Environmental factor guidance: Terrestrial Environmental Quality

ntepa Northern Territory Environment Protection Authority

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1. Introduction

Under the *Environment Protection Act 2019* (EP Act), a proposal (proposed action or strategic proposal) that has the potential to have a significant impact on the environment must be referred to the Northern Territory Environment Protection Authority (NT EPA) for assessment. The NT EPA is responsible for deciding whether a proposal requires environmental impact assessment (EIA) under the EP Act. A proposal that undergoes EIA by the NT EPA must have an environmental approval granted by the Minister for Lands, Planning and Environment (Minister) before it can proceed.

To guide the EIA process the NT EPA has developed a series of environmental factors and objectives as a system for organising environmental information and identifying key values that require protection. The environmental factors assist in determining the potential significant impacts of a proposal.

This guidance is prepared in accordance with section 291 of the EP Act to provide advice on the operation of the EP Act with respect to Terrestrial Environmental Quality.

2. Purpose

The purpose of this guidance is to outline when and how the NT EPA's Environmental factor: Terrestrial Environmental Quality is considered in the EIA process. It is intended to provide clarity and facilitate process efficiency.

The guidance provides advice on:

1. A proponent's obligations in respect to the EP Act.
2. When to consider referral of a proposal based on potential impacts on Terrestrial Environmental Quality.
3. Requirements of assessment documentation relating to Terrestrial Environmental Quality.

This document is part of a series of guidance prepared by the NT EPA to support proponents through the EIA process. Accordingly, this guidance is meant to be read in conjunction with other guidance documents, ensuring a fuller understanding of the EIA process and the NT EPA's requirements, as shown in Figure 1.

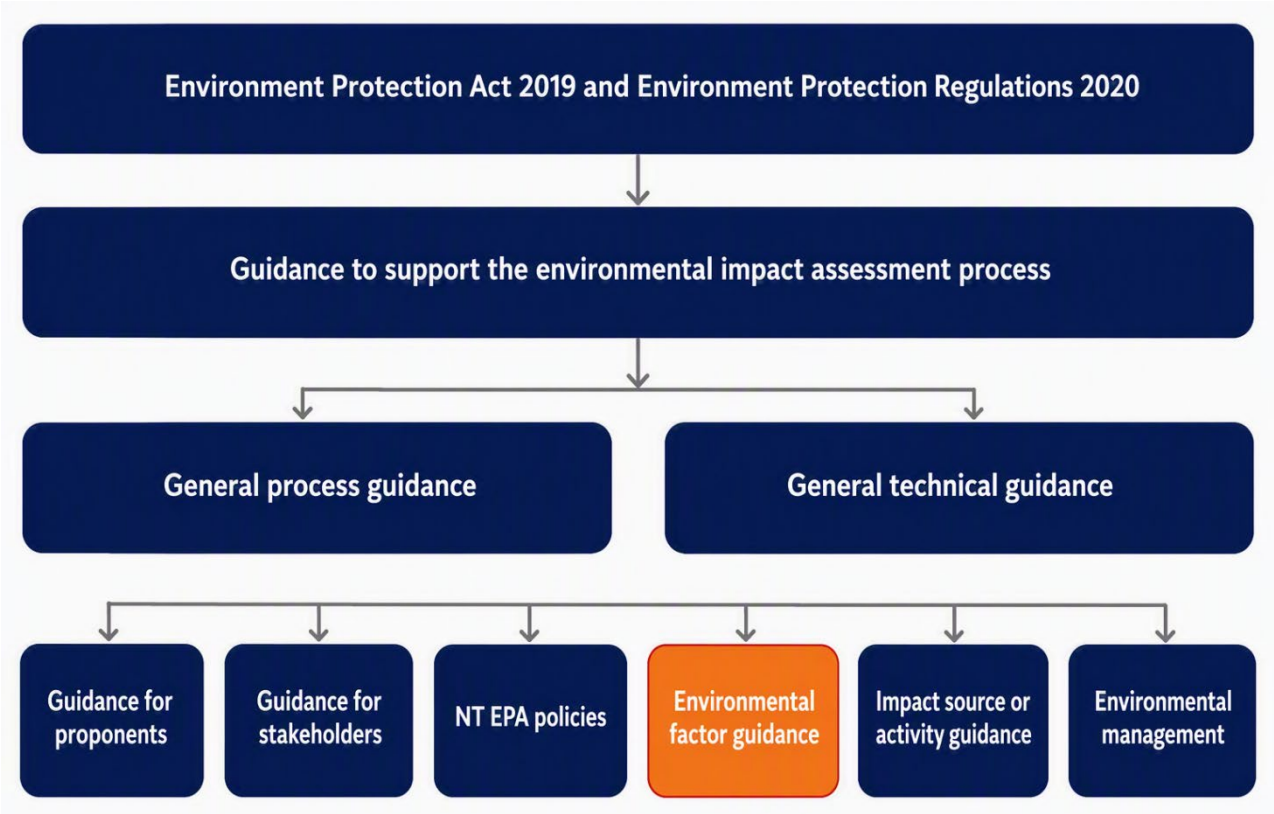


Figure 1 Environmental impact assessment guidance framework

3. Environmental factor: Terrestrial Environmental Quality

Soils are an essential component of terrestrial ecosystems and contribute significantly to the Territory's environmental, economic, cultural and social wellbeing. Soils are the layer of organic and inorganic weathered material that accumulates at the Earth's surface. Soil is a component of land, mainly made up of mineral particles (sand, silt, clay), organic matter, air, water, microbes and living organisms. Good quality soils provide the basis for healthy ecosystems, help store carbon and water, support biodiversity, and are fundamental in sustaining all life.

The NT EPA's objective recognises the chemical, physical, biological and aesthetic characteristics of soils, the importance of soil quality and integrity and its role in supporting and maintaining environmental, ecological, cultural and social values. Therefore, this factor will focus on how proposal-related changes to soil structure, composition and quality impact environmental values.

Environmental Factor	Environmental Objective
Terrestrial Environmental Quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained

3.1. How this factor links with other environmental factors

The NT EPA recognises the complex interrelationships between Terrestrial Environmental Quality and other NT EPA environmental factors, within and across themes. Environmental impacts to Terrestrial Environmental Quality values are considered by the NT EPA within the context of other factors, such as

Landforms, Terrestrial Ecosystems, Inland Water Environmental Quality, Culture and Heritage, and Community and Economy.

The physical, chemical, biological and aesthetic characteristics of land and soils are important in determining underlying environmental values which may be related to other environmental factors. Therefore, the focus of this factor and its objective is how changes to land and soil quality impact environmental values. Where Terrestrial Environmental Quality values (e.g. soil structure and function) are linked to other factors (e.g. Inland Water Environmental Quality) proponents should integrate the various parts of their EIA documents so that relationships are clear.

3.2. Application of this guidance

The EP Act requires a proponent to refer a proposal to the NT EPA for assessment if it has the potential for a significant impact on the environment. If a referral is required but is not made by the proponent, a statutory decision-maker may refer a proposal to the NT EPA for assessment, or the NT EPA may call-in (i.e. require referral of) a proposal for assessment. If a proposal is referred based on its potential impacts to Terrestrial Environmental Quality, the referral should include the information specified in this guidance.

Proponents are encouraged to undertake their own investigations and seek pre-referral advice from the Department of Lands, Planning and Environment (DLPE) about:

- whether a proposal is likely to have the potential for a significant impact on Terrestrial Environmental Quality values
- whether targeted information about existing soil conditions and the area of predicted direct, indirect, and cumulative impacts is required to inform the EIA process.

A proponent also has general duties under an environmental impact assessment process (section 43 of the EP Act). Proponents must describe in their referral information and, where assessment is required, any subsequent documents prepared to submit to the NT EPA during the assessment process, how the general duties under section 43 of the EP Act have been met.

If a referral has insufficient information about potential impacts to Terrestrial Environmental Quality, and the NT EPA decides to assess the proposal, it may request that a proponent provide further information in subsequent EIA documents such as a supplementary environmental report (SER) or environmental impact statement (EIS). The NT EPA may recommend that the Minister impose conditions on an environmental approval to manage potential significant impacts to Terrestrial Environmental Quality. Proponents should consider the NT EPA's published guidance related to EIA statutory processes and timeframes.

4. Considerations for EIA

Consideration of the Environmental factor: Terrestrial Environmental Quality includes but is not limited to:

- the current state of knowledge about land and soil types and quality in the potentially affected area
- the environmental values supported by Terrestrial Environmental Quality that would potentially be impacted, and their significance
- contaminants of concern and potential pathways for impacts to soil quality, and the risk to environmental values supported by soil quality
- the sensitivity, value and quality of potentially affected land and soils and the duration, magnitude and geographic extent of impacts to environmental values
- how the general duties under section 43 of the EP Act have been met:

    - information and opportunities for consultation provided to affected communities, to assist each community's understanding of the proposal and its potential impacts and benefits
    - how affected communities, including Aboriginal communities, have been consulted in a culturally appropriate manner
    - how community knowledge and understanding (including scientific and traditional knowledge and understanding) of the natural and cultural values of areas that may be impacted by the proposal, has been sought and documented
    - how Aboriginal values and the rights and interests of Aboriginal communities in relation to areas that may be impacted by the proposal, have been addressed
    - how the principles of ecologically sustainable development and the waste management hierarchy, have been considered in the design of the proposal
    - how the environmental decision-making hierarchy has been applied to the design of the proposal to avoid, and then mitigate impacts to land and soil quality
- whether proposed avoidance, mitigation and management measures are technically and practically feasible
- information gaps or uncertainties in relation to land and soils and the level of confidence in predicted impacts
- whether targeted studies, soil testing investigation and analysis, land assessment, modelling, and mapping have been undertaken to a standard consistent with published guidance and best practice
- whether a proposal will enhance or restore environmental quality in a manner that protects the quality of land and soils.

Proponents are encouraged to engage early with DLPE, prior to preparing and submitting the referral information or any subsequent EIA documents.

When considering the significance of potential impacts to land and soil quality, the NT EPA may have regard to the matters as outlined in the NT EPA Environmental factors and objectives guidance.

4.1. Issues

In its assessment of referred proposals for which the Terrestrial Environmental Quality is a key factor, areas of particular interest to the NT EPA that may impact the quality and integrity of land and soils are discussed below.

Land use practices causing erosion and salinity

Soil structure can take thousands of years to develop but can be changed rapidly by land use practices e.g. an increased amount of water passing through an irrigated soil profile compared to natural conditions. This can cause the acceleration of mineral weathering, sediment transport, leaching, degradation of soil structure, and changes to groundwater level and quality. Intensive cropping and tillage can also expose the soil surface to wind disturbance and erosion, and soil disturbance at depth.

Erosion occurs through soil being transported by natural forces such as wind, water, waves or gravity. It is a natural geological process that usually occurs at low rates and is influenced by landforms, climate, rainfall, soil type, vegetation cover and land use. Erosion can be accelerated by vegetation clearing, earthworks, crop cultivation, livestock grazing and fires. Severe erosion leads to poor soil structure in remaining soil, reduced water infiltration and a general loss of soil health. Soil erosion can affect biodiversity through

stripping native vegetation seed banks from topsoil and spreading weeds. Loss of valuable topsoil can significantly reduce the productivity of agricultural land, requiring soil amelioration to improve quality.

Salinity is the accumulation of salt in land and water to a level that has the potential to cause environmental impacts. Many parts of the NT landscape are naturally salty, but development activities can cause salt levels to rise. This may cause issues when salts are carried by water to affect agricultural land, infrastructure such as roads and buildings, water resources, and environmental values such as wetlands. Salinity usually occurs with other issues such as decreasing soil and water quality, erosion, and loss of native vegetation. Areas affected by salinisation may require management to reduce the potential for environmental impacts.

The most significant impacts leading to erosion are from land use practices that increase exposure and vulnerability of soils through vegetation clearing. Where potential significant impacts to land and soil quality are likely to occur during implementation of a proposal, the NT EPA will consider and assess these impacts as part of the EIA process.

Waste or storage structures as a source of contaminants

Many developments require the storage of large quantities of waste soil and rock materials. Waste or storage structures, including tailings storage facilities, waste rock dumps, and temporary stockpiles, can cause impacts to soil quality during construction and mining operations or post-closure. Areas of particular interest to the NT EPA include:

- the appropriate siting of waste structures and temporary stockpiles in a catchment
- the nature and characteristics of the materials stored in the waste structures or stockpiles, where there is the potential for soil quality to be impacted by erosion, oxidisation of acid forming materials, or the mobilisation of metals and other pollutants
- the 'co-disposal' of large volumes of waste rock material in residual pit voids, where there is potential for contamination of groundwater or a risk of resource sterilisation
- the availability of suitable material to encapsulate and neutralise acid forming soils or mine waste rock which could cause downstream soil and water contamination
- the design, monitoring, and management of waste structures and soil stockpiles to avoid environmental impacts, taking into account appropriate guidance and standards.

Acid sulfate soils

Due to the extensive, intertidal, estuarine and floodplain systems of the Top End, the Northern Territory has the most extensive area of land susceptible to acid sulfate soils (ASS) risk in Australia[1]. ASS occurring naturally are not considered an issue when left in a waterlogged, undisturbed environment.

Disturbance through drainage or excavation can cause the iron sulfides in the soils to react with oxygen and water to produce iron compounds and sulfuric acid and mobilise other pollutants such as heavy metals, into the receiving environment and downstream waterways.

Remediation, rehabilitation and monitoring

[1] Hill, J and Edmeades, B. 2008. Acid Sulfate Soils of the Darwin Region, Technical Report no 09/2008D. Department of Natural Resources, Environment, the Arts and Sport. http://www.ntlis.nt.gov.au/hpa-services/techreport?report_id=LRD08009

Many developments require rehabilitation and monitoring for extended periods following completion or closure. Areas of interest to the NT EPA include:

- assessment and management of site contamination to protect human health and the environment in line with the National Environment Protection (Assessment of Site Contamination) Measure
- proposed changes in land use that require treatment or management of contamination e.g. from industrial to residential use
- management of mine waste rock and tailings and naturally occurring radioactive material for mine site remediation, rehabilitation and closure
- management of land contaminated by chemicals, pollutants, acid sulfate soils, or radioactive materials
- the need for scientifically defensible and measurable monitoring criteria for e.g. site contamination, biodiversity recovery, erosion stability, and reduced oxidation rates
- progressive stabilisation and revegetation of disturbed areas.

5. EIA of terrestrial environmental quality

Under section 11 of the EP Act, a 'significant impact' of an action means:

'an impact of major consequence having regard to the context and intensity of the impact; and the sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact.'

Therefore, in assessing the potential significant impacts of a proposal, proponents should have regard to environmental values with consideration of the quality and sensitivity of land and soils in the potentially impacted area, and the duration, magnitude and extent of potential impacts to those values.

5.1. Terrestrial environmental quality values

The physical, chemical, biological and aesthetic characteristics of soils are indicators of soil types and quality and support other environmental values. The beneficial uses of good quality soils are primarily agriculture, maintaining water quality, recreation and cultural values. Soils support values that maintain ecosystem health such as biodiversity, water quality and seed banks.

5.2. Potential impacts

The focus of this factor and its environmental objective is on the significance of impacts to land and soil. In examining potential impacts to Terrestrial Environmental Quality, the NT EPA may consider the predicted direct, indirect and cumulative impacts to the physical, chemical, biological and aesthetic characteristics of soils. The pathways for potential impacts include, but are not limited to:

- direct removal or addition of soil or rock material for earthworks, extraction, or mining
- soil erosion, sedimentation, salinisation dispersion and compaction
- leached irrigation water or industrial water
- changes to physical and chemical properties of soil.

Activities that may have the potential to impact Terrestrial Environmental Quality include, but are not limited to:

- native vegetation clearing
- agricultural practices (e.g. cropping, livestock grazing, intensive tillage or irrigation)
- earthworks, quarrying and mining
- mine waste rock and tailings disposal
- wastewater disposal
- disturbance of acid sulfate soils or acid forming materials
- industrial land uses involving chemicals or pollutants
- land use practices impacting soil structure and quality.

5.3. Information required by the NT EPA

Proponent EIA documents should describe, map and quantify land and soil values and the potential significant impacts to those values, assess impacts in potentially affected areas, and include management measures for all stages of the proposal from initial land clearing and development through to rehabilitation and closure.

The level of information and detail in a proponent's EIA documents should be proportionate to the size and scale of the proposal, and the duration, magnitude and geographic extent of its direct, indirect and cumulative impacts.

The Terrestrial Environmental Quality component of an EIA document should provide information, investigations or studies including but not limited to:

- topography (e.g. elevation, slope, aspect), geology (e.g. bed rock, minerals) and surface and groundwater hydrology of the proposal and surrounding areas
- description of soil types and profiles in the proposal and surrounding areas
- physical, chemical, biological and aesthetic characteristics of soils
- results of geotechnical information and interpretation regarding soil stability and suitability
- land evaluation and suitability assessment information
- existing condition of soils and land in the proposal and surrounding areas
- current land use practices
- assessment of erosion hazard and risk for exposed soil surfaces in line with Best Practice Erosion and Sediment Control guidance
- assessment of potential or actual presence of acidic soils in line with the National Acid Sulfate Soils Guidance
- assessment of site contamination in line with the National Environment Protection (Assessment of Site Contamination) Measure
- calculated estimation of cut and fill volumes, overburden and/or waste materials, hazardous substances and contaminants
- physical and chemical characteristics of overburden and/or waste materials

- the pathways (causes) for impact on soil structure and quality (e.g. erosion, disposal or storage of overburden materials, release of hazardous substances, release of contaminants)
- the avoidance, mitigation, management, and rehabilitation measures at local and catchment level which may include (where applicable), but not necessarily limited to:
  - measures to address soil erosion, such as the protection of native vegetation, rehabilitation of degraded native vegetation, reforestation and tree planting
  - measures to maintain land stability
  - measures to address salinity
  - measures to address or manage ASS/PASS
  - measures to address or manage potential acid-forming (PAF) material and acid mine drainage (AMD)
  - remediation, rehabilitation, and mine closure plans
- consideration of cumulative impacts of the proposal on land and soil values in conjunction with other existing and reasonably foreseeable proposed development activities
- whether the impacts of the proposal would interact with the impacts of a changing climate in a way that amplifies the severity or permanence of impacts to land and soil quality
- justification of the suitability of the methodologies, surveys or processes used to provide information about land and soils
- any information gaps or uncertainties in relation to potential land and soil quality impacts
- potential residual impacts or risks of the proposal on the identified environmental values
- proposed monitoring and reporting activities related to the management of potential significant impacts and risks
- the methods and outcomes of engagement and consultation with stakeholders, including Aboriginal stakeholders, about a proposal's potential significant impacts to land and soil quality.

Depending on the causal pathways of impacts to land and soil values, information and results of specialised soil and geotechnical surveys, modelling, mapping (e.g. erosion hazard assessment, soil loss estimates, ASS/PASS assessment, slope stability assessments etc.) and high resolution aerial imagery or LiDAR may be required.

If soil erosion or sedimentation is identified as one of the key issues under the Terrestrial Environmental Quality factor in relation to a proposal, the development and implementation of an Erosion and Sediment Control Plan should conform to standards required by the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control guidance.

If soil testing confirms the presence of ASS/PASS in the potentially affected area, an ASS management plan should be developed and implemented in line with the National Acid Sulfate Soil Guidance.[2]

The results of any relevant land and soil investigations, studies and/or modelling used in impact predictions (e.g. Revised Universal Soil Loss Equation (RUSLE), Landscape Evolution Model (LEM)) should be provided to inform an understanding of potential impacts. The RUSLE may be used to predict long-term soil loss

[2] Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. Available at: https://www.waterquality.gov.au/sites/default/files/documents/identification-laboratory-methods.pdf

rates and soil erodibility to determine suitable drainage, erosion and sediment controls and management options. LEMs have the added capability of predicting how landscapes will evolve at annual, decadal, centennial, and longer time scales. If high resolution aerial imagery or light detection and ranging (LiDAR) methods are used to support the assessment process, these data should be provided in an agreed format.

Proponents must engage and consult with stakeholders, including Aboriginal stakeholders, as part of the EIA process. Proponents of proposals on Aboriginal or Native Title Land should engage with the appropriate land council at each stage of the EIA process and consider the value of Indigenous Ecological Knowledge in relation to potential impacts to land and soil quality. Refer to NT EPA guidance Stakeholder Engagement and Consultation[3] for more information.

6. Environmental approval

The Minister for Lands, Planning and Environment (the Minister) is responsible for granting or refusing to grant an environmental approval.

At the conclusion of the EIA process the NT EPA provides its assessment report to the Minister to provide advice on the acceptability of a proposal and may recommend conditions for an environmental approval to manage potential impacts to Terrestrial Environmental Quality.

The Minister may impose conditions on an environmental approval to manage the potential impacts of the proposal.

7. Review

This guidance will be reviewed periodically and in response to changes in the policy or regulatory environments or expert advice.

[3] NT EPA 2021, Stakeholder Engagement and Consultation. Northern Territory Environment Protection Authority.