Environmental factor guidance: Landforms

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 Landforms.

2. Purpose

The purpose of this guidance is to outline how the Environmental Factor: Landforms is considered by the NT EPA 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 landforms.
3. Requirements of assessment documentation relating to the Environmental Factor: Landforms

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 the other guidance documents, ensuring a fuller understanding of the EIA process and the NT EPA's requirements, as shown in Figure 1.

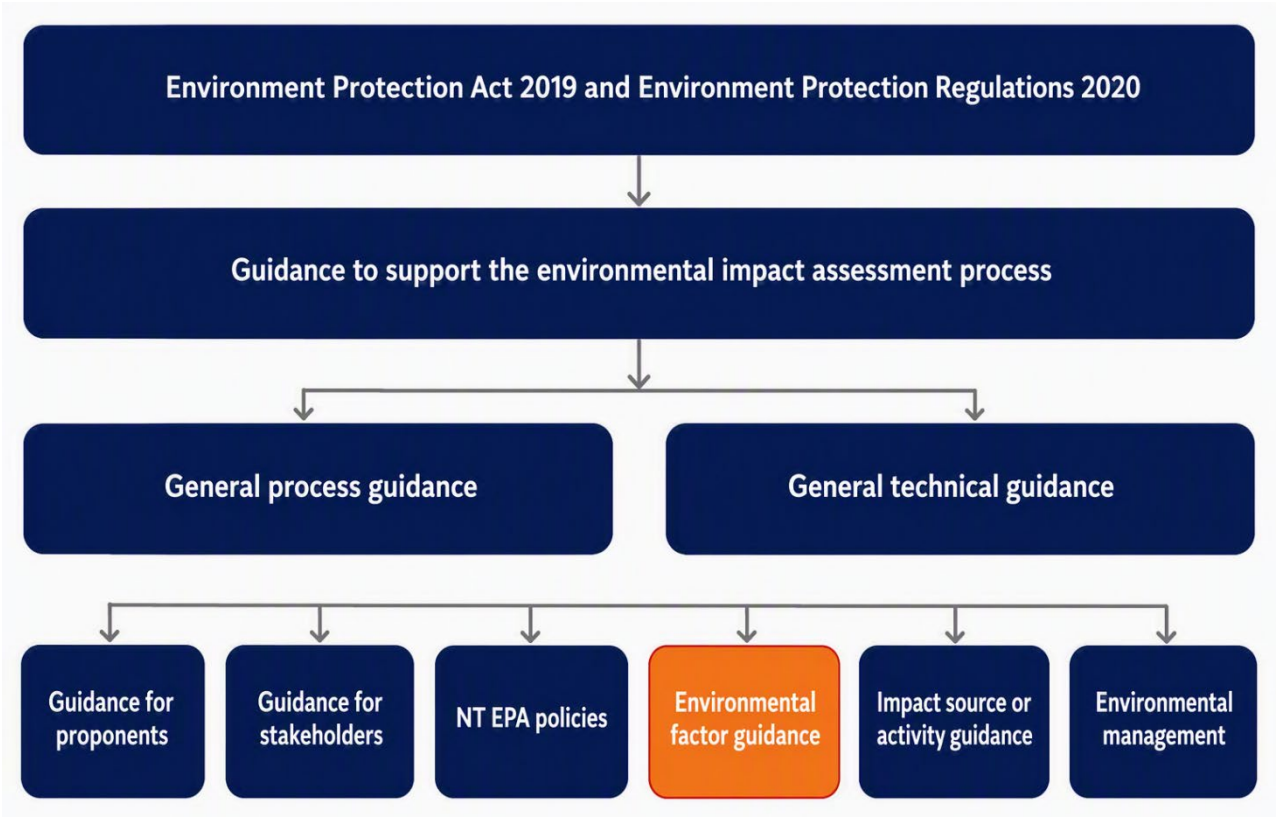


Figure 1 Environmental impact assessment guidance framework

3. Environmental Factor: Landforms

Landforms are a component of a landscape. The term 'landscape' is broadly defined as:

> 'An area of land comprising landforms and interacting ecosystems; an expanse of land, usually extensive, that can be seen from a single viewpoint'.

Landscapes can be either natural (largely unaffected by human activity) or anthropogenic (created or largely modified by human activity).[1]

For the purpose of EIA, the NT EPA defines 'landforms' to mean:

> 'The distinctive, recognisable physical features of the Earth's surface having a characteristic shape produced by natural processes. A landform is defined by the combination of its geology (composition) and morphology (form).[1]

The environmental objective for the factor Landforms is: 'Conserve the variety and integrity of distinctive physical landforms.' This objective recognises that the natural geology and morphology of a landform may

[1] Adopted from WA EPA, 2018. Environmental factor guideline: Landforms (https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Guideline-Landforms-29062018.pdf).

have intrinsic value, and the important role distinctive landforms often have in supporting and maintaining environmental values.

Environmental Factor	Environmental Objective
Landforms	Conserve the variety and integrity of distinctive physical landforms

Features in the landscape that are distinctive physical landforms include, for example:

- prominent ranges e.g. Tjoritja (West MacDonnell Ranges)
- gorges e.g. Nitmiluk (Katherine Gorge)
- cliffs and canyons e.g. Watarrka (Kings Canyon)
- caves, karsts, adits e.g. Cutta Cutta Caves, Kohinoor Adit
- mesas e.g. Artilla (Mount Conner)
- inselberg e.g. Uluru (Ayers Rock)
- claypans e.g. Ilparpa claypan
- craters e.g. Tnorala (Gosse Bluff)
- springs e.g. Bitter Springs
- rivers and lakes e.g. Adelaide River, Lake Woods
- wetlands e.g. Port McArthur Tidal Wetlands System
- floodplains e.g. Mary River floodplain
- faults e.g. Angkerle Atwatye (Standley Chasm)
- massifs, plateaus, escarpments e.g. Arnhem Plateau and escarpment
- deserts e.g. Tanami desert, Simpson desert
- sand dunes e.g. parallel rolling sand dunes in Munga-Thirri-Simpson Desert National Park.

During EIA, the NT EPA considers potential significant impacts to natural distinctive physical landforms and their associated environmental values.

3.1. How this factor links with other environmental factors

The NT EPA recognises that there are complex links between the Environmental Factor: Landforms and other NT EPA environmental factors.

Environmental impacts to landforms values are considered by the NT EPA within the context of other factors, such as Terrestrial Environmental Quality, Terrestrial Ecosystems, Hydrological Processes, Inland Water Environmental Quality, Aquatic Ecosystems, Coastal Processes, Community and Economy, and Culture and Heritage.

Landforms may affect and be affected by hydrological processes, terrestrial ecosystems, aquatic ecosystems, soil quality and inland water quality. The loss or alteration of a landform can trigger cascading effects across multiple other environmental factors. The NT EPA may consider Landform values in line with other environmental factors during its assessment of impacts.

A change in the extent or condition of physical landforms may impact environmental values (e.g. ecological, hydrological, recreational, social, cultural) which are covered under other environmental factors.

Where values and impacts associated with landforms are addressed under other environmental factors the various parts of EIA documents should be integrated so that the 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 a proposal for assessment. If a proposal is referred based on its potential impacts to Landforms, the referral information should include the information specified in section 5 of 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 the proposal is likely to have the potential for a significant impact on environmental values associated with Landforms and the type of information required about the proposal to inform EIA and decision-making.

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 landform values, 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 that are necessary to manage impacts to landforms. Proponents should consider the NT EPA's published guidance documents for advice on EIA statutory processes and timeframes.

4. Considerations for EIA

Considerations for EIA for the Environmental factor: Landforms include, but are not limited to:

- the current state of knowledge of Landforms and their associated environmental values (physical, biological, economic, social and cultural)
- the significance of potential impacts from the proposal on environmental values and defining Landforms features
- the extent of impacts to Landforms from previous and reasonably foreseeable planned future development activities or land uses
- the impact of the proposal on the stability and integrity of Landforms
- the sensitivity and quality of Landforms and the duration, magnitude, and geographic extent of potential significant impacts to Landforms and associated 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, and offset impacts to Landforms
- whether proposed avoidance, mitigation, and offsets measures to manage impacts are practical and feasible
- whether targeted studies and investigations have been undertaken to a standard consistent with this guidance and best practice
- the conservation significance of Landforms and their associated cultural, social and biodiversity values
- whether the proposal would enhance or restore environmental quality in a manner that protects the variety and integrity of Landforms.

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 distinctive Landforms, the NT EPA may have regard to the matters as outlined in the NT EPA Environmental factors and objectives guidance.

5. EIA of landforms

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

'an impact of major consequence having regard to:

(a) the context and intensity of the impact; and

(b) the sensitivity, value and quality of the environment impacted on and the duration, magnitude, and geographic extent of the impact.'

In assessing impacts under the Landforms factor, proponents are to identify the environmental values associated with or supported by the Landforms that would potentially be impacted by the proposal and include an assessment whether the landform is considered to be a distinctive physical Landform.

5.1. Determining if a landform is distinctive

The following criteria may be used in determining whether a landform is distinctive:

- Variety – whether the landform is a particularly important example of its type and whether the landform type is well represented over the local, regional or national scale or differs from other examples at these scales, either naturally or as a result of cumulative impacts from existing and reasonably foreseeable activities, developments and land uses.

- Integrity – whether the landform is intact, being largely complete or whole and in good condition.
- Ecological importance – whether the landform has a significant or distinctive role in maintaining existing ecological and physical processes e.g. by providing a unique microclimate, source of water flow, or shade, or supports endemic or highly restricted plants or animals.
- Scientific importance – whether the landform provides evidence of past ecological processes or is an important geomorphological or geological site; whether the landform is of recognised scientific interest as a reference site, or an example of where important natural processes have taken place or are operating.
- Rarity – whether the landform is rare or relatively rare, being one of the few of its type at a national, regional, or local level.
- Social and cultural importance – whether the landform supports significant visual or scenic amenity, and significant social, cultural and/or heritage values linked to its defining physical features.

The landform does not necessarily need to meet all criteria to be considered a distinctive landform, only one criterion may be enough to qualify a landform as being distinctive.

5.2. Landforms environmental values

Distinctive physical landforms have value in their own right and can also play a significant role in supporting a variety of other environmental values (e.g. biodiversity, water, cultural values). Landforms can represent an example of important physical landscape processes; a site of special scientific interest related to geology and geomorphology and may be a foundation for particular types of ecosystems. Landforms often also embody significant social and/or economic values (e.g. tourism) and cultural values (e.g. sacred sites). Many distinctive landforms have strong historical and cultural associations and provide enjoyment through aesthetics (panoramas, views, lookouts) or active recreational use (e.g. tourism, climbing, hiking). Distinct groups of people may ascribe different aesthetic, cultural, spiritual, and economic values to distinctive Landforms.

Proponents are to identify the environmental values of the landform itself (such as landscape values), and the environmental values the landform supports (such as biodiversity and ecosystem values).

The NT EPA notes that many distinctive physical landforms in the NT are protected in conservation reserves and therefore the landform and its associated environmental values are unlikely to be subject to disturbance from a proposal undergoing EIA.

Additionally, many distinctive physical landforms in the Territory hold significant cultural values that require ongoing protection. For some Aboriginal people, the relationship with the natural world comes from the belief that all elements of the universe, including humans, plants, animals, landforms, and waterways as well as the Sun, Moon, and stars, were all created by ancestral (spirit) beings. After the creation of the world, these spirits became part of the landscape, and they live on in mountains, rivers, and other natural landform features today.

5.3. Potential impacts

The focus of this factor and its environmental objective is on potential significant impacts to existing distinctive physical landforms, their defining features, and environmental values. The NT EPA evaluate the direct, indirect, and cumulative impacts from a proposal on environmental values associated with a landform.

In considering these impacts, the NT EPA will focus on the impact of the removal or alteration of the landform's defining geology, morphology or physical processes and the dependent environmental values.

The sensitivity, value and quality of existing landforms and the duration, magnitude and extent of the proposal's impacts should be considered when predicting impacts. Sensitivity refers to how sensitive or vulnerable to change an environmental value is to a proposal's impacts. Magnitude refers to the physical scale of the proposal and the contrast it presents to the existing condition of a distinctive landform. Magnitude also includes consideration of potential cumulative impacts i.e. the result of the incremental impact of a proposal when added to other past, current, and known likely future development activities.

Impacts to landforms may occur as a result of activities such as vegetation clearing, earthworks, mining, agriculture, forestry, alteration of waterways, or changes in surface or groundwater flows.

Direct impacts to distinctive physical landforms such as a loss or reduction in area, and indirect impacts such as a change in the quality of landform values (ecological, aesthetic, or recreational, cultural and heritage, human use) should be considered.

In determining whether potential impacts to environmental values associated with landforms are significant, proponents should consider if:

- the landform is rare, unique or poorly represented in the NT at local, regional, national or global scale
- the proposal would reduce the extent, integrity or condition of a landform that contributes to regional landscape character or connectivity
- the landform supports important ecological processes, habitats or threatened species, and the proposal would disrupt those functions
- the landform is associated with culturally significant places, practices or values for Aboriginal people
- the proposal may alter hydrological, ecological or geomorphological processes, including sediment transport, groundwater recharge or surface water flows that sustain the landform
- the landform is sensitive to disturbance or irreversible change, or unlikely to recover within a reasonable timeframe
- the cumulative impact of the proposal, combined with other past, present or reasonably foreseeable activities, would materially alter the character, integrity or functioning of the landform or broader landscape system
- 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 e.g. where a landform already faces reduced water recharge or intensified fire weather under credible climate scenarios, whether the proposal would compound those pressures.

Proponents should engage appropriate qualified and experienced professionals (e.g. geomorphologists, landscape ecologists, landscape and visual impact assessment professionals) to prepare assessments of significant landforms using recognised methodologies.

5.4. Information required by the NT EPA

A proponent's EIA documents should describe, map, and quantify (where possible) the environmental values of landforms and the potential significant impacts of the proposal.

The assessment information and level of detail in a proponent's EIA documents should be proportionate to the proposal, the sensitivity and value of the environment that would be impacted, and the duration, magnitude, and extent of potential impacts. The EIA process should assess impacts on all potentially affected areas whether on or off the proposal site and include consideration of impacts during all stages of the proposal from initial land clearing and earthworks through to decommissioning and rehabilitation.

The Landforms component of an EIA document should provide information or studies which may include the following:

- analysis of whether the landform is distinctive in a local, regional, and national context having regard to the variety and integrity of the landform and its associated environmental values
- identification of the spatial extent of the distinctive landform in a local and regional context
- physical, chemical, biological and aesthetic values and characteristics of landforms and potential impacts to those values and characteristics
- social, cultural and economic values associated with landforms and the significance of potential impacts to those values
- description of the geology, topography and geomorphology, and associated processes that are relevant to the formation and shaping of the existing landform (such as geological structure, soil and substrates characteristics, contour, slope, aspect, drainage pattern, surface and groundwater movement, erosion potential, sedimentation processes, and stability)
- identification of the environmental values supported by the landform, and a discussion of the interrelationships between values including how the proposal would affect a distinctive landform in maintaining and supporting these values (e.g. through changes to land and soil stability, structure, quality, erosion, sedimentation, access, landscape connectivity, essential habitat, surface water or groundwater, and , and potential impacts to cultural heritage values)
- analysis of the landform both prior to (baseline assessment) and after proposal implementation (post-construction)
- prediction of the direct, indirect, and cumulative impacts from the proposal on Landforms
- evaluation of the significance of landform impacts within a local, regional, and national context
- description of how the environmental decision-making hierarchy has been applied to avoid, and then mitigate and offset impacts
- justification for why the identified measures proposed to manage impacts to landform values are considered appropriate
- justification for any measures proposed to enhance or restore the environmental quality of impacted landforms
- discussion on whether there is likely to be a significant residual impact to landforms
- identification of monitoring and reporting measures and contingency plans to demonstrate that impacts are not greater than predicted
- the methods and outcomes of engagement and consultation with stakeholders, including Aboriginal stakeholders, about a proposal's potential significant impacts to landforms.

Where a distinctive physical landform may be impacted by a proposal, the proponent's EIA documentation should describe the potential impact to environmental values, causal impact pathways (source-pathway-receptor) and the results of investigations, surveys, and modelling conducted to inform the NT EPA's understanding about how the proposal would potentially impact the landform. High-resolution modelling

such as a digital terrain model (DTM), digital elevation model (DEM), Light Detection and Ranging or Laser Imaging, Detection, and Ranging (LiDAR), and corresponding aerial imagery of the potentially impacted area and its surrounds should be provided. Modelling data generated to support the assessment should be provided to the NT EPA in an accessible format.

Depending on the landform, potentially impacted values (e.g. sand dunes, cliffs), causal impact pathways (e.g. drill and blast mining methods) and the results of investigations, studies and/or modelling may be required to inform an understanding of a proposal's potential significant impacts.

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 landforms. Refer to NT EPA guidance Stakeholder Engagement and Consultation[2] 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 environmental impact assessment process, the NT EPA provides its assessment report to the Minister and advises on the acceptability of a proposal. The NT EPA advises the Minister to grant or refuse to grant an environmental approval, including recommended conditions of approval when the advice recommends an environmental approval be granted. The Minister is not bound by the NT EPA's advice.

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.

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