, those basin standards are inadequate.

An alternative basin design (such as a high efficiency basin) can be used provided it has been demonstrated that the contaminant load to be released to the receiving environment for the life of the project will be equal to or less than the standard design.

The department supports high efficiency basin technology especially as it may lead to both flexibility for the site operator and if appropriately designed and managed, sound environmental outcomes.

A high efficiency basin generally incorporates the following design features. The inlet and outlet structures and length to width ratios are designed to maximise hydraulic efficiency. Typically there will be a sediment fore bay for primary sediment removal (retain fast settling coarse material). The inlet structure is designed to promote laminar flow (often supported by a weir structure), and includes infrastructure to support automated chemical flocculation dosing.

(g) All sediment basins should have a spillway, designed, constructed and effectively armoured to convey anticipated flows. Design for a 50 year ARI critical event is considered a minimum. In some circumstances a more stringent design criteria may apply e.g. where there are structures that are referable dams under the *Water Supply (Safety and Reliability) Act 2008* or regulated structures under the EP Act.

(h) All sediment basins must minimise impacts to the natural waterway from releases to waters. This can be achieved by:
   i. maintaining the point(s) of discharge approved within the conditions of approval[9]
   ii. not increasing peak flows discharging from the site for events up to the 1 year ARI event; and
   iii. managing releases to prevent scouring in the receiving waters.

(i) Any sediment basin designed in accordance with item (f) of this list, must be operated in such a manner that within 120 hours of the most recent rainfall event, the required design capacity of the **upper settling volume** is available for capture and storage of stormwater runoff from the next rainfall event.

(j) In addition to the requirements of (f), any sediment basin should be also designed with a **sediment storage zone** equal to 50% of the **upper settling volume**[10].

(k) The use of a coagulant or flocculants to treat stormwater in a sediment pond design must not cause environmental harm to receiving waters.

(l) A monitoring program should be designed for implementation at the site that, at a minimum, meets the requirements of Table 1. The monitoring program should at a minimum address all of the following:
   i. water quality characteristics
   ii. monitoring locations
   iii. monitoring frequency
   iv. release limits.

[8] Within the Fitzroy Basin, values may exceed 50mg/L. Reference should be made to the F*itzroy River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Fitzroy River sub-basin, September 2011*.

[9] Queensland Urban Drainage Manual: Volume 1 Second Edition Queensland Government 2007.

[10] Alternatively, the volume of the sediment storage zone may be determined by estimating the expected sediment runoff volumes over the desired maintenance period; not less than 4 months.

Table 1: Stormwater quality characteristics, release limits and monitoring frequency

Quality characteristic	Release point	Limit	Limit type	Frequency	Comment
Total suspended solids	RP XX	50mg/L[11] [12]	maximum	Minimum of quarterly upon release	Applies to all high erosion hazard ERA's
pH		Derived in accordance with QWQG 2009[13]	range		
Electrical conductivity			maximum		
Dissolved oxygen			minimum		
Total organic carbon	RP XX	Derived on a site specific basis			Individual quality characteristics may apply to specific ERAs, e.g. ERAs involving the handling of specific toxicants
Total phosphorus (TP)					
Total nitrogen (TN)					
Ammonia (as N)					
Bicarbonate (HCO3)					
Calcium					
Chloride					
Iron (total)					
Lead					
Manganese					
Potassium					
Sulphate					
Zinc					

[11] Within the Fitzroy Basin values may exceed 50mg/L reference should be made to the *Fitzroy River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Fitzroy River sub-basin September 2011*.

[12] To support on-site decision making, the department may consider the use of a site specific correlation between total suspended solids and turbidity provided a statistically significant correlation can be demonstrated.

[13] Department of Environment and Resource Management 2009, *Queensland Water Quality Guidelines*, Version 3 (or later version).

Quality characteristic	Release point	Limit	Limit type	Frequency	Comment
Copper					
Aluminium					
Temperature					
Total petroleum hydrocarbons					
Total organic halogen					
Chemical oxygen demand					
Biochemical oxygen demand					

(m) An **appropriately qualified person** should design the sediment basin to comply with item (f) of this list and certify the construction.

For the purposes of calculating item (f), the following formula can be used:

$Vs = A \cdot Cv \cdot R_{(1 \text{ in } 10 \text{ ARI. } 24hr \text{ OR } 1 \text{ in } 5 \text{ ARI for quarries})}$
Where:
Vs = settling volume (m^3)
A= catchment area (m^2)
Cv = volumetric runoff co-efficient
R = rainfall depth for a **24 hour storm event with an ARI of 1 in 10 years** (**24 hour storm event with an ARI of 1 in 5 years** for quarries)

Applicant checklist

- ☐ Has a stormwater management plan been developed?
- ☐ Are there sufficient site plans attached with the application for each phase of works that detail the type and location of all erosion and sediment control measures (including location of sediment basin, drainage lines and structures)?
- ☐ Is the stormwater management plan consistent with this guideline and current best practice standards (where applicable), taking into account all environmental constraints including erosion hazard, soil type and proximity to waterways?
- ☐ Does the stormwater management plan address all the relevant requirements outlined above in items (a) to (m)?; and
- ☐ Has the stormwater management plan been prepared by an **appropriately qualified person**?

Part 2 Low erosion hazard sites

The following requirements are considered appropriate for low erosion hazard sites and must be implemented.

(a) Stormwater quality and its potential impact on receiving waters must be numerically modelled[14] to determine treatment requirements.

[14] Numeric modelling must be in accordance with Water by Design 2010, *MUSIC Modelling Guideline*, Version 1.0 – 2010 or local government guidelines (where relevant).

(b) A treatment train must be designed[15], constructed and operated such that it satisfies the design objectives specified in Table 2.
(c) A validation report must be provided within 6 months of the commencement of the operation of the site, providing certification from an **appropriately qualified person**, that the stormwater treatment train was designed and constructed to meet the requirements of (a) and (b) above.

Table 2: Design objectives for management of stormwater quality (low erosion hazard sites)[16]

Region	Minimum reductions in mean annual loads from unmitigated development (%)				Notes
	Total suspended solids (TSS)	Total phosphorus (TP)	Total nitrogen (TN)	Gross pollutants (>5mm)	
Eastern Cape York	75	60	35	90	
Central and Western Cape York (north)	75	60	40	90	
Central and Western Cape York (south)	80	65	40	90	
Wet Tropics	80	65	40	90	
Dry Tropics	80	65	40	90	
Central Coast (north)	75	60	35*	90	*In the Mackay Regional Council area, the minimum TN reduction to be adopted is 40%.
Central Coast (south)	85	70	45	90	
South East Queensland	80	60	45	90	
Western Districts	85	70	45	90	

[15] Treatment train should be designed in accordance with the current guideline versions of the Healthy Waterways, technical design suite (http://waterbydesign.com.au) or local government guidelines (where relevant).

[16] Derived from the current version of the *Urban Stormwater Quality Planning Guidelines*, Department of Environment and Resource Management.

Section 2—Assessing compliance with stormwater or erosion and sediment control(s)

This section has been prepared to provide the department with an assessment tool for undertaking stormwater and erosion and sediment control inspections for a prescribed ERA and to assist in the decision making process for applying enforcement provisions under the EP Act. This section will also provide transparency to site operators on how the department will approach a compliance inspection.

When undertaking a compliance inspection, the departmental officer will work their way through the following series of questions.

Part 1 High erosion hazard sites

The department will firstly work through Stage 1 questions. If an unlawful release has occurred or there is the potential for a release to cause environmental harm, the department will then move onto Stage 2 questions. Each question in Stage 2 sets out what the desired response to the question should be. If the desired response cannot be demonstrated, the responses must then be considered on balance with responses to other questions in Stage 2, to determine whether the general environmental duty has been satisfied.

Stage 1—Assessment of compliance with conditions of an approval

Question 1

Is the release of the prescribed contaminant(s) and/or the build-up of sediment, expressly permitted by a condition of a relevant approval?

If yes, the release is lawful. Progress onto question 2 below.

If no, the lawfulness of the release needs to be determined by assessing compliance with general environmental duty in Stage 2 below.

Notes: Under s.493A of the EP Act, an act which causes serious or material environmental harm, or a breach of s.440ZG is unlawful, unless it is authorised by one of the provisions listed in s.493A(2), which includes a development condition of a development approval or an environmental authority.

Section 493A also applies to sites where water contamination has been authorised to be done under an environmental protection policy, a transitional environmental program, an environmental protection order, a temporary emissions licence, a standard condition of a code of environmental compliance of Chapter 4 under the EP Act, or an emergency direction.

Question 2

Has any of the following occurred, or could reasonably be expected to occur?

a) Stormwater has been released or has the potential to be released from the site with a concentration of total suspended solids greater than the limits prescribed in the environmental authority; or
b) *Sediment has built up, or has the potential to build up, in the receiving environment downstream of the activity.*

If yes, proceed to questions under heading *Stage 2—Assessment of compliance with the* general *environmental duty*.

If no, further assessment against the general environmental duty is not generally required. However, in some instances, compliance with the conditions of approval cannot always be easily determined e.g. if the condition states that releases must not occur in concentrations great enough to cause environmental harm. In these situations, officers can use the questions *Stage 2—Assessment of compliance with the* general *environmental duty*, to assist in determining whether the condition has been met.

Stage 2—Assessment of compliance with the general environmental duty

Section 319 of the EP Act (the general environmental duty) requires that 'all reasonable and practicable' measures be taken to avoid or minimise environmental harm including water contamination (environmental nuisance). Demonstrating compliance with the general environmental duty constitutes a defence against those offences.

The questions under this section set out practices to assist departmental officers and operators on what constitutes 'reasonable and practicable'. This will assist in determining whether the general environmental duty has been fulfilled. These practices have been developed in consideration of the management hierarchy of s.14 of the EPP Water, to include the principles of preventing or reducing the production of contaminants, ensuring effective treatment of contaminants and ensuring releases, discharges and flows do not adversely affect the environmental values of the receiving environment.

Each question in Stage 2 sets out the desired response. Where the desired response is not achieved, the response must be considered on balance with other responses in Stage 2 to determine whether the general environmental duty has been satisfied.

Stormwater management plans

Question 3

(a) Do site specific stormwater control plan(s) exist?
(b) Do the plan(s) for each phase of the works (including clearing, operation, rehabilitation and site closure) detail the type, location, sequence and timing of measures and actions to effectively minimise erosion, manage flows and capture sediment?
(c) Are the plan(s) consistent with the department guideline, taking into account all environmental constraints including erosion hazard, season, climate, soil, and proximity to waterways?
(d) Does the plan(s) address the prevention, reduction and treatment of contaminants?
*(e) Have the plan(s) been prepared by an **appropriately qualified person**?*
(f) *Have the plan(s) been modified as necessary to address the changing physical conditions of the site?*

Desired response: A positive response to all question 3 parts should be achieved.

Notes:

The stormwater management plan for a site should include consideration of:

- erosion hazard for different parts of the site
- soil types, particularly dispersive, sodic and saline soils, and the suitability of the soil for establishing the intended vegetation type, as well as amelioration required to improve soil suitability
- high risk activities such as works in or near waterways
- the storage of potential contaminants such as fuel storages
- the available area required for effective controls
- risk reduction strategies such as staging of works in manageable portions
- seasonal climatic variations and implications for environmental risk
- local hydrology including groundwater and surface water
- local topography including temporary and surface flow paths
- the need to integrate the control measures to minimise the potential impact to operational activities

Prevention, reduction and treatment of contaminants

Question 4

Are there controls in place for the prevention, reduction and treatment of contaminants?

Desired response: A positive response to question 4 should be achieved.

Notes:

Section 14(2)(b) of the EPP Water, requires that the production of contaminants be prevented, and where not feasible to prevent the production of contaminants, the production of contaminants is minimised.

Erosion should be minimised and sediment capture maximised with a full suite of control measures as necessary to protect the environmental values, and in consideration of site attributes and risk factors, including antecedent weather conditions.

If the production of contaminants cannot be prevented, any contaminated stormwater should be treated to ensure that releases will not affect the environmental values of waters ((s.14(2)(c) and (d) EPP Water).

Minimising soil exposure

Question 5

Is non-essential exposure of soil avoided in terms of:

(a) the extent of clearing is restricted to that necessary for access to, and operation of the ERA.
(b) vegetation remains intact or is protected in all other areas of the site.
(c) the duration of exposure is minimised, such that:
- *i. clearing of vegetation is only undertaken immediately prior to an area being actively worked.*
- *ii. the work is staged to minimise the area of soil exposed at any one time.*
- *iii. if clearing is undertaken in areas which are not intended to be immediately worked, such areas are effectively stabilised immediately following clearing.*
- *iv. areas at finished level or where the activity has ceased are effectively stabilised.*
- v. *steep areas, such as stockpiles, batters and embankments, which are not being actively worked, are effectively stabilised.*

Desired response: A positive response to all question 5 parts should be achieved.

Notes: Clearing large areas of land at the one time may deliver some cost benefits due to economies of scale. However, this benefit needs to be considered in terms of the increased risk of causing water contamination and the additional cost of temporary stabilisation. Cleared areas, where the soil is left exposed, pose a high risk of causing water contamination from rainfall and runoff. It is the responsibility of those who create the risk to manage that risk.

Clearing of vegetation should be restricted to the operational areas. Other areas should be identified as 'no go' areas and the vegetation left intact and protected from unnecessary disturbance. Areas at 'finished level' should receive permanent stabilisation as soon as possible after reaching finished level and cessation of the activity.

In cleared areas which are not being actively worked, minimising the risk caused by vegetation removal is generally achieved most effectively by applying a temporary erosion control. Stabilisation is most effectively achieved by covering the soil with 'sacrificial' mulch, hydro-mulch, surface tactifier, turf, or a reusable cover such as geotextile, to prevent the erosion caused by raindrop impact and by implementing surface water flow controls (such as clean water cut off drains up slope and dirty water surface drains down slope). In areas where surface water flows concentrate, lining of flow paths with an appropriate material may be required to prevent erosion.

Some guidelines define stabilisation as having achieved 70% vegetation cover; however caution should be applied with generalised standards such as this, because surface cover is only one of several key components for consideration in determining soil stability. If turbid stormwater is flowing from a site with 70% surface cover, then from a water quality perspective, the site has not been effectively stabilised.

Stabilisation methods:

- should not result in water contamination, for example, bark mulch should not be used in concentrated flow paths because it is likely to be washed away.
- for areas at finished levels, need to provide effective stabilisation for the short, medium and long term.
- for revegetation areas, consideration needs to be given to soil testing, amelioration and preparation to provide optimal conditions for plant establishment.

For the purpose of this document the term 'soil' includes 'subsoil' and an effectively stabilised surface is defined as one that does not have visible evidence of soil loss caused by erosion, or lead to sedimentation, or lead to water contamination.

Managing stormwater flows

Question 6

All *concentrated stormwater flows (including 'clean' stormwater and 'dirty' stormwater) should have concentrated flow paths, such as drainage lines, diversion drains, channels and batter chutes (where applicable) which have been designed, constructed, armoured and maintained to convey the runoff generated from all storm events up to and including the average recurrence interval (ARI) of a 1 in 10 ARI critical duration storm event (1 in 5 ARI for quarries) without causing water contamination, sheet, rill or gully erosion, sedimentation, or damage to structures or property.*

Desired response: A positive response to question 6 should be achieved.

Notes: It is important that at a minimum stormwater releases do not cause erosion. This means ensuring that the releases occur via energy dissipation devices or other control structures to reduce velocity and erosive potential of the flows.

The 10-year ARI structural stability objective for temporary drains (5-year ARI for quarries) is based on the need to protect water quality, from a catchment perspective. It is intended to mitigate the potential cumulative impacts from failures caused by more frequent rain events. Drains designed to manage more frequent events may make sense from the point of view of individual site risk, but not catchment risk. Inevitably all the disturbed sites in a catchment will be subject to a less frequent larger storm event, and when that happens, if structures are only designed to cater for small, frequent events, many more structures are likely to fail than would otherwise be the case. Failure of temporary drains can negate the functioning of other erosion and sediment controls, which will then compound negative impacts on the receiving environment.

Question 7

Is clean stormwater diverted around or through the site?

Desired response: A positive response to question 7 should be achieved, unless clean stormwater does not need to be diverted.

Note: An example of where clean stormwater diversions may not be needed is a site with no upslope catchment, i.e. on the crest of a hill.

Question 8

If clean stormwater is diverted around or through the site, does it cause:

(a) an *increase in the concentrations of any contaminants in the clean stormwater flows or*
(b) erosion *(on site and/or off site)?*

Desired response: A negative response to all question 8 parts should be achieved.

Notes: Uncontrolled run off from up slope adds to the volume of stormwater to be managed on site and a corresponding increase in the size of the sediment basin. If possible, it should be diverted around or through the site and released in such a way that it doesn't cause erosion, water contamination, flooding or damage to structures.

Question 9

If clean stormwater has not been diverted around or through the site, have sediment basins been sized to accommodate the additional volume of runoff?

Desired response: A positive response to question 9 should be achieved.

If the response to this question is negative, section 1 of this guideline provides sizing criteria. Also consider responses under heading '*Erosion and sediment controls (other than sediment basins)'* further below.

Sediment basins

If no sediment basins are installed at the site, go to set of questions under heading '*Erosion and sediment controls (other than sediment basins)'* further below.

Question 10

Are all sediment basins meeting the following criteria:

(a) designed*, constructed and operated to:*
  i. retain the runoff generated from a ***24-hour storm event with an ARI of 1 in 10 years*** *or a* ***24-hour storm event with an ARI of 1 in 5 years*** *(quarries); and*
  ii. release stormwater with a quality that complies with the limits set out in the environmental authority.
(b) operated *in such a manner that within 120 hours of the most recent rainfall event, the required design capacity of the storage volume is available for capture and storage of stormwater runoff from the next rainfall event*
(c) the *capacity to store sediment in the basin has been designed such that the sediment storage zone is*

*equal to 50% of the **upper settling volume**.*

Desired response: A positive response to all question 10 parts should be achieved.

Notes: An alternative basin design to the **24-hour storm event with an ARI of 1 in 10 years** or **24-hour storm event with an ARI of 1 in 5 years** (quarries) may be accepted provided the contaminant load released to the receiving environment for the life of the design is no worse. This alternative design approach would need to be demonstrated to the department through appropriate site specific modelling.

It is expected that an alternative basin design, referred to as a high efficiency sediment basin, may incorporate the following:

- a rain activated flocculent/coagulant dosing system
- a sediment fore bay for primary sediment removal
- a spreader bar or weir structure between the fore bay and the sediment basin to cause laminar flow (i.e. limit turbulence) from the fore bay to the basin
- a hydraulically efficient sediment basin for secondary sediment removal
- a staged floating off take which preferentially releases the cleanest water begins releasing as the pond starts to fill, and increases the release flow rate corresponding to increases in water depth within the basin.

Other site features such as quarry voids, pits and drop cuts may be utilised as on-site storage.

When determining the cessation of rainfall, the department will consider a site based logging rain gauge or the nearest Bureau of Meteorology (BOM) monitoring station.

If the volume of the sediment storage zone is less than 50%, regard should be made to the maintenance frequency and its alignment to the expected sediment volumes expected to be generated during this maintenance period.

Question 11

Are sediment basin spillways structurally sound and in accordance with the requirements of a stormwater management plan?

Desired response: A positive response to question 11 should be achieved.

Notes: Sediment basin outlets (including spillways) and embankments should be structurally designed and constructed to be capable of withstanding the flows from a 50-year ARI rainfall event[17].

Reference should be made to the Queensland Urban Drainage Manual (QUDM) for applicable criteria including spillways, basin embankment and freeboards for consideration regarding the protection of property and human safety. It is the responsibility of the designer to correctly identify and clearly state the design ARI selected for the design of all structures based on an analysis of the consequences of failure.

[17] Design for a 50 year ARI critical event is considered a minimum. In some circumstances a more stringent design criteria may apply e.g. where there are structures that are referable dams under the *Water Supply (Safety and Reliability) Act 2008* or regulated structures under the EP Act.

Question 12

Are sediment basins:

(a) maintained with sufficient storage capacity to capture and treat the runoff from the design rainfall event; and
(b) dewatered as soon as practicable (but not more than 120hrs) following rainfall events?

Desired response: A positive response to all question 12 parts should be achieved.

Notes: Sediment basins should be kept empty in readiness to capture the next rainfall event. If captured water is intended to be reused, for example, for dust suppression or for processing materials, the basin needs to be sized to accommodate the additional capacity. Refer to heading '*Sediment basins'* for basin design criteria.

Question 13

Is accumulated sediment from sediment basins and other controls removed and disposed of properly?

Desired response: A positive response to question 13 should be achieved.

Notes: Sediment basin design usually allows for an additional 50% of the settlement design volume to be stored in the sediment basin. It is important that this volume is not exceeded because that causes a corresponding reduction in the basin's stormwater capture capacity. When sediment is removed from a sediment basin it should be disposed of appropriately without causing water contamination or placed where it could cause water contamination for example on-site burial of the sediment.

Erosion and sediment controls (other than sediment basins)

Question 14

For all areas that are not effectively stabilised:

(a) are erosion and sediment controls installed in accordance with a stormwater management plan?
(b) *does the runoff from all areas that are not effectively stabilised, drain to a sediment basin or, in instances where it is not feasible to direct runoff to a sediment basin, have compensatory erosion and sediment controls been implemented to minimise erosion and maximise sediment capture?*

Desired response: A positive response to all question 14 parts should be achieved.

Notes: Where erosion and sediment controls are not in accordance with the stormwater management plan, consider whether this is due to deficiencies or errors in the stormwater management plan or whether areas of the site are being actively worked for a short temporary period. For example, at the time of inspection, a drainage line adjacent to an internal site road is not in place as per the requirements of the stormwater management plan. This is because the road is undergoing maintenance over period of two days i.e. site is being actively worked. The drainage line will be immediately reinstated immediately following completion of road maintenance.

Runoff containing suspended sediment almost always needs to be captured in a sediment basin, and treated to remove suspended sediment prior to release. Operators who fail to provide for stormwater treatment run a high risk of not meeting the release criteria. The exception to this is where erosion control is so effectively implemented that runoff complies with the release criteria. This is usually only achievable in relatively small areas and is typically implemented where installing a sediment basin is impracticable (although the principle could be applied to an area of any size, providing the operator can demonstrate they met their general environmental duty).

Compensatory erosion sediment controls are erosion controls, flow controls and sediment controls which compensate for the lack of sediment basin and are applied such that the type, timing, placement and management of controls minimise the potential for water contamination and environmental harm. This is primarily achieved by reducing the risk of erosion and subsequent sediment release, for example, stabilising concentrated flow paths and by effectively stabilising exposed areas with an effective surface cover such as mulch, hydromulch, surface stabilising agent or turf.

Question 15

Are erosion controls applied to effectively protect steep areas, (such as stockpiles, batters and embankments) which are currently being worked or are not effectively stabilised, from erosion (including sheet, rill and gully erosion) caused by run-on flows from the upslope catchment. Are such flows conveyed to

lower levels without causing erosion (for example via a stable drain, chute, flume or pipe)?

Desired response: A positive response to question 15 should be achieved.

Notes: Uncontrolled sheet flows can cause erosion as velocity of the flow increases. Stabilisation of areas not subjected to concentrated flows can usually be achieved with a protective layer such as vegetation, mulch or geotextile. Sediment barriers such as sediment fences provide a secondary protection, but are usually insufficient to use without erosion controls, because they do not control suspended sediment.

'Effective' slope length should be regulated by the use of banks/bunds/drains/batter steps constructed parallel to the contour and at intervals sufficient to keep flows at non erosive velocities.

Question 16

Are sediment controls applied to effectively capture sediment eroded from steep areas, (such as stockpiles, batters and embankments) which are currently being worked or not effectively stabilised (for example, a sediment fence immediately down slope of such steep areas)?

Desired response: A positive response to question 16 should be achieved.

Notes: For stockpiles, batters and embankments being actively worked, it is incumbent on the operator to manage these areas such that, in the event of rain, these areas do not impact on receiving waters. It is important to protect stockpiles, batters and embankments from erosion because:

- this is part of a 'treatment train' approach, which seeks to minimise erosion in the first place
- through the process of erosion by stormwater, soil is usually separated into its constituent parts, which in terms of erosion sediment control are:
  - coarse and medium sediment unless captured on site is likely to cause sedimentation off site. If captured it needs to be disposed of appropriately.
  - fine sediment will usually become suspended in stormwater flows and unless captured and removed from released stormwater, is likely to impact on receiving waters. Once captured it needs to be disposed of appropriately.
  - topsoil greatly assists in the timely re-establishment of vegetation, which can significantly reduce the duration of soil exposure and the consequent potential for water contamination.

Question 17

(a) Are erosion and sediment controls installed correctly?
(b) Are erosion and sediment controls maintained in effective working order:
i. prior to each rainfall event; and
ii. at the end of each work day?
(c) *Have controls been implemented to prevent or minimise sediment from leaving the site on the tyres of vehicles?*

Desired response: A positive response to all question 17 parts should be achieved.

Notes: Sediment deposited on roads from vehicles exiting an ERA site is likely to constitute a breach of s.440ZG of the EP Act. From the roadway it is highly likely to enter the (unprotected) stormwater system during a subsequent rain event.

Disturbances in waterways

Question 18

If works or other disturbances in waterways are planned or have occurred:

(a) does prior written approval from the relevant consent authority exists, if required (for example permits under the Planning Act 2016, Coastal Protection and Management Act 1995, Vegetation Management Act 1999, Water Act 2000 (Water Act), etc)?
(b) where approval is not necessary for certain entities under the Water Act, has reference been made to Department of Resources (formerly Department of Natural Resources, Mines and Energy) Guideline – Riverine Protection Permit Exemptions Requirements - refer to https://www.dnrm.qld.gov.au/?a=109113:policy_registry/riverine-protection-permit-exemption-requirements.pdf

Desired response: A positive response to all question 18 parts should be achieved.

Notes: Work in waterways can have significant effects on stream health. Planning for works in waterways should include consideration of alternatives such as tunnel boring instead of trenching. Work within waterways should be planned and executed such that minimal erosion, sedimentation and turbidity results, such as scheduling works to occur during low flow or no flow seasons. At the completion of works, the waterway should be rehabilitated to pre-existing conditions.

Adaptive management

Question 19

Is there an effective monitoring program that measures and records the quality of all releases, flow and discharges from the activity to waters in accordance with monitoring condition?

Desired response: A positive response to question 19 should be achieved.

Notes: An inspection program should be implemented by those responsible for the site. The program should monitor all event based releases from the site including controlled releases and releases caused by rain events.

Question 20

a) Are non-compliances reported to the administering authority within 48 hours?
b) *Have events causing serious and material harm been reported in accordance with section 320 of the EP Act*?
c) Have additional measures been implemented to achieve compliance when non-compliances have been detected?

Desired response: A positive response to all question 20 parts should be achieved.

Notes: Typical erosion and sediment controls may produce different results on different sites, due to variations in soils, rainfall, slope, etc. In satisfying their legal requirements, those responsible for the site need to ensure that releases meet the release criteria, or where the release criteria is exceeded, that all reasonable and practical measures have been implemented. This includes reviewing monitoring data and where exceedences are found, implementing additional and or alternative controls to achieve the environmental outcomes.

Part 2 Low erosion hazard sites

The department will firstly work through Stage 1 questions. If an unlawful release has occurred or there is the potential for a release to cause environmental harm, the department will then move onto Stage 2. Responses to Stage 2 questions must be considered on balance to determine whether the general environmental duty has been satisfied.

Stage 1—Assessment of compliance with conditions of an approval

Design, construction and operation of stormwater treatment train.

Question 1

Is the release of the prescribed contaminant(s) expressly permitted by a condition of a relevant approval?

If yes, the release is lawful. In some instances, officers may need to also consider questions under heading *Stage 2—Assessment of compliance with the general environmental duty* below if compliance with the condition cannot be easily determined.

If no, the lawfulness of the release needs to be determined by assessing compliance with general environmental duty under heading *Stage 2—Assessment of compliance with the* general *environmental duty* below.

Notes: Under s.493A of the EP Act, an act which causes serious or material environmental harm, or a breach of s.440ZG is unlawful, unless it is authorised by one of the provisions listed in s.493A(2), which includes a development condition of a development approval or an environmental authority.

Section 493A also applies to sites where water contamination has been authorised to be done under an environmental protection policy, a transitional environmental program, an environmental protection order, a

temporary emissions licence, a standard condition of a code of environmental compliance of Chapter 4 under the EP Act, or an emergency direction.

If relevant, the department may request that the operator submit the following information as supporting evidence to demonstrate compliance with the conditions of approval:

- a MUSIC modelling report (including all data files)
- any as constructed completion report; and
- Water quality monitoring data that validates the contaminant reduction targets are being satisfied.

Modelling should be consistent with the *Water by Design: MUSIC Modelling Guideline Version 1.0 – 2010* or local government guidelines (where relevant) to demonstrate compliance with load reduction targets.

Where there is concern about the performance of the water quality improvement devices, the department may consider it necessary to require monitoring at the inlet and outlet of the stormwater treatment train. Any water quality monitoring would need to consider temporal variation for the key water quality parameters of TSS, TP and TN.

Surrogate methods involving analysis of the hydrologic and hydraulic performance may be considered on a case by case basis. The underlying assumption being that the hydrologic and hydraulic characteristics of the system define the detention time of the stormwater treatment elements which is critical to their performance.

Stage 2—Assessment of compliance with the general environmental duty

Question 2

*Has a validation report been completed, within six months of operation of the site, providing certification from an **appropriately qualified person** that the stormwater treatment train was designed and constructed in accordance with Section 1, Part 2 of this guideline?*

Desired response: A positive response to question 2 should be achieved.

Question 3

Is the stormwater treatment train being maintained and operated such that the design objectives and pollution reduction targets are being achieved?

Desired response: A positive response to question 3 should be achieved.

Notes: The performance of stormwater treatment devices is dependent on the maintenance considerations incorporated into their design. If treatment devices are not appropriately maintained they are unlikely to be delivering the design treatment efficiency and be operating in non-compliance with contaminant reduction targets prescribed in the environmental approval.

Routine monitoring checks the status of key functional elements to ensure they meet specified design requirements and may have particular reference to:

- ensuring that inlet and outlet structures are free of debris
- erosion
- an evenly distributed vegetative cover of the system that is maintained free of weeds and debris
- sediment fore bays and basins that are de-silted to maintain design capacity; and
- algal blooms in any standing water bodies.

The maintenance checklists in the Healthy Waterways - Water by Design technical design suite (www.waterbydesign.com.au) should be considered.

It may be appropriate to require a site operator conduct water quality monitoring if it is apparent that the stormwater management measures are in a poor state of maintenance.

Definitions

Note: *that where a term is not defined, the definition in the EP Act, its regulations or environmental protection policies must be used. If a word remains undefined it has its ordinary meaning.*

Appropriately qualified person(s) means a person or persons who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature.

The appropriately qualified person(s) should have, or collectively have, the following capabilities:

(a) A detailed understanding of relevant sections of the following guidelines and legislation:
   i. *Environmental Protection Act 1994* and Environmental Protection Regulation 2019
   ii. Environmental Protection (Water and Wetland Biodiversity) Policy 2009
   iii. Environment and Heritage Protection Urban Stormwater Planning Guidelines 2010
   iv. Queensland Urban Drainage Manual 2007
   v. IECA (2008) Best Practice Erosion and Sediment Control
(b) An understanding of hydrology and hydraulics, including the ability to size and determine stabilisation requirements of drainage structures and treatment devices.
(c) An understanding of soil as it relates to revegetation and erosion. Specifically the ability to conduct an effective soil sampling program, interpret results and design management strategies to address problems soils (pH, sodic, dispersive, and saline).
(d) An understanding of appropriate use of the revised universal soil loss equation (RUSLE) to estimate soil loss.
(e) An understanding of the erosion, drainage and sediment controls considered best practice in Australia, and knowledge on the correct installation, operation and maintenance of these controls.
(f) Ability to prepare erosion and sediment control plans of a standard that is suitable for construction.
(g) Has experience in erosion and sediment control and a suitable environmental or engineering degree from a recognised institution.
(h) Has demonstrated experience in modelling (using MUSIC) and design and detailing of stormwater treatment systems (Part 2 low erosion hazard site designs).

Sediment storage zone means the storage available in the bottom section of the sedimentation basin designed to retain settled sediments.

24 hour storm event with an ARI of 1 in 5 years means the maximum rainfall depth from a 24 hour duration precipitation event with an average recurrence interval of once in 5 years. *For example, at location XX an Intensity-Frequency-Duration table for a 24 hour duration event with an average recurrence interval of 1 in 5 years identifies a rainfall intensity of 7.09mm/hour. The rainfall depth for this event is therefore 24 hour x 7.09mm/hour = 170.16mm.*

24 hour storm event with an ARI of 1 in 10 years means the maximum rainfall depth from a 24 hour duration precipitation event with an average recurrence interval of once in 10 years. *For example, at location XX an Intensity-Frequency-Duration table for a 24 hour duration event with an average recurrence interval of 1 in 10 years, identifies a rainfall intensity of 8.2mm/hour. The rainfall depth for this event is therefore 24 hour x 8.2mm/hour = 196.8mm.*

Upper setting volume means the volume of the sediment basin designed to capture surface runoff from storm events up to the design event.