Additional sector guidance
Metals and mining

June 2024
Version 1.0

SICS® industries:
Metals & Mining (EM-MM)
Iron & Steel Producers (EM-IS)
Coal Operations (EM-CO)

tnfd.global

T N F D Taskforce on Nature-related Financial Disclosures

Contents

1. Introduction

1.1. The purpose of this guidance

In September 2023, the TNFD published its recommendations for disclosure of nature-related issues and supporting implementation guidance. This document provides sector-specific additional guidance for the metals and mining sector, covering:

- The assessment of nature-related issues using the TNFD's LEAP approach (Section 2); and
- The disclosure of sector-specific metrics in line with the TNFD's recommended approach to metrics (Section 3).

The TNFD's Guidance on the identification and assessment of nature-related issues: The LEAP approach is designed as an iterative process – across business locations and business lines – in line with established risk management processes and corporate reporting cycles. Organisations may choose to start with a narrow scope for a LEAP assessment and gradually expand the scope of the assessment as they gain experience and insight.

The TNFD recognises that there can be significant differences across sectors for corporates applying the LEAP approach. It has published this additional guidance with significant input from a range of knowledge partners and market participants to help metals and mining sector organisations apply the LEAP approach to their context. The overall structure of the LEAP approach is set out in Figure 1. This guidance follows that structure and Table 1 sets out the elements of LEAP for which this document provides additional guidance.

The Taskforce also recognises that investors and other stakeholders require quantitative information to compare performance and nature-related issues within sectors. To facilitate that sector-level analysis, this guidance also includes:

- Guidance on the application of the core global disclosure indicators and metrics to the metals and mining sector (Section 3.1); and
- Core and additional sector disclosure indicators and metrics (Sections 3.2 and 3.3).

Figure 2 provides an overview of the TNFD disclosure measurement architecture and where indicators and metrics are listed in the TNFD recommendations and relevant sector guidance.

Figure 1: The TNFD approach for identification and assessment of nature-related issues – LEAP

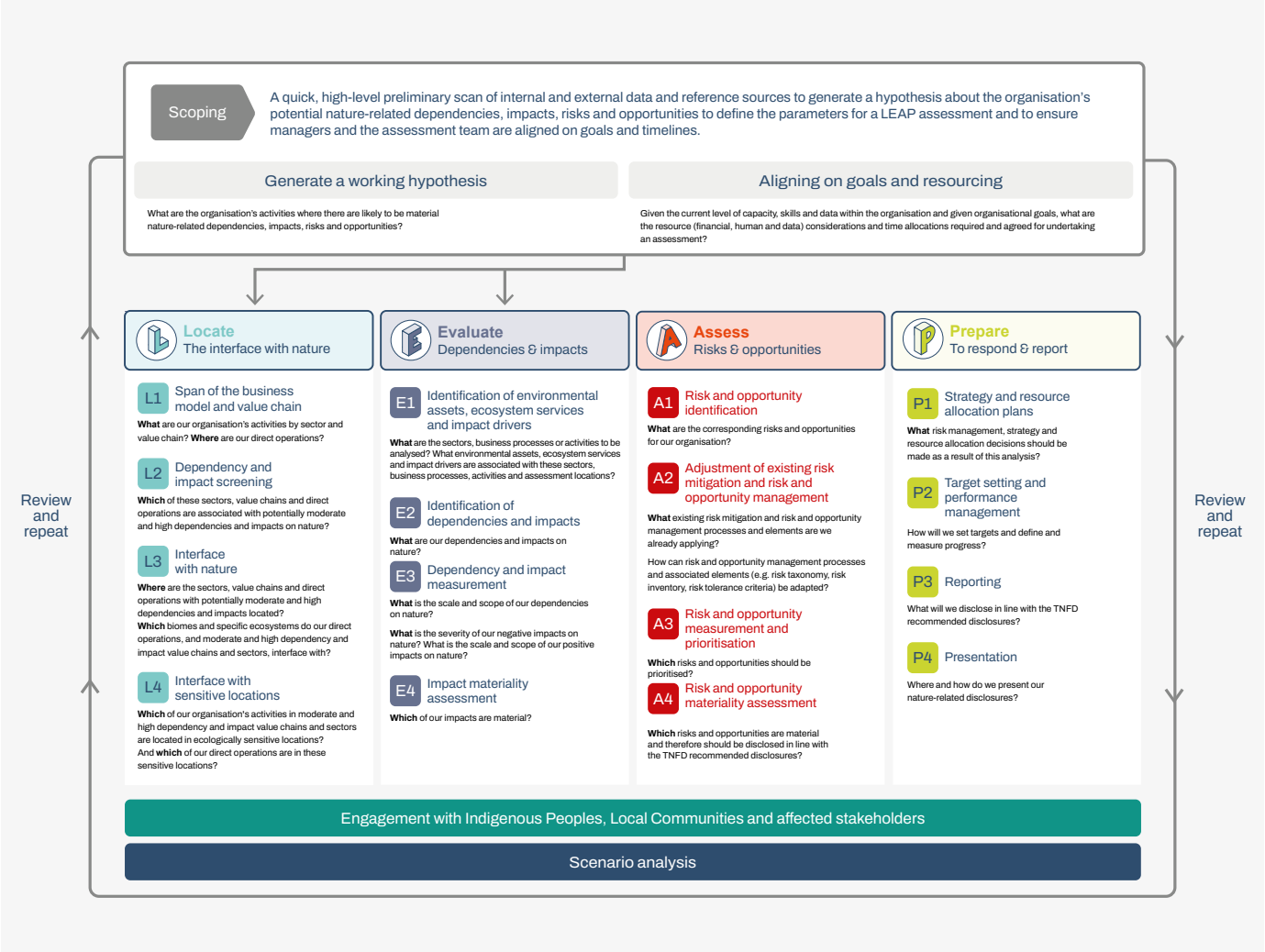
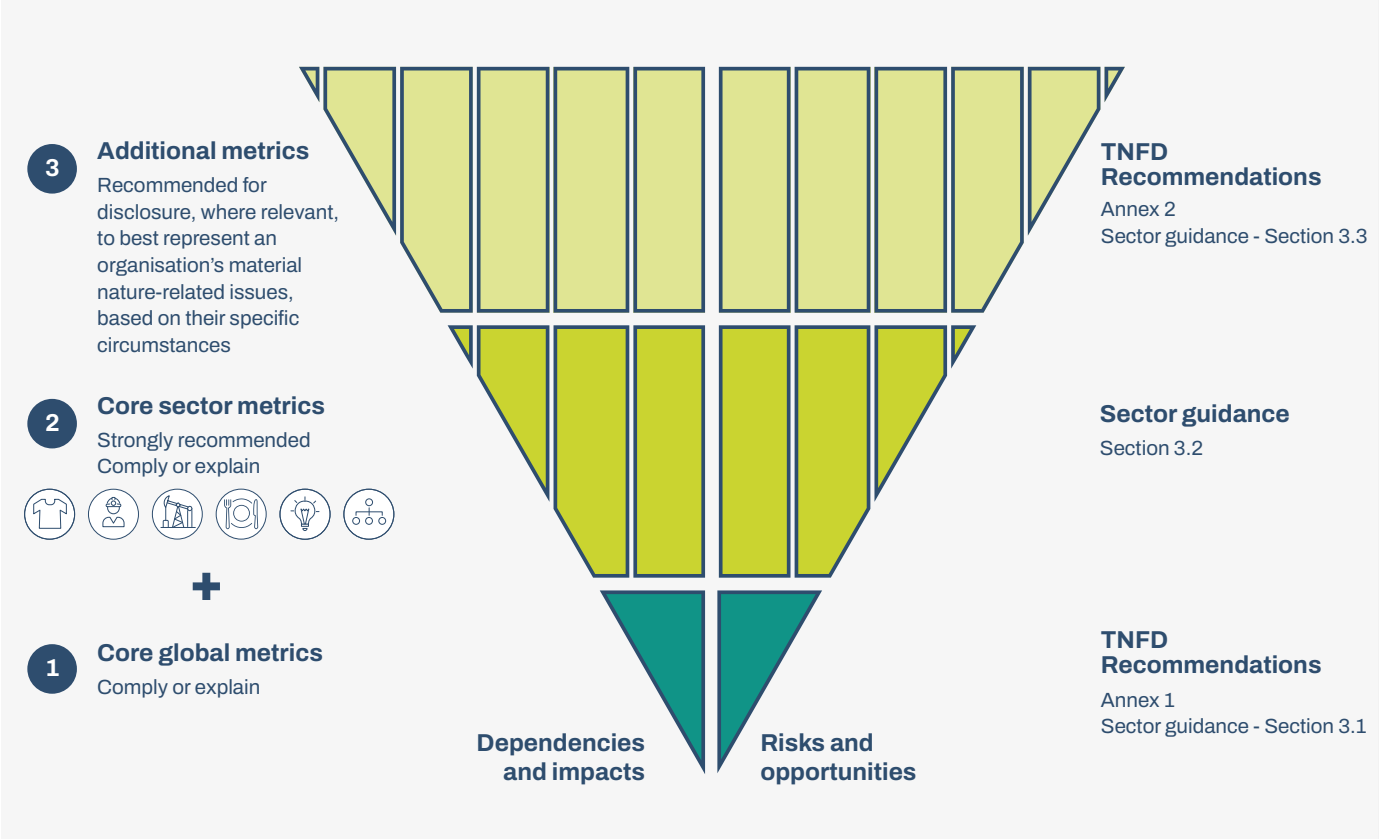


Figure 2: TNFD disclosure metrics architecture signposted to metrics lists



The guidance in Section 3 on the application of the TNFD core global metrics for this sector, as well as the core and additional sector metrics outlined, expand on the disclosure indicators and metrics outlined in Annexes 1 and 2 of the TNFD recommendations. As outlined in the TNFD recommendations, the TNFD has incorporated and sought to build on existing industry standards and disclosure metrics wherever possible to build on current data collection and reporting practices and minimise additional assessment and reporting costs.

1.2. Audience for this guidance

This guidance aims to support organisations with business models or value chain(s) in the metals and mining sector organisations, including the SICS® industries of Metals & Mining, Iron & Steel Producers and Coal Operations (Box 1).[1] For simplicity, all organisations in these industries are referred to as 'Metals and mining sector organisations' in this guidance.

1 SASB (2018) SASB's Sustainable Industry Classification System (SICS).

Box 1: SICS® industries in the scope of this guidance document

Metals & Mining (EM-MM)

Iron & Steel Producers (EM-IS)

Coal Operations (EM-CO)

This guidance is a supplement to the TNFD's Guidance on the identification and assessment of nature-related issues: The LEAP approach and should be read in conjunction with that guidance.

Table 1: Areas of LEAP with additional guidance for the metals and mining sector in this guidance document

Scoping	✓

L1	✓	E1	✓	A1	✓	P1	✓
L2	✓	E2	✓	A2	✓	P2	✓
L3	✓	E3	✓	A3	✓	P3	✓
L4	✓	E4	✓	A4		P4	✓

2. Sector-specific LEAP assessment guidance

2.1. Scoping a LEAP assessment

Working hypothesis generation:

What are the organisation's activities where there are likely to be material nature-related dependencies, impacts, risks and opportunities?

Goals and resource alignment:

Given the current level of capacity, skills and data within the organisation, and given organisational goals, what are the resource (financial, human and data) considerations and time allocations required and agreed for undertaking an assessment?

A metals and mining organisation will need to determine the starting point and overall approach for its assessment, reflecting complex and often multinational operations, value chains and associated areas of influence.

The starting point for an assessment may differ depending on the company's priorities, resources and needs. An assessment might start from a top-down (corporate down to the site level) or bottom-up (from the site level up to the corporate) perspective (Figure 3). It may initially only include a single site to test the approach, or consider only certain aspects of either the direct operations or value chain. Another avenue may be to undertake a gap assessment of existing analysis, such as life cycle assessments[2], against the needs of a TNFD LEAP assessment and to focus primarily on the gaps.

Figure 3 illustrates different approaches an organisation might take at different levels of maturity, but each organisation will need to follow its own pathway depending on its priorities. Partnerships across the sector and joint assessments of nature-related dependencies, impacts, risks and opportunities also provide mutually beneficial departure points. Organisations should also refer to the TNFD guidance on value chains.

Throughout the assessment, an organisation should consider the social context it is operating in (Box 2).

2 Life cycle assessments (LCA) under the standard ISO 14040:2006 and other common methods to measure the life cycle environmental performance, such as Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF).

Figure 3: Top-down and bottom-up approaches to scope a LEAP assessment

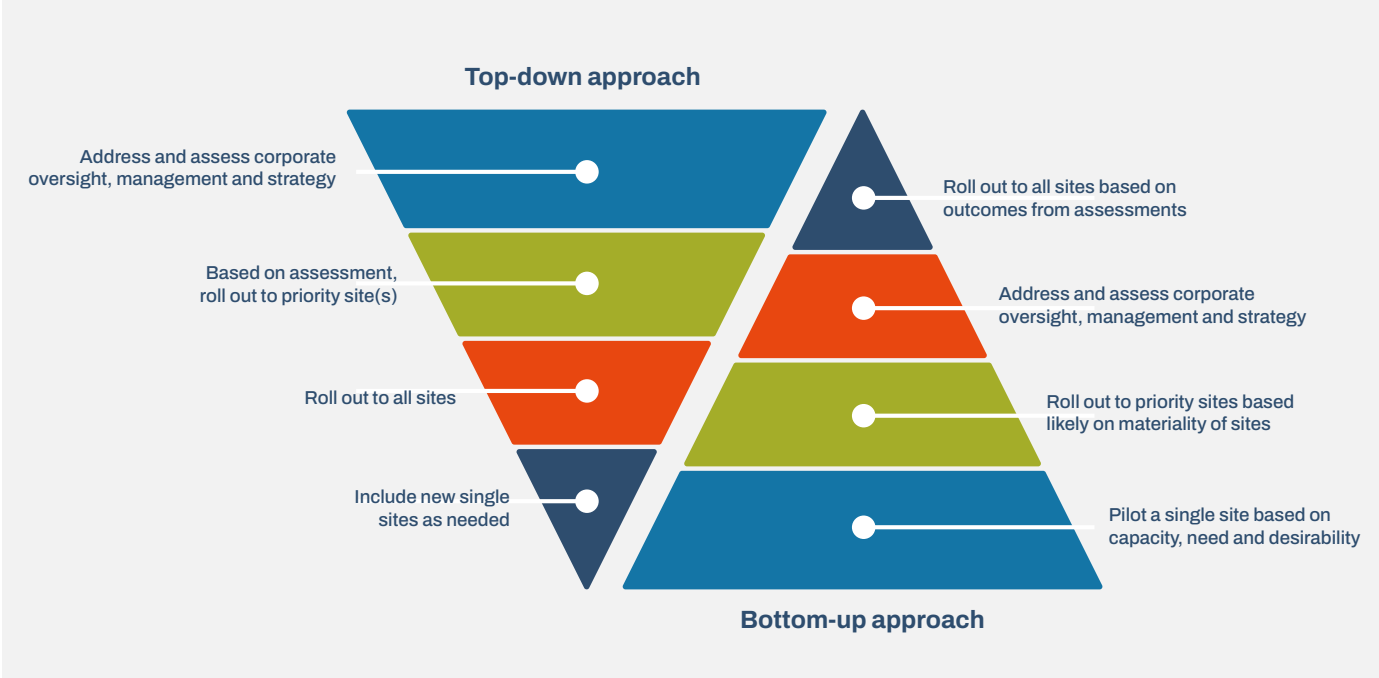


Figure 4: Illustrative example of how to implement the TNFD LEAP approach at different maturity phases

Maturity	Value chain	Area of influence	Key assessment inputs
Low	Direct operations: priority sites	Direct area of influence and known impacts (e.g. resettlement areas, workers housing and contractors)	Regulatory information, risk registers
	Direct operations: all sites Preliminary assessments upstream and downstream	Direct and indirect area of influence	Indirect area of influence: methods to determine the area of influence Upstream and downstream: general open access and other available information for value chain assessment to identify initial priorities
	Direct operations Prioritised assessments upstream and downstream	Direct and indirect area of influence	Indirect area of influence: quantifiable metrics and indicators to accurately determine the area of influence Upstream and downstream: detailed assessments of prioritised value chain aspects
High	Full value chain	Direct, indirect and cumulative area of influence	Cumulative area of influence: mechanism to assess cumulative impacts and assign apportionment Upstream and downstream: Detailed assessments, questionnaires and capacity building for the full value chain

Box 2: Social considerations and engagement with Indigenous Peoples, Local Communities and affected stakeholders

A metals and mining organisation should take into account the social context in which it is operating throughout its LEAP assessment. The TNFD recommends that metals and mining organisations refer to the cross-sector TNFD Guidance on engagement with Indigenous Peoples, Local Communities and affected stakeholders. This guidance notes the specific human rights of Indigenous Peoples to have their Free, Prior and Informed Consent (FPIC) sought in relation to activities impacting their land, territories or other resources, and the right to provide or withhold that consent, as set out in the UN Declaration on the Rights of Indigenous Peoples (UNDRIP).[3]

Social considerations are particularly important for understanding the relevance of ecosystem services for the workforce and communities around operating sites, as well as the importance of nature more generally in the area around sites for Indigenous Peoples, Local Communities, affected and other stakeholders.

The TNFD recommends putting in place best practices for engagement, including but not limited to:

- Effective grievance mechanisms;
- Engagement with affected stakeholders throughout due diligence processes (following the UN Guiding Principles on Business and Human Rights); and
- Adequate resources for engagement, including human and financial resources, time and, in some situations, technological resources.

Engagement is an important cross-cutting component of the TNFD's LEAP approach, informing all phases of LEAP:

1. **Locate:** For example, Indigenous traditional and local knowledge (accessed respectfully with approval and/or agreement obtained in accordance with the principle of Free, Prior and Informed Consent) can assist in identifying and mapping nature-related issues and sensitive locations, including identifying sites of significant biocultural heritage;[4]

3 United Nations (2007), Declaration on the Rights of Indigenous Peoples: A Manual for National Human Rights Institutions

4 The Kunming-Montreal Global Biodiversity Framework (GBF) acknowledges the important roles and contributions of Indigenous Peoples and Local Communities as custodians of biodiversity and as partners in its conservation, restoration and sustainable use. The framework's implementation must ensure that the rights, knowledge, including traditional knowledge associated with biodiversity, innovations, worldviews, values and practices of Indigenous Peoples and Local Communities are respected, and documented and preserved with their Free, Prior and Informed Consent.

2. **Evaluate:** Indigenous traditional and local knowledge, comments and responses from regulatory and other engagement processes, issue and response registers and conflict resolution processes can support dependency and impact evaluation. Appropriate consideration of rightsholders' and stakeholders' views is important for a thorough understanding of dependencies and impacts;
3. **Assess:** Consideration of social aspects enhances risk and opportunity identification and assessment, including for landscape initiatives, offset sites and post-mining land uses. Resilience and adaptation to climate and water risks can also inform scenario analyses; and
4. **Prepare:** Nature action plans, metrics, reporting outputs and design of information access points can all be informed and enhanced by considering social requirements and stakeholder needs. Inclusive design and rightsholder and stakeholder buy-in improves the likelihood of interventions' success and longevity.

Organisations are encouraged to refer to Table 1 in the TNFD guidance on engagement, which describes how an effective engagement process informs each of the components of the LEAP approach, with key questions for engagement for each component. Other useful references for metals and mining organisations are ICMM (2015) Guidance on indigenous peoples and mining and UN (2008) Resource kit on indigenous peoples' issues

Sector stakeholders to engage at the scoping phase of a LEAP assessment

Initial assessment of the capacity, skills and data available can be supported through early engagement of a range of stakeholders. Table 2 includes some of the key internal and external stakeholders who may be relevant for scoping of a LEAP assessment by a metals and mining organisation.

Table 2: Stakeholders in the metals and mining sector when scoping a LEAP assessment

Stakeholder	Internal or external	Purpose of engagement
Regulatory, approvals and land access teams (current or historic)	Internal	These teams lead baseline environmental and social characterisation and impact assessments and may have information and data on nature-related dependencies and impacts.
Corporate/site environmental, community, social and cultural heritage teams	Internal	These teams manage implementation of regulatory and stakeholder conditions and agreements, including collection of nature-related monitoring and evaluation data.

Stakeholder	Internal or external	Purpose of engagement
Spatial data teams	Internal	These teams support identification of location-specific data and maintain repositories of historic spatial data.
Hydrology and hydrogeology teams	Internal	These teams hold water models and water-related data.
Processing and mining teams	Internal	These teams can provide insights into the operational source, extent and frequency of dependencies and impacts on nature.
Supply chain, human rights and climate teams	Internal	These groups understand supply chain risks and impacts and can support engagement and analysis of the upstream and downstream value chains. Climate teams may have experience undertaking TCFD assessments and scenario analysis.
Risk and governance teams	Internal	These functions can provide insights on internal frameworks and risk-related data.
Integrated planning functions	Internal	Operational plans and scenarios may influence the frequency and magnitude of dependencies and impacts on nature. Internal operational planning and impact management teams will also have planning, risk and/or impact registers (commonly in place for sites with ISO14001 or aligned processes).
Indigenous Peoples, Local Communities, Traditional Owners and Landowning Communities, and other affected community representatives and associations	External	These groups often have traditional knowledge of the health and condition of nature, and the values of nature and its contributions to people within given areas, and may have personal connections to specific aspects of nature and the broader landscape. See TNFD Guidance on engagement with Indigenous Peoples, Local Communities and affected stakeholders.
Local, national and international nature-focused NGOs	External	These groups may have local and scientific expertise, as well as local datasets.
Academic organisations/ individuals	External	These groups can have expertise, knowledge and experience in a diverse range of thematic areas and local data sources.
Local regulatory and public sector authorities or government bodies	External	These organisations may have regional schemes and programmes, and regional datasets.

List of datasets and tools

Metals and mining organisations often have biophysical and social datasets that can inform a LEAP assessment. Common site-level information and data sources for consideration may include:

- Infrastructure spatial locations (point and polygon data) and asset registers;
- Bio-survey data collected during baseline characterisation and environmental and social impact assessment stages. This may include descriptive information, point and polygon data, vegetation and habitat boundaries, locations of flora and fauna, weed mapping, feral animal sightings and wildlife mortalities;
- Environmental and social impact assessments and associated studies, covering:
  - Activity descriptions and requirements (e.g. water use, soil removal);
  - Impact assessments; and
  - Action registers or plans;
- Environmental management plans, environmental and social management systems, biodiversity action plans and risk registers;
- Monitoring data, including of water quality, air quality, dust, vegetation condition, rehabilitation and restoration activities, river flow, threatened species, invasive alien species mapping and other observations;
- Groundwater modelling including groundwater contours (modelled and actual);
- Water catchment assessments;
- Ground and surface water chemistry assessment data;
- Grievance registers and stakeholder engagement records;
- Cultural heritage information;
- Climate scenario analysis; and
- Mine plans and proposed capital improvement plans.

2.2. Locate the organisation's interface with nature

L1

L1: Span of the business model and value chain

Guiding questions:

What are our organisation's activities by sector, value chain and geography? Where are our direct operations?

Figure 5 provides an overview of the typical activities and processes in the metals and mining value chain. Metals and mining organisations should at this stage take an expansive view of their value chain, including:

- The full lifecycle of individual sites, covering sites in closure and post-closure, particularly rehabilitation and restoration, as well as non-operational landholdings;
- Supporting infrastructure such as powerlines and access roads and railways[5] that connect operational facilities with the market, shipping routes and port facilities, pipelines, and onsite linear infrastructure such as conveyor systems and cabling;
- Commodities and industrial inputs, leveraging procurement data; and
- Downstream sectors, wherever possible, drawing on customer sales and product logistics data.

5 With linear infrastructure, the full required route and associated services should be included when considering the interface with nature (e.g. clearing associated with a borefield pipeline may include a service track, firebreak and powerline). For more detail, see the TNFD guidance on engineering, construction and real estate.

Figure 5: Typical business activities in the value chain of the metals and mining sector

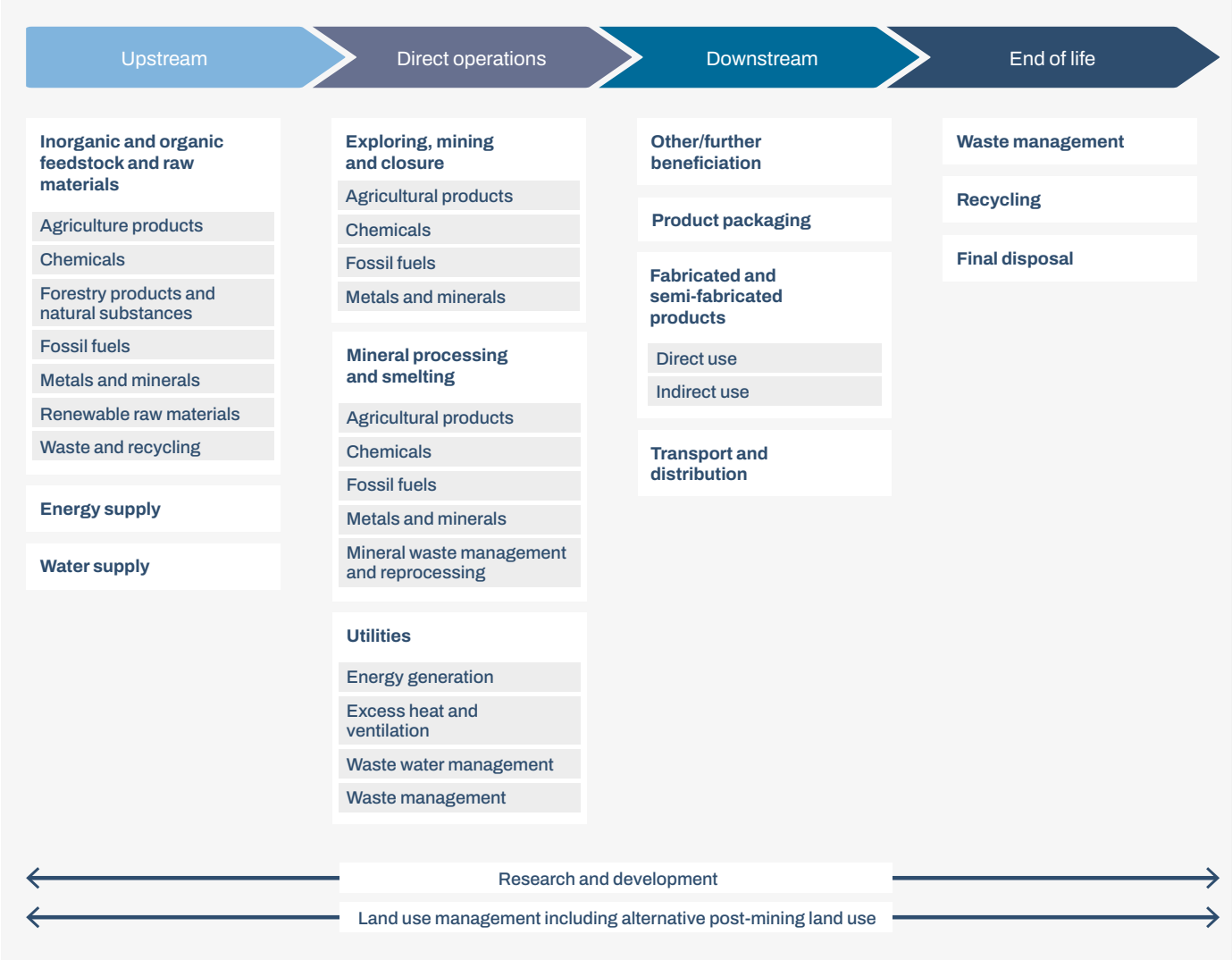


Table 3 outlines the life cycle stages of a metals and mining project that can be considered in a LEAP assessment.

Table 3: Life cycle stages of a metals and mining project for consideration in a LEAP assessment

Life cycle stage	Definition	Considerations for LEAP assessment
Pre-development	Planning and due diligence stages where limited physical disturbances to nature are expected. For example, greenfield sites acquired but with no activities, due diligence, pre-feasibility and feasibility assessments.	Interfaces with nature are likely to be limited. Scenario analyses may assist with evaluation, particularly the identification of no-go areas. Pre-development LEAP assessments may be useful for the early identification of dependencies and impacts to understand long-term risks.
Exploration (including advanced reserve definition)	All activities associated with reserve determinations, from less intrusive methods (e.g. remote sensing and geophysics) through to high impact methods (e.g. high resolution and frequency drilling).	A LEAP assessment can inform potential dependencies and impacts on nature for exploration activities of different scales and to support the overall success and sustainability of the project. Existing operations may also undertake exploration activities and these should be similarly assessed.
Construction	Infrastructure development and expansions, which may vary from small to large-scale. This may include mining, ancillary and processing infrastructure, including linear, utility and socio-economic support infrastructure.	Organisations should refer to the TNFD engineering, construction and real estate guidance for support in undertaking a LEAP assessment for a construction project.
Operations	Includes all infrastructure, activities and other business assets required for revenue generation. This includes shafts, warehouses, offices, linear infrastructure, processing facilities, waste areas and any incidental unplanned impacted areas. This also includes maintenance.	Likely to have the largest and most disruptive interface with nature. Some maintenance activities may have a material interface with nature and require assessment (e.g. instream impoundments).
Closure	Includes concurrent closure and rehabilitation (as executed throughout the life of a mine), decommissioning, rehabilitation/restoration and subsequent monitoring and management activities.	Likely to have key interfaces with nature. Assessing closure as a scenario can be useful for an organisation's nature management strategy and may present opportunities to achieve positive impacts on nature.

Life cycle stage	Definition	Considerations for LEAP assessment
Care and maintenance	Activities associated with business assets that are not in active use for revenue generation, or only contribute to a limited/indirect extent, but are maintained either for potential future use, repurposing and/or legal requirements. Care and maintenance sites can be considered to be part of either operational or non-operational land.	A LEAP assessment may help to improve management of the site and harness opportunities for its future use.
Non-operational mining lands and business assets	This refers to all land and business assets either managed or under the control of the organisation but not used for revenue generating activities. Examples may include: • Areas acquired for potential future prospecting, mining or other activities but where no current economic activities are occurring on site; • Incidental areas acquired due to jurisdictional land ownership requirements; • Land acquired to create risk buffer areas between mines and stakeholders; and • Land acquired for other corporate use but not yet developed.	These areas may present key opportunities to have positive impacts on nature and help the organisation achieve its objectives and business strategy.
Activities within operational control supporting alternative socio-economic activities not related to metals and mining	Any sites and business assets where the organisation has control (financially or legally) that do not contribute to the revenue generation of the organisation but may provide alternative socio-economic activities. Examples may include: • Offices; • Residential areas supporting workers and others; and • Recreational areas.	Organisations should refer to the relevant TNFD sector and biome guidance, where available.
Other areas not under the control of the organisation	Activities, sites and business assets that support the organisation in its revenue generating activities but are not within its control. This most often would involve key activities in the upstream value chain, such as water and power supply.	Inclusion in a LEAP assessment would be based on the potential materiality of dependencies, impacts, risks and opportunities that may be associated with the third-party controlled area.

Table 4 summarises the aspects of the metals and mining upstream value chain (i.e. suppliers) that may interface with nature.

Table 4: Metals and mining upstream value chain (suppliers) – aspects that may interface with nature

Supply area	Supply item
Reagent production and supply	Lime
	Acid
	Cyanide
	Sodium metabisulfite
	Flocculant
	NaSH
	Caustic
	Explosives – ammonium nitrate fuel oil
	Explosives – emulsion
	Others
Tyres	Heavy vehicle tyres
	Light vehicle tyres
Fixed plant consumables and spares	Mill balls
	Mill liners
	Oil and grease
	High Density Polyethylene (HDPE) and other liners
	HDPE and poly pipe
	Conveyor belt
	Fabricated steel – e.g. plate and pipes
	Packaging – pallets, crates, strapping and plastic

Supply area	Supply item
Mobile plant and mobile plant spares	Heavy vehicles – haul trucks
	Heavy vehicles – e.g. diggers, dozers, graders, water trucks, cranes
	Drill rigs
	Medium vehicles – trucks, manitou, forklifts, cranes
	Light vehicles
	Mobile and machine maintenance materials – e.g. filters, spark plugs, pipes and fittings
	Oil and grease
	Packaging – pallets, crates, strapping and plastic
	Others
Fuel	Hydrocarbon
	Gas
	Hydrogen
	Biofuels
	Other
Construction materials	Concrete
	Quarry material and fill
	Buildings – portable and fixed
Camp supplies	Food
	Food packaging – containers
	Food packaging – soft plastics
	Medical and other health related products
	Waste management providers including all non-mineral waste e.g. landfill, recycling, waste water and hazardous was management

Supply area	Supply item
Transport and freight	Flights
	Overland – e.g. bus
	Train
	Shipping
Utilities	Electric power supply
	Gas supply
	Telecommunications
	Water and wastewater
Contractors and professional service providers	Contract service providers – logistics, contract mining, waste management, camp management
	Professional service providers – consultants

The sector continues to work to understand the aspects of the value chain with the highest nature impacts. Those listed in this Table 4 represent a significant portion of operational spend at most operating metals and mining sites. Metals and mining sector organisations rely on these aspects of their upstream value chain to ensure business continuity, and it is therefore reasonable to include these at an early stage when extending the scope of a LEAP assessment to the upstream value chain. Due to information availability, this version of the metals and mining sector guidance includes only the upstream value chain (suppliers), but organisations should eventually undertake a full nature-related assessment of the value chain, including downstream.

L2 L2: Dependency and impact screening

Guiding question:

Which of these sectors, value chains and direct operations are associated with potentially moderate and high dependency impacts?

Table 5 and Table 6 provide the dependency and impact materiality ratings from the ENCORE knowledge base for a selection of metals and mining value chain activities. Table 7 lists commodities identified by SBTN[6] as associated with elevated impacts on nature, and their relevant impact drivers.

These tables can be used to screen the value chain activities identified in L1 to identify which areas to focus on for further assessment. Organisations may wish to complement the ENCORE and SBTN ratings with other sources, including internal company assessments, environmental risk registers, and environmental and social impact assessments to identify which activities and value chains are most likely to be associated with material dependencies, impacts, risks or opportunities. Organisations should also review the relevant TNFD sector guidance for other industries in the value chain.

6 Science Based Targets Network (SBTN) High Impact Commodity List (HICL)

Table 5: Materiality ratings of ecosystem services the metals and mining sector typically depends on

	ISIC Group/class	Mining and quarrying n.e.c.	Mining of hard coal	Mining of iron ores	Mining of lignite	Mining of non-ferrous metal ores	Support activities for other mining and quarrying
Provisioning services	Water supply	High	High	High	High	High	Medium
	Biomass provisioning	Low	Low	Very low	Low	Very low	N/A
Regulating and maintenance services	Soil and sediment retention	Medium	Medium	Medium	Medium	Medium	Medium
	Flood control	High	High	High	High	High	Low
	Water flow regulation	High	High	High	High	High	Medium
	Rainfall pattern regulation	Very high	Very high	Very high	Very high	Very high	High
	Local (micro and meso) climate regulation	Low	Low	Low	Low	Low	Very low
	Global climate regulation	High	High	High	High	High	Low
	Solid waste remediation	Low	Low	Low	Low	Low	ND
	Storm mitigation	Medium	Medium	Medium	Medium	Medium	Medium
	Water purification	Very high	Very high	Very high	Very high	Very high	Medium
	Air filtration	Very low	Very low	Very low	Very low	Very low	Very low
	Noise attenuation	Very low	Very low	Very low	Very low	Very low	Very low

	ISIC Group/class	Mining and quarrying n.e.c.	Mining of hard coal	Mining of iron ores	Mining of lignite	Mining of non-ferrous metal ores	Support activities for other mining and quarrying
Regulating and maintenance services continued	Other regulating and maintenance service – Dilution by atmosphere and ecosystems	Medium	Medium	Medium	Medium	Medium	Very low
	Other regulating and maintenance service – Mediation of sensory impacts (other than noise)	Low	Low	Low	Low	Low	Low
Cultural services		N/A	N/A	N/A	N/A	N/A	N/A

N/A= Non-applicable

ND = No data

Source: ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (Unpublished, Expected 2024). ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. Cambridge, UK: the ENCORE Partners. Available at: https://encorenature.org. *DOI:* https://doi.org/10.34892/dz3x-y059.

Table 6: Materiality ratings for impact drivers typically relevant for the metals and mining sector

	ISIC Group	Mining of iron ores	Mining and quarrying n.e.c.	Mining of hard coal	Mining of lignite	Mining of non-ferrous metal ores	Support activities for other mining and quarrying
Land, freshwater and ocean use change	Area of land use	Medium	Medium	Medium	Medium	Medium	Medium
	Area of freshwater use	High	High	High	High	Very high	Medium
	Area of seabed use	High	High	ND	ND	Very high	ND
Climate change	Emissions of GHG	Medium	High	Very high	Very high	Medium	High
Pollution/ pollution removal	Emissions of non-GHG air pollutants	Medium	High	High	High	High	High
	Emissions of toxic soil and water pollutants	High	High	High	High	Very high	Very high
	Emissions of nutrient soil and water pollutants	ND	ND	ND	ND	ND	ND
	Generation and release of solid waste	Very high	Medium	Medium	Medium	High	Medium
	Disturbances	High	High	High	High	Very high	Very high
	Volume of water use	Low	Medium	Medium	Medium	Medium	Medium
	Other abiotic resource extraction	High	Medium	N/A	N/A	High	Medium
Introduction of invasive alien species		Very low	Very low	Very low	Very low	Low	Low

N/A= Non-applicable
ND = No data

Source: ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (Unpublished, Expected 2024). ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. Cambridge, UK: the ENCORE Partners. Available at: https://encorenature.org. *DOI:* https://doi.org/10.34892/dz3x-y059.

Table 7: Impact drivers typically associated with extraction and production of selected mining products

Commodity name	Impact drivers	Commodity name	Impact drivers
Bauxite/ Aluminium	• Land use and land use change • Other resource use • Water use • Climate change • Soil pollution • Water pollution	**Nickel**	• Land use and land use change
Coal	• Land use and land change • Other resource use • Water use • Climate change • Soil pollution • Freshwater pollution	**Platinum**	• Land use and land use change • Soil pollution • Freshwater pollution • Marine pollution
Copper	• Land use and land use change • Other resource use • Water use • Climate change • Soil pollution • Water pollution	**Potash**	• Land use and land use change • Water use • Climate change • Soil pollution • Freshwater pollution
Gold	• Land use and land use change • Other resource use • Water use • Climate change • Soil pollution • Water pollution	**Silver**	• Land use and land use change • Other resource use • Water use • Climate change • Soil pollution • Water pollution
Iron	• Land use and land use change • Other resource use • Water use • Climate change • Solid waste	**Steel**	• Climate change • Soil pollution • Freshwater pollution • Non-GHG air pollution

Commodity name	Impact drivers	Commodity name	Impact drivers
Lead	• Land use and land use change • Soil pollution • Water pollution	**Zinc**	• Land use and land use change • Freshwater pollution
Lithium	• Land use and land change • Other resource use • Water use • Soil pollution • Water pollution • Non-GHG air pollution		

Source: SBTN (2023) High impact commodity list.

L3

L3: Interface with nature

Guiding questions:

Where are the sectors, value chains and direct operations with potentially moderate and high dependencies and impacts located?

Which biomes and specific ecosystems do our direct operations, and moderate and high dependency and impact value chains and sectors, interface with?

Box 3 provides guidance for metals and mining organisations when considering the area of influence around sites upstream and downstream. Organisations should iterate between the Locate and Evaluate phases of LEAP to identify the location and areas of influence of dependencies and impacts upstream and downstream.

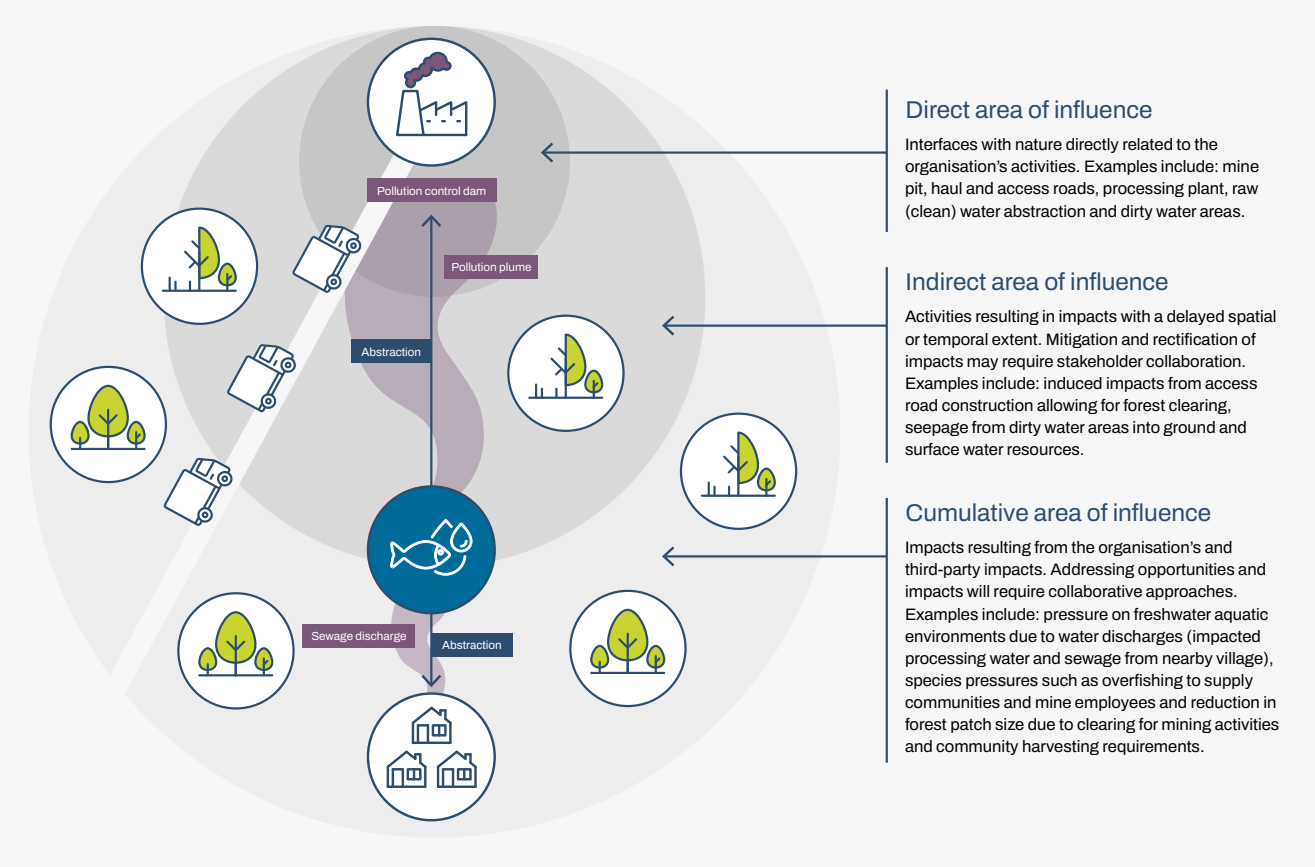
Area of influence

When considering the location of direct operations – and value chain activities in L3 – organisations should incorporate an initial assessment of the area of influence around a site.

Box 3: Area of influence

A site's area of influence is generally larger than the physical footprint of the project itself and includes the area within which a project may potentially directly, indirectly and cumulatively cause impacts or have dependencies on nature (Figure 6). For example, water abstraction required for mine dewatering or bore-field development may affect groundwater kilometres beyond the physical footprint of an operation, with potential to affect groundwater-dependent ecosystems regionally. Organisations should iterate between the Locate and Evaluate phases as understanding of connections between a site and the surrounding ecosystems develops.

Figure 6: Area of influence schematic



There are several approaches to defining an area of influence, balancing accuracy, utility and analytical requirements (Table 8). Organisations may want to adopt more sophisticated approaches as they proceed through iterations between Locate and Evaluate. For additional guidance on assessing direct and indirect areas of influence, organisations can refer to the UNEP-WCMC Technical Briefs on Direct and Indirect Areas of Influence.

Table 8: Approaches to area of influence analysis

Option	Information requirement	Description
Buffer area	Low	A nominal buffer area around a site can capture a good sample of an organisation's interface with nature. The buffer distance can be increased or decreased based on known dependency and impact considerations, such as the location of water bodies or species' home ranges. It is recommended that specialist advice is sought when defining buffer distances. The Integrated Biodiversity Assessment Tool (IBAT) and the Species Threat Abatement and Restoration (STAR) metric use a 50km buffer area.

Option	Information requirement	Description
Landscape approach	Medium	A High Conservation Value (HCV) assessment may be useful for sites or projects where the project specifics are not yet known (e.g. exploration), or where there is a high level of uncertainty about areas of influence, for example due to lack of data, modelling or site accessibility. A simplified process includes defining a general region/landscape or catchment-based area of investigation, conducting a screening assessment of the site (literature review, consultation and spatial datasets) and identifying HCV areas, potential impacts and further data needs. The subsequent steps of the HCV approach may require more in-depth assessment and increase the complexity to align with the other area of influence assessment options.
Direct operations, dependencies and impacts	Medium	This option considers the physical boundary of a site and the boundary of direct dependencies and impacts (e.g. groundwater drawdown, catchment-based impacts, air shed, dust, invasive alien species and vertebrate pests). Directly affected areas can be attributed to the direct and measurable dependencies and impacts associated with operations. These are usually also located within areas of the operation's control, but there may be instances where these occur in areas under third party control.
Indirect infrastructure and indirect (and induced) impacts	High	This option considers both the physical boundary of a site, the boundary of direct dependencies and impacts, the boundary of indirect infrastructure (e.g. access roads and utility lines) and/or induced impacts, such as increased hunting pressure, migration impacts and the increased viability of other economic activities. Indirect infrastructure refers to infrastructure built to support the organisation's activities that would not have been constructed or expanded otherwise. The organisation may not have a high degree of control of the assets, infrastructure and/or land. Direct and indirect impact areas are often interlinked and the distinction is subjective. Area of influence considerations frequently include both types.
Cumulative impacts	High	Cumulative areas of impact result from the impact of the organisation and other third parties on the same ecosystem assets. This may be related to either direct or indirect infrastructure and impacts.

Sources: HCV Network: HCV Approach*; IBAT (2021)* Species Threat Abatement and Restoration (STAR) data layer: Business User Guidance*; IFC (2012)* Performance Standard 6*; IFC (2013)* Good Practice Handbook – Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets*; Minerals Council of Australia (2015)* Cumulative Environmental Impact Assessment Industry Guide.

L4 L4: Interface with sensitive locations

Guiding questions:

For our organisation's activities in moderate and high dependency and impact value chains and sectors, which are located in ecologically sensitive locations? And which of our direct operations are in sensitive locations?

When assessing sensitive locations in L4, companies should iterate between Locate and Evaluate to identify whether the ecosystem assets on which organisations depend or have impacts are sensitive – in addition to the organisation's sites themselves. This may include dependencies or impacts on the ecological network areas linked to the sensitive locations.[7]

Organisations may use a variety of data sources to assess sensitivity, combining global and regional datasets with locally collected data, including from environmental impact assessments and regulatory compliance activities.

Organisations involved in deep sea mining should consider all seabed sites as sensitive. While this is one of the least explored biomes, the extreme conditions have given rise to a unique set of species, many of which are likely to be highly vulnerable or as yet unknown.[8]

Table 9 provides a worked example of a sensitivity assessment for a set of metals and mining sites.

7 Further guidance on this is available from: Bentrup, G. (2008) Conservation buffers: design guidelines for buffers, corridors, and greenways; Macfarlane, D. and Bredin, I. (2017) Buffer zone guidelines for rivers, wetlands and estuaries. Part 1: Technical Manual; and Dudley, N. (ed.) (2008) Guidelines for applying protected area management categories.

8 IUCN (2024) The impact of deep-sea mining on biodiversity, climate and human cultures; WRI (2024) What we know about deep-sea mining — and what we don't.

Table 9: Illustrative worked example of a sensitive location assessment for one site

Area category	Example data sources	Hypothetical outputs of sensitive location assessment
Biodiversity importance	Site Environmental Impact Assessment, Biodiversity Management Plan or ongoing monitoring; Stakeholder Engagement Plan and Monitoring, engaging with site teams.	Mine site A is not located close to protected areas but the site Biodiversity Management Plan includes the avoidance of important habitat for a critically endangered species and there are 12 other endangered and endemic species in the local area. For this reason, the site was assessed as being in a sensitive location.
Ecosystem integrity	Biological Diversity Protocol – percentage positive footprint Environmental Impact Assessment – vegetation quality Environmental permit compliance monitoring – habitat quality, aggregated or for a target species/ group of organisms Site risk register – Resilience to climate change from regional climate risk assessments	Mine site B is an open pit and has lower vegetation quality on the site itself, but is in an area with Ecosystem Integrity Index scores close to 0.7 (natural) and was therefore assessed as being in a sensitive location.
Area of rapid decline in ecosystem integrity	Cumulative impact assessment and Environmental Impact Assessment, Biodiversity Monitoring Plan – species in decline, changes in threat level	Mine site C has a processing plant in an area that is between two protected areas supporting species of conservation concern. They have identified that there are no corridors between the protected areas, these in-between areas are rapidly declining in condition, as identified by the STAR metric and in-situ biodiversity monitoring on site, and the threat level for the species are increasing due to the resulting migration limitations. This site was therefore assessed as being in a sensitive location.
Physical water risk	Site risk/incident register or water balance monitoring – Number of drought or flood incidents recorded on site	Mine site D is located in a basin of high to extreme water stress and was therefore assessed as being in a sensitive location.

2.3. Evaluate dependencies and impacts on nature

E1

E1: Identification of environmental assets, ecosystem services and impact drivers

Guiding questions:

What are the sectors, business processes or activities to be analysed?

What environmental assets, ecosystem services and impact drivers are associated with these sectors, business processes, activities and assessment locations?

Guidance for E1 and E2 is covered together under E2.

E2

E2: Identification of dependencies and impacts

Guiding question:

What are our dependencies and impacts on nature?

Tables 10-14 include lists of common nature-related dependencies and impacts in the metals and mining sector. Organisations will need to consider how these apply to their specific contexts and their areas of influence. Organisations should consider dependencies and impacts both within the reporting period and looking forward over the lifecycle of a mining project. This will support effective risk and opportunity identification in the Assess phase and appropriate responses in the Prepare phase.

For dependencies and impacts upstream and downstream and for activities the organisation undertakes beyond narrow metals and mining, organisations should refer to the relevant TNFD sector guidance, such as for electric utilities and power generators and engineering, construction and real estate.

Impacts

LEAP assessment teams should consider impacts over different time horizons and spatial areas. For example, vegetation clearing during construction may be the most acute impact, but if this continues to occur periodically, e.g. for maintenance purposes, this can change the vegetation structure and functionality over the longer term. From a spatial perspective, clearing multiple patches within an area reduces the ability of the system to recover as the natural vegetation or buffer areas are reduced.

Organisations should pay particular attention to impacts associated with deep-sea mining, which is associated with potentially irreversible changes to deep sea ecosystems and the broader ecosystems they support. The deep sea, one of Earth's most unexplored biomes marked by cold temperatures, continuous darkness, timescales often far exceeding those in terrestrial biomes and immense pressure, supports a remarkable variety of biodiversity.

Deep sea mining is associated with noise and light pollution from machinery, which can travel far through the ocean and affect a wide variety of species, as well as physical disruptions to the seabed and the – potentially unknown – species that live there. It can also create sediment plumes that can potentially have far-reaching impacts on marine life. The energy-intensive nature of mining operations contributes to greenhouse gas emissions and disturbances to the ocean floor have the potential to cause the release of substantial quantities of methane.[9]

Organisations should also consider how their activities might induce further impact by others. For example, the construction of a mine is often associated with new infrastructure that improves access to the area for other people, who may then start to undertake other activities, such as clearing land and harvesting other natural resources (e.g. collecting wood, hunting).

Dependencies

Dependency assessments should include consideration of:

- Availability, quality, quantity and ease or cost of access to mineral resources, land, water resources, water purification, energy resources and building materials;
- Mitigation of natural hazards, such as flood and storms, and global climate regulation; and
- Employee and stakeholder supporting requirements: cultural services, energy resources, water supply, land, purification and food supply.

Dependencies may not always be obvious, especially when considering services and resources sourced from external suppliers. For example:

- Water sourced from a utility provider could pose a problem if the utility provider inadequately manages its water resources; or
- Where the company's workforce depends on aspects of nature that the organisation is having an impact on, the organisation's impact may undermine the workforce's health and wellbeing.

State of nature

Dependency and impact assessments need to take into account the state of nature in the location. This might include the degree of interaction with sensitive locations, as well as:

- Buffer areas and transition zones around sensitive locations, whose disruption may have knock-on effects on sensitive locations themselves;
- Corridors between sensitive locations and other habitats that help maintain species and habitat diversity and functionality, facilitate migration and dispersion of genetic material and habitat and species resilience;
- Habitat patch size, distribution and quality all provide indications of the state and resilience of the ecosystem.

9 IUCN (2024) The impact of deep-sea mining on biodiversity, climate and human cultures; WRI (2024) What we know about deep-sea mining — and what we don't.

Table 10: Impacts associated with the predevelopment and exploration phase

Driver of nature change	Environmental asset/ecosystem services affected	Description
Land/freshwater/ocean-use change Land ecosystem use: Land clearing for hardstands, fly camps and access roads. Excavation, drilling, blasting and movement during exploration.	Environmental assets • Land • Terrestrial ecosystems • Subterranean terrestrial ecosystems • Freshwater ecosystems • Subterranean freshwater ecosystems Ecosystem services • Various: depends on precise activity and local context	Surface and subterranean ecosystems may be altered by exploration (e.g. drilling) and land clearance for exploration camps, particularly in remote and undisturbed areas. This may disrupt ecosystems and ecological functions due to reduced habitat extent, increased erosion and habitat degradation.
Resource use/replenishment Water use: Water abstraction for drilling fluids.	Environmental assets • Subterranean freshwater ecosystems • Freshwater ecosystems • Water resources • Terrestrial (land based) ecosystems Ecosystem services • Water supply • Ecosystem services provided by ecosystems that use the water supply • Recreation-related services	Water extraction can lead to the dewatering of aquifers, subterranean freshwater ecosystems and the depletion of other water resources, especially in arid and drought-prone areas. These activities can lead to reduced water flow regulation and increased drought severity and frequency. Such water use affects the supply of water to other users – households, aquaculture and agriculture – and to nature, with many other ecosystem services potentially affected.

Driver of nature change	Environmental asset/ecosystem services affected	Description
Pollution/pollution removal Non-GHG air pollutants: Drilling and blasting activities can create dust pollution.	Environmental assets • Atmospheric systems • Terrestrial (land-based) ecosystems • Freshwater ecosystems • Marine ecosystems	Dust can lead to degradation of the quality of the surrounding atmospheric systems and ecosystems. This can affect local ecosystems by decreasing the quality of land, contaminating plants and affecting the health of animals. This in turn can disrupt ecosystem service provision such as pollination, biological control, nursery population and habitat maintenance and other cultural services.
Pollution/pollution removal Water pollutants: e.g. wastewater discharge, sewage disposal from exploration camps, heavy metal and/or sediment runoff from small waste rock dumps Soil pollutants (chemical manufacturing, recovery and management): e.g. spillage of fuel, oil or drilling fluids during exploration drilling Mineral waste generation and management: small scale waste rock dumps	Environmental assets • Freshwater ecosystems • Subterranean freshwater ecosystems • Water resources • Terrestrial ecosystems • Land Ecosystem services • Water supply • Soil quality regulation • Cultural services	Changes in water quality as a result of runoff from small waste rock dumps or discharge from camps can affect the health of aquatic organisms living in the habitat, support the spread of disease and create the conditions for invasive species. This can in turn affect water flow regulation, water supply and water purification services. Spills to soil can adversely affect soil microbial communities and terrestrial land-based and subterranean ecosystems, and in turn, soil quality regulation services.

Table 11: Impacts associated with the development and operation phase

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Land/freshwater/ocean-use change Land ecosystem use: Land clearing (surface layers including vegetation, water and soils) for open cut mining, underground mine portals, haulways, waste rock dump deposition etc.; land excavation, drilling, blasting and movement (below surface layer) to recover minerals and to develop infrastructure.	Environmental assets • Land • Terrestrial (land-based) ecosystems • Subterranean terrestrial ecosystems • Freshwater ecosystems • Subterranean freshwater ecosystems Ecosystem services • Potentially all	Terrestrial and subterranean land and freshwater habitats will be altered by the development and operational phases of metals and mining facilities. This can disrupt ecosystems and ecological functions due to reduced habitat extent, habitat degradation, increased erosion and changes to water resources. Land use change can also fragment habitat, impeding species' feeding and reproduction patterns, reducing populations and increasing extinction risk. These changes can have knock-on effects on ecosystem services, including cultural services. Land use change can lead to displacement of communities for new asset construction or transportation routes. It may disrupt and/or damage local sacred areas.

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Pollution/pollution removal Water pollutants: Water discharged from mining operations and seepage or runoff from mine stockpiles may have higher temperature, altered pH, elevated metals and salt concentrations, suspended solids. Soil pollutants: Chemical manufacturing, recovery and management e.g. explosives used in blasting. Solid waste: Non-mineral waste generation and management, e.g. tyres, equipment, waste material from routine processes (concrete, paper, food).	Environmental assets • Freshwater ecosystems • Subterranean freshwater ecosystems • Water resources • Land • Terrestrial (land-based) ecosystems Ecosystem services • Water supply • Genetic material • Biological control • Soil and sediment retention • Nursery population and habitat maintenance • Solid waste remediation • Soil quality regulation	Changes in water quality parameters as a result of mine water discharge or runoff from mine waste stockpiles can affect aquatic organisms' health, support the spread of disease and create the conditions for invasive species. Heavy metals can also cause serious health problems for aquatic organisms and the people that consume them. Excessive sediment can clog riverbeds and smother watershed vegetation, wildlife habitat and aquatic organisms. These changes affect ecosystem services that local waterways provide including water supply, genetic material, soil and sediment retention. Soil pollutants can affect soil microbial communities and subterranean terrestrial ecosystems and in turn soil quality regulation services.
Pollution/pollution removal Non-GHG air pollutants: Drilling, blasting and heavy vehicle movement around mines can create dust pollution.	Environmental assets • Atmospheric systems • Terrestrial (land-based) ecosystems • Freshwater ecosystems • Marine ecosystems Ecosystem services • Various	Dust can lead to degradation of the quality of the surrounding atmospheric systems and ecosystems. This can affect local ecosystems by decreasing the quality of land, contaminating plants and affecting the health of animals. This in turn can disrupt ecosystem service provision such as pollination, biological control, nursery population and habitat maintenance and other cultural services. Pollution may also lead to the worsening health and living conditions of surrounding local communities.

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Pollution/pollution removal Disturbances (visual and noise): sites may operate continuously, create noise and light pollution from heavy vehicles and lighting.	Environmental assets • Terrestrial (land-based) ecosystems Ecosystem services • Various	Wildlife and local communities may be disturbed by increased human access, light pollution and noise from blasting and traffic to and through metals and mining operations. This can have variable impacts on ecosystem services depending on how nature is affected.
Resource use/replenishment Water use: For dust suppression, servicing infrastructure and staff buildings. Other resource use (including living and non-living resources): Power generation and management. Other resource use (including living and non-living resources): Non-hazardous material use (such as wood, food, paper, concrete) used in routine processes and equipment.	Environmental assets • Mineral and energy resources • Subterranean freshwater ecosystems • Freshwater ecosystems • Water resources • Terrestrial (land based) ecosystems Ecosystem services • Water supply • Genetic material • Biomass provisioning • Water flow regulation • Cultural services	Water extraction can lead to the dewatering of aquifers, subterranean freshwater ecosystems and the depletion of other water resources, especially in arid and drought-prone areas. Mine dewatering may affect the groundwater level. These activities can lead to reduced water flow regulation and increased drought severity and frequency. Such water use affects the supply of water to other users – households, fishing, aquaculture and agriculture – and to nature, with many ecosystem services affected, including water purification, water flow regulation, water supply and recreation-related services.

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Invasive alien species introduction/removal Introduction of invasive alien species (including vertebrate pests): Land cleared for large scale waste rock dumps and roads that are frequented by heavy machinery are more prone to colonisation by invasive alien species. The inhospitable geochemical characteristics of some mineral waste can make it more prone to colonisation by alien species.	Environmental assets • Terrestrial (land-based) ecosystems • Freshwater ecosystems Ecosystem services • Various, including cultural services	Change in the structure and function of ecological communities due to the arrival of new species, increasing extinction risk for native species. The ecosystem services affected depends on the shifts in the ecosystems that result.

Table 12: Impacts associated with processing and beneficiation

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Land/freshwater/ocean-use change Land ecosystem use: Land clearing (surface layers including vegetation, water and soils) for tailings storage facilities and processing infrastructure.	Environmental assets • Land • Terrestrial (land-based) ecosystems • Subterranean terrestrial ecosystems • Freshwater ecosystems • Subterranean freshwater ecosystems Ecosystem services • Various, including cultural services	Terrestrial and subterranean land and freshwater habitats will be altered by the land change required for processing and beneficiation activities. This can disrupt ecosystems and ecological functions due to reduced habitat extent, habitat degradation, increased erosion and changes to water resources. Land use change can also cause habitat fragmentation, which impedes species' feeding and reproduction patterns, reducing populations and increasing extinction risk. These changes can have knock-on effects on ecosystem services, including cultural services. Land use change can lead to the displacement of communities for new asset construction or transportation routes. It may also cause disruption and/or damage to local sacred areas.

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Pollution/pollution removal Water pollutants: Mineral waste generation and management. Seepage from tailings storage facilities may have higher temperature, altered pH, elevated metals and salt concentrations, suspended solids. Solid waste: Non-mineral waste generation and management from routine use of equipment.	Environmental assets • Freshwater ecosystems • Subterranean freshwater ecosystems • Water resources • Land • Terrestrial (land-based) ecosystems Ecosystem services • Water supply • Genetic material • Pollination • Biological control • Soil and sediment retention • Nursery population and habitat maintenance • Solid waste remediation • Soil quality regulation • Water purification	Changes in water quality parameters (temperature, pH, metals, salts, total dissolved solids) as a result of water discharge from processing operations, or runoff or seepage from tailings storage facilities, into local freshwater systems can affect the health of aquatic organisms living in the habitat, support the spread of disease and create the conditions for invasive species. Heavy metals can also cause serious health problems for aquatic organisms and the people that consume them. Excessive sediment can clog riverbeds and smother watershed vegetation, wildlife habitat and aquatic organisms. In turn, these changes impact the ecosystem services that local waterways provide including water supply, water purification, and soil and sediment retention and their genetic diversity.
Pollution/pollution removal Non-GHG air pollutants: Processing and beneficiation can create dust and other atmospheric emissions.	Environmental assets • Atmospheric systems • Terrestrial (land-based) ecosystems • Freshwater ecosystems • Marine ecosystems	Dust can lead to degradation of the quality of the surrounding atmospheric systems and ecosystems. This can affect local ecosystems by decreasing the quality of land, contaminating plants and affecting the health of animals. This in turn can disrupt ecosystem service provision such as pollination, biological control, nursery population and habitat maintenance and cultural services. Pollution may also lead to the worsening health and living conditions of surrounding local communities.

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Pollution/pollution removal Disturbances (visual and noise): Sites may operate continuously, create noise and light pollution.	Environmental assets • Terrestrial (land-based) ecosystems Ecosystem services • Various	Wildlife and local communities may be disturbed by increased human access, light pollution and noise from continuous operations. Ecosystem services affected will depend on how the ecosystem responds to the disturbance.
Resource use/replenishment Water use: for mineral processing. Other resource use (including living and non-living resources): Power generation and management. Other resource use (including living and non-living resources): Chemicals used in flotation and processing.	Environmental assets • Mineral and energy resources • Subterranean freshwater ecosystems • Freshwater ecosystems • Water resources • Terrestrial (land based) ecosystems Ecosystem services • Water supply • Genetic material • Biomass provisioning • Water flow regulation	Water extraction can lead to the dewatering of aquifers, subterranean freshwater ecosystems and the depletion of other water resources, especially in arid and drought-prone areas. These activities can lead to reduced water flow regulation and increased drought severity and frequency. Such water use affects the supply of water to other users – including households, fishing, aquaculture and agriculture – and to nature, with many ecosystem services affected, including water purification, water flow regulation, water supply and recreation-related services.

Table 13: Impacts associated with mine closure and rehabilitation

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Land/freshwater/ocean-use change Land ecosystem use: Land clearing (surface layers including vegetation, water and soils) for long-term water management structures, post-mining land use requirements etc. Land ecosystem use: Land excavation, drilling, blasting and movement (below surface layer) as part of reshaping mine pits and mine waste landforms. Freshwater ecosystem use: For post-mining land use requirements (e.g. revegetation, establishment of agricultural land uses).	Environmental assets • Land • Terrestrial (land-based) ecosystems • Subterranean terrestrial ecosystems • Freshwater ecosystems • Subterranean freshwater ecosystems Ecosystem services • Various, potentially all	Terrestrial and subterranean land and freshwater habitats will be altered by the land and freshwater change that occurs with closure activities. This could have positive impacts in the case of restoration and rehabilitation, or negative impacts in the case of new disturbance for establishment of alternative post-mining land uses. Rehabilitation and restoration actions may restore ecosystems and repair ecological functions through habitat reconstruction, stabilisation and repair of ecosystems. It may fragment habitats or improve connectivity. These changes can have effects on the provision of ecosystem services. Land use change can lead to the displacement of communities for new asset construction or transportation routes. It may also cause disruption and/or damage to local sacred areas.

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Pollution/pollution removal Water and soil pollutants: Closure activities to cover waste rock stockpiles and tailings storage facilities and treat seepage can reduce water and soil pollution. Solid waste: Treating brine or water affected by acid rock drainage and metal leaching can generate significant volumes of non-water pollutants (e.g. large volumes of iron oxide). Solid waste: Non-mineral waste generation and management can be significant during closure with decommissioning of infrastructure, old equipment, tyres, etc.	Environmental assets • Freshwater ecosystems • Subterranean freshwater ecosystems • Water resources • Land • Terrestrial (land-based) ecosystems Ecosystem services • Water supply • Genetic material • Pollination • Biological control • Soil and sediment retention • Nursery population and habitat maintenance • Solid waste remediation • Soil quality regulation • Water purification	Changes in water quality parameters (temperature, pH, metals, salts, total dissolved solids) in the closure phase of a metals and mining operation could have either negative impacts or positive. Negative impacts would result from poor quality runoff or seepage from tailings storage facilities into local freshwater systems that can affect the health of aquatic organisms living in the habitat, support the spread of disease and create the conditions for invasive species. Heavy metals can also cause serious health problems for aquatic organisms and the people that consume them. Excessive sediment could clog riverbeds and smother watershed vegetation, wildlife habitat and aquatic organisms. In turn, these changes impact the ecosystem services that local waterways provide including water supply, water purification, genetic diversity, soil and sediment retention. Positive impacts resulting from closure activities would be improved water quality runoff from mine waste landforms following rehabilitation efforts, which in turn leads to ecosystem restoration and improved water-related ecosystem services.

Driver of nature change	Environmental asset/ ecosystem services affected	Description
Resource use/replenishment Water use: For establishing vegetation or alternative post-mining land uses, for treating saline or acid rock drainage impacted water.	Environmental assets • Mineral and energy resources • Subterranean freshwater ecosystems • Freshwater ecosystems • Water resources • Terrestrial (land based) ecosystems Ecosystem services • Water supply • Genetic material • Biomass provisioning • Water flow regulation	Water extraction for closure activities (e.g. establishing vegetation) can lead to the dewatering of aquifers, subterranean freshwater ecosystems and the depletion of other water resources, especially in arid and drought-prone areas. At the same time, increased water application for irrigation for establishing vegetation during rehabilitation or for establishment of post-mining land uses can change water supply and water flow regulation services in those areas. Such water use impacts affect the supply of water to other users – including households, fishing, aquaculture and agriculture – and to nature, with many ecosystem services affected, including water purification, water flow regulation, water supply and recreation-related services.
Invasive alien species introduction/removal Introduction of invasive alien species (including vertebrate pests): Inappropriate planting of invasive alien species to stabilise disturbed areas, and/ or re-shaping waste rock dumps and tailings storage facilities can induce colonisation of invasive species.	Environmental assets • Terrestrial (land-based) ecosystems • Freshwater ecosystems Ecosystem services • Pollination • Biological control • Genetic material • Nursery population and habitat maintenance	Change in the structure and function of ecological communities due to the arrival of new species.

Table 14: High-level list of business dependencies linked to environmental assets and ecosystem services, with examples

Business activity	Environmental assets or ecosystem services depended on	Description
Predevelopment, exploration, mine operation and maintenance	Environmental assets • Atmospheric systems • Underwater mineral and energy resources • Marine (ocean) ecosystems • Subterranean-terrestrial ecosystems • Land • Terrestrial (land based) ecosystems • Subterranean-freshwater ecosystems • Mineral and energy resources • Water resources • Freshwater ecosystems • Subterranean-marine ecosystems Ecosystem services • Water supply • Soil and sediment retention • Flood mitigation • Water flow regulation • Rainfall pattern regulation • Local and global climate regulation • Solid waste remediation • Storm mitigation • Water purification • Air filtration • Noise attenuation • Cultural services	Mining sites depend directly on the environmental assets surrounding the site and the presence of minerals in the site. The operations themselves depend heavily on access to clean water to detoxify effluents, suppress dust, cool and crack chemicals, and to recharge back-filled pit voids. Nature also provides services that protect mines from various hazards, including flooding and storm damage, as well as helping to maintain the soil stability around the mine. Nature supports mining operations in the disposal and dilution of waste, pollution and noise, helping to protect local communities.

Business activity	Environmental assets or ecosystem services depended on	Description
Mine closure and rehabilitation	Environmental assets Surface and subterranean marine (ocean), terrestrial (land based) and freshwater ecosystems Ecosystem services • Water supply • Genetic material • Biomass provisioning • Pollination • Biological control • Soil and sediment retention • Flood mitigation • Water flow regulation • Rainfall pattern regulation • Local and global climate regulation • Nursery population and habitat maintenance • Solid waste remediation • Soil quality regulation • Storm mitigation • Water purification • Air filtration	Closure activities will depend on the ongoing presence of healthy ecosystems around the site to support repopulation. An ongoing supply of clean water and protection from hazards such as landslides, floods and storms can also help provide stability to support nature's recovery.

Business activity	Environmental assets or ecosystem services depended on	Description
Processing and beneficiation	Environmental assets • Land • Terrestrial (land based) ecosystems • Water resources Ecosystem services • Water supply • Soil and sediment retention • Flood mitigation • Water flow regulation • Rainfall pattern regulation • Local and global climate regulation • Storm mitigation • Water purification	The principle dependency of the metals processing and casting process is on water-related ecosystem services for cooling and cleaning as well as providing other functions in processing. Facilities further depend on services that protect them from various hazards, including flooding and storm damage, as well as helping to maintain the soil stability.
Transport and supporting infrastructure	Organisations should refer to the relevant TNFD sector guidance.	Storm mitigation ecosystem services protect infrastructure from the impacts of wind, sand and other storms. These can particularly affect harbours and waterways. Organisations should refer to the relevant TNFD sector guidance.

E3

E3: Dependency and impact measurement

Guiding questions:

What is the scale and scope of our dependencies on nature?

What is the severity of our negative impacts on nature? What is the scale and scope of our positive impacts on nature?

Water balances, disaster management plans, mineral resource plans, tailings and rock deposition rates and tailings management plans, as well as other standard operational plans, can provide information on the scope of dependencies.

Changes in the state of nature should be viewed across spatial (area of influence) and temporal horizons (e.g. life of mine), and consider the interrelationships with external factors, such as climate change or other actors' water use in a catchment.

E4

E4: Impact materiality assessment

Guiding question:

Which of the identified impacts are material?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

List of datasets and tools

Table 15 provides a list of tools that metals and mining sector organisations may find useful for the Evaluate phase of LEAP. Organisations should also refer to tools in the LEAP guidance and TNFD Tools Catalogue.

Table 15: Additional tools for metals and mining sector organisations in the Evaluate phase of the LEAP

Tool name	Use in this LEAP phase	Link to tool
Environmental and social impact assessment and associated management plans or programmes	Environmental and social impact assessments usually require a systematic review of a project's impacts on the receiving environment and society. These assessments usually require a risk and impact ranking, and the definition of key values that require ongoing management.	IUCN Environmental and Social Impact Assessment IFC Performance Standards on Environmental and Social Sustainability
ReCiPe	Methodology for lifecycle impact assessments, distilling impacts into a limited number of indicator scores.	ReCiPe
NARIA	Ecosystem integrity data and forecasting of likelihood of ecosystem integrity degrading or being maintained.	NARIA

2.4. Assess nature-related risks and opportunities

A1

A1: Risk and opportunity identification

Guiding question:

What are the corresponding risks and opportunities for our organisation?

Table 16 and Table 17 contain illustrative examples of risks and opportunities in the metals and mining sector.

Table 16: Illustrative nature-related risks for the metals and mining sector

Category	Examples of potential risks
Physical risks (acute and chronic)	Increased risk of damage from floods, storms and landslides if protective terrestrial ecosystems are degraded. Increased closure and habitat rehabilitation costs if soil quality is too degraded. The accidental spillage of oil upstream contaminates the water body that the organisation depends on. Wildfires, tropical cyclones, extreme heat and other extreme weather events damaging infrastructure or interrupting business activities. Degraded protective terrestrial ecosystems and changes in rainfall pattern increasing the risk of disruption of operations (e.g. overtopping of dams due to heavy rainfall events). Declining water supply and/or water quality as a result of the organisation's activities, those of others in the watershed and climate change. Disruption of operations due to scarcity and increased cost of raw materials and freshwater.
Reputation and stakeholder risks	Changes in sentiment towards the organisation/brand due to competition for natural resources (e.g. water, land), impacts on nature and/or failure to meet expected stakeholder community expectations (e.g. nature no net loss, failure to meet rehabilitation and closure expectations or late life divestments). Operational interruptions reducing business continuity due to community conflict. As protections increase, the discovery of rare species onsite, or rare species moving onto a site, may interrupt operational activities. Inability to gain new land access to support business growth.

Category	Examples of potential risks
Transition risks – policy and legal (including land access agreements with Indigenous Peoples and Local Communities)	As countries start implementing the Global Biodiversity Framework targets, the amount of land placed under protection mechanisms will rise, which will lead to a reduction in possible new areas to explore for mining and a decrease in permitting. There may also be increased restrictions on access to remote areas where remaining reserves are located. Organisations may refer to National Biodiversity Strategies and Action Plans (NBSAPs) to identify areas that may become protected in the future. Tighter regulations may for instance mean that the discovery of an important, previously undetected habitat may require a halt in operations, more inspections and surveys, or a location change. There could also be increased timeframes for new projects, permits and land access. Introduction of biodiversity offset schedule to support government no-net loss or nature-positive initiatives. Sterilisation of part or all of prospective orebodies due to location relative to areas of critical biodiversity significance. Increased closure costs (tightening regulation on financial evaluations and physical/social expectations).
Transition risks – market and finance	Reduction in revenue due to lower demand for products and services (e.g. unfavourable commodities and products, such as those that do not support energy transition or UN SDGs). Risks to access to capital as financial institutions apply exclusions to highly damaging activities like deep sea mining.[10]

10 UNEP-FI PRB (2023) Banking on nature: What the Kunming-Montreal Global Biodiversity Framework means for responsible banks.

Table 17: Illustrative potential nature-related opportunities for the metals and mining sector

Category	Examples of potential opportunities
Resource use efficiency Ecosystem protection, restoration and regeneration	Innovations in the processing of tailings residues, by converting them into commercially viable materials. For example, repurposing sand tailings generated in the production of iron ore as a replacement for sand quarried from riverbeds and coastal areas. Technological innovations to restore the ecosystem and avoid permanent tailings dams, such as tailings dry backfill, that return inert mining tailings to mined areas before rehabilitation, preventing permanent storage, enabling forest regeneration and accelerating the rehabilitation of mining-affected areas. Other innovations that reduce impacts on nature may include: in-situ leach mining, in-place mining, block-cave/sub-cave, tailings reprocessing, low-grade stockpile processing, dry or low water milling and processing, lower energy intensive infrastructure (e.g. vertical roller mills and load scheduling), and transition to efficient and circular production systems and value chains. Innovations that use nature-based solutions to reduce impacts on nature may include: using revegetation or increasing flood resilience through natural catchment measures and floodplain storage capital/infrastructure costs.
Products/ services	Replace virgin raw materials through the reuse and repurposing of waste and loss into alternative products. Nature-based solution innovation by replacing traditional chemicals used in mining processes with natural bioactive substances from biodiversity. Certification of sustainable products. Use of owned or managed natural assets to create or enhance ecosystem services that may be monetised (e.g. natural flood risk management).
Markets and finance	Opportunities for organisations to engage in emerging natural capital markets.
Reputational capital	Reputational credentials to support new country entry, land access and regulatory permitting. Increase in consumer brand loyalty and enhanced social licence to operate though actions such as transparent biodiversity management plans and focus on circular economy.

A2: Adjustment of existing risk mitigation and risk and opportunity management

Guiding questions:

What existing risk and opportunity management processes and elements are we already applying?

How can risk and opportunity management processes and associated elements (e.g. risk taxonomy, risk tolerance criteria) be adapted?

Existing risk management processes

The business systems and processes used to inform the materiality of impacts in the E4 component are also likely to provide a useful starting point to identify any existing nature-related risk management processes at the organisational or business asset level in the metals and mining sector. These may include:

- Environmental and social impact assessments;
- Scoping and feasibility assessments;
- Environmental and social management plans or programmes;
- Site and corporate risk assessment process and registers;
- Other specialist and regulatory assessments; and
- Board charters.[11]

Additionally, organisational strategy planning processes are often geared towards managing macro-context risks to maintain business resilience and continuity. Such organisational strategy frameworks can also provide a useful insight into an organisation's risk appetite and market positioning.

Existing opportunity management processes

In the metals and mining sector, opportunities may be infrequently identified in organisational risk systems and processes but can be inferred through some existing business processes and systems. Existing processes and systems where relevant nature-related opportunities may already be considered include:

- Internal financial capital and other project application processes: These often consider the motivation for a project to be implemented, may include a list of opportunities for the project to be taken forward and the recommendation of a preferred option; and
- Option analyses associated with feasibility assessments: These often consider a range of options and trade-offs to determine the most feasible pathway forward. For example, identifying preferred water supply options may consider resilience, impact analysis, capital and operational expenditure to confirm the preferred option.

11 In some jurisdictions and settings, boards have a fiduciary responsibility to manage risk and opportunities on behalf of their stakeholders.

A3

A3: Risk and opportunity measurement and prioritisation

Guiding question:

Which risks and opportunities should be prioritised?

Measurement and prioritisation of the risks and opportunities can be based on both quantitative and qualitative approaches, and leverage existing risk assessment methods in the sector:

- Financial implications (e.g. lack of water during drought seasons will result in production stoppages and alternative supplies are not financially feasible to support the business model);
- Reputational impact (e.g. mineral resources are limited and will not be seen as a sustainable investment choice);
- Impact on employee and stakeholder health, wellbeing, safety and/or livelihoods (e.g. flood attenuation improved through the reduction of hardened surfaces in the catchment as a result of closure and rehabilitation);
- Legislative considerations and impacts (e.g. pollution amelioration services reduced due to wetland degradation leading to increased liabilities and penalties to address downstream pollution); and
- Alignment/misalignment with regulatory conditions and other good practice guidance requirements (e.g. ICMM Performance Expectation Validation Guidance, International Finance Corporation Performance Standards, relevant company-specific environmental, health and safety standards).

For additional guidance, organisations should refer to TNFD's Guidance on the identification and assessment of nature-related issues: The LEAP approach. Specifically for what concerns 'Scenario-based risk assessment', organisations are encouraged to refer to TNFD's Guidance on scenario analysis.

A4

A4: Risk and opportunity materiality assessment

Guiding question:

Which risks and opportunities are material and therefore should be disclosed in line with the TNFD recommended disclosures?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

List of datasets and tools

Table 18 provides a list of tools that metals and mining sector organisations may find useful for the Assess phase of LEAP for the assessment of risks and opportunities within the direct operations and value chain. Organisations should also refer to tools in the LEAP guidance and TNFD Tools Catalogue.

Table 18: Additional tools for metals and mining sector organisations in the Assess phase of the LEAP

Tool name	Use in this LEAP phase	Link to tool
Forest Declaration Assessment: Theme 2	Provides analyses of the progress within various sectors towards achieving the global forest goals and provides insights on the risks based on the findings to date.	Sustainable production and development: Theme 2 Assessment

Locate | Evaluate | Assess | Prepare

2.5. Prepare to respond and report

P1

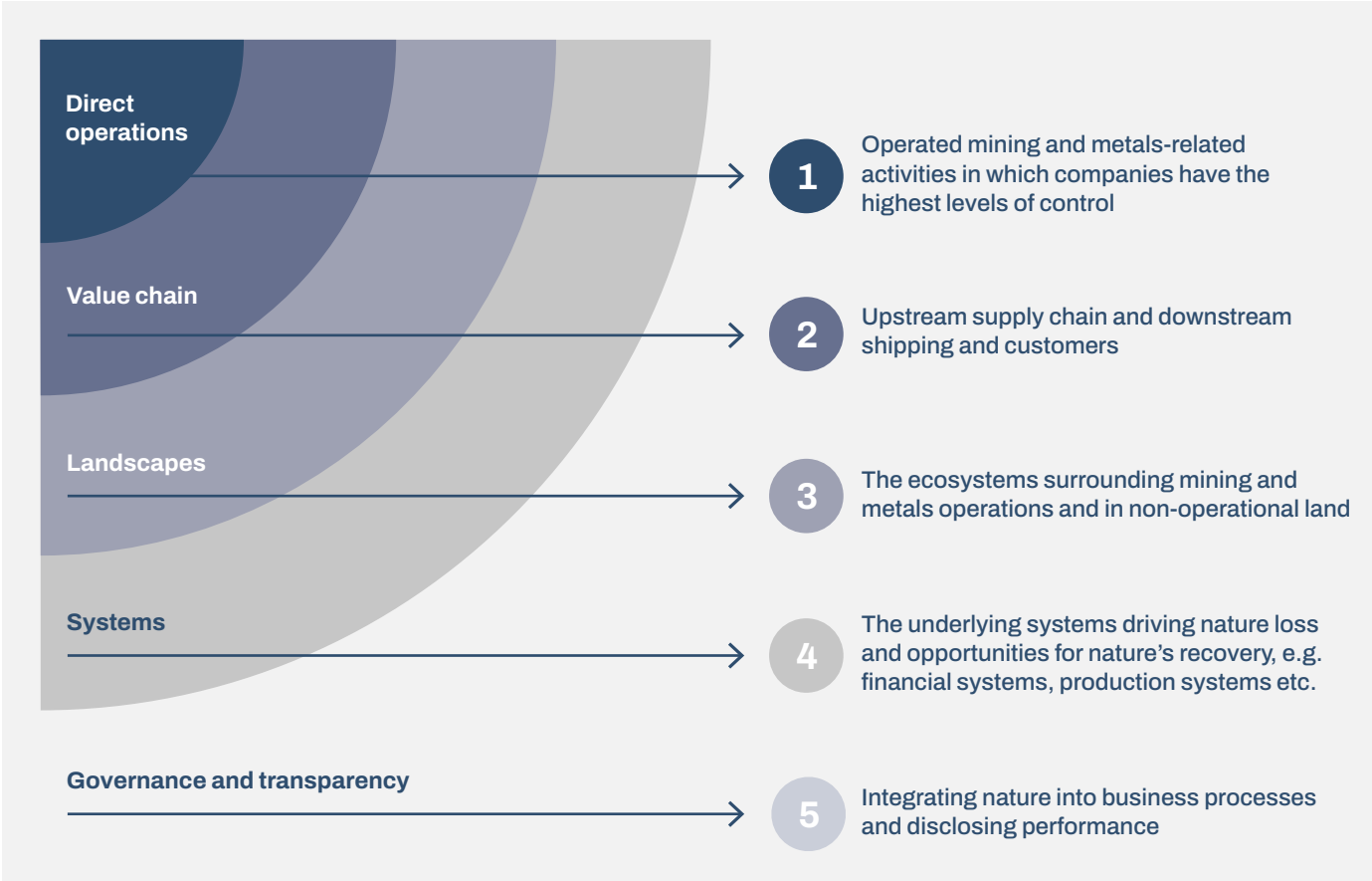
P1: Strategy and resource allocation plans

Guiding question:

What risk management, strategy and resource allocation decisions should be made as a result of this analysis?

Figure 7 provides a framework to support metals and mining organisations' decision-making when responding to nature-related dependencies, impacts, risks and opportunities. It describes different spheres of influence of a metals and mining organisation, for which different kinds of decisions might be required. The mitigation hierarchy should also be applied, emphasising avoiding impacts. Avoidance is not limited to project choice, but also to decisions throughout the project lifecycle.

Figure 7: Nature-positive action framework for mining and metal companies



Source: ICMM Nature Position Statement, 2024.

Table 19 presents illustrative examples of actions that metals and mining organisations may consider to manage the risks and opportunities identified in the Assess phase. The actions are mapped against the spheres of influence in Figure 7 and SBTN's AR3T framework (based on TNFD's interpretation and pending alignment with future development of SBTN's Step 4 guidance), which covers mitigation hierarchy principles when determining responses to identified nature-related issues.

Table 19: Illustrative priority and transformative actions for the metals and mining sector mapped to the AR3T Framework

Activity	Impact driver/ ecosystem service	Example of addressed risk/ opportunity	Examples of actions	Sphere of influence	SBTN Action Framework (AR3T)				
					Avoid	Reduce	Regenerate	Restore	Transform
Direct operations (all)	All	**Reputational risk:** Poor management of impacts on nature as results of incidents.	Commit to No Net Loss or Biodiversity Net Gain across operations. Improve nature monitoring, documentation and research on sites.	Direct operations					
Exploring, mining and closure	Land-use change	**Liability risk:** Potential actions or inactions leading to potential harm to nature.	Consult with local governments to identify areas of high ecological value and conduct nature assessment and management of land occupied.	Direct operations					

Activity	Impact driver/ ecosystem service	Example of addressed risk/ opportunity	Examples of actions	Sphere of influence	SBTN Action Framework (AR3T)				
					Avoid	Reduce	Regenerate	Restore	Transform
Exploring, mining and closure continued	Freshwater-use change	**Reputational risk:** Failure to manage water resources in a way that maintains the system for others' use.	Engage in species-focused habitat management and water stewardship, with enhancement of natural features and replenishment activities.	Direct operations					
	Ocean-use change	**Transition risks – market and finance:** Disruption to finance as a result of exclusions on deep sea mining.	Avoid deep sea mining as an activity.	Direct operations					
	Disturbances	**Reputational risk:** Poor management of nature leading to high human–animal collisions and other negative interactions	Adopt best practices, such as adequate lighting, suitable crossing points for linear infrastructure, visual and noise deterrents on tailings facilities, wind turbines and power infrastructure.	Direct operations					

Activity	Impact driver/ ecosystem service	Example of addressed risk/ opportunity	Examples of actions	Sphere of influence	SBTN Action Framework (AR3T)				
					Avoid	Reduce	Regenerate	Restore	Transform
Exploring, mining and closure, processing and smelting	Water use	**Technological risk:** Obsolescence of water systems, requiring increasing cost to source water.	Harness best practices (water audits, context-based targets) and new technologies (such as reuse and recycling systems).	Direct operations					
Inorganic and organic feedstock and raw materials	All	**Reputational risk:** Relationship with suppliers perceived as non-sustainable.	Set nature-aligned procurement policy.	Value chain					
			Collaborate with industry association to develop common data request for suppliers.	Value chain					
			Set requirements for all highest risk tier 1 (direct) suppliers to conduct and disclose the outcomes of nature-related impact, dependency, risk and opportunity assessments for activities in priority locations.	Value chain					

Activity	Impact driver/ ecosystem service	Example of addressed risk/ opportunity	Examples of actions	Sphere of influence	SBTN Action Framework (AR3T)				
					Avoid	Reduce	Regenerate	Restore	Transform
Exploring and mining	Land-use change; pollution	**Resource efficiency opportunity:** Reducing land excavation and potentially reducing operational costs.	Invest in precision mining tech, develop natural chemical or non-chemical extraction techniques.	Systems transformation					

Activity	Impact driver/ ecosystem service	Example of addressed risk/ opportunity	Examples of actions	Sphere of influence	SBTN Action Framework (AR3T)				
					Avoid	Reduce	Regenerate	Restore	Transform
Direct operations (all)	Land-use change; water use	**Reputational opportunity:** Improve reputational capital at local level, enhancing relationship with local community	Engage in supporting nature conservation and restoration projects (e.g. restoration and protection of native forests).	Landscapes					
	Land-use change		Collaborate and build capacity with local partners to support and enhance livelihoods and wellbeing of people depending on the ecosystem.	Landscapes					
	Water use		Partner with local economic actors to improve water systems, improving water distribution and access for the community.	Landscapes					

Activity	Impact driver/ ecosystem service	Example of addressed risk/ opportunity	Examples of actions	Sphere of influence	SBTN Action Framework (AR3T)				
					Avoid	Reduce	Regenerate	Restore	Transform
Mineral processing and smelting, other/further beneficiation, fabricated and semi-fabricated products	All	**Market opportunity:** Improve sustainability positioning and have a stronger competitive positioning (e.g. ability to increase prices for sustainable products) and new revenue streams.	Form partnerships with customers, improving product transparency and traceability (drawing learnings from climate collaborations).	Value chain					
			Repurpose mining waste for use in other industry, e.g. collaborating with clients to co-design low-impact circular metals.	Value chain					

Source: ICMM; WEF (Unpublished) Workshop: Sector Actions towards Nature Positive: Mining & Metals

Table 20 provides further examples of avoidance actions relevant to the metals and mining sector.

Table 20: Examples of avoidance actions

Activity	Example	Avoidance actions			
		Design and plan	Preventative monitoring	Preventative actions	Transformative actions
Disturbance of new site/area	Clearing of vegetation and removal of soils for exploration or construction activities in a natural area.	Establish no-go areas, considering sensitive locations, dependencies, safety and socio-economic aspects. Design layouts and infrastructure to minimise spatial footprints and avoid sensitive locations.	Implement early detection to prevent impacts from occurring, e.g. monitor anti-collision measures to ensure they operate correctly.	Alarm systems and frequent inspections to prevent unintended impacts. Education and awareness-raising; clear responsibilities for people involved in activities that interface with nature. Infrastructure maintenance.	Focus strategies on existing resources and impacted areas ahead of new unimpacted areas. Appropriately weight nature-related dependencies, impacts, risk and opportunities in pre-feasibility, feasibility and planning processes.
Disturbance of existing site/area	Construction of new infrastructure on old rock dump footprints.	Better planning and design to limit new impacts. Restore nature, e.g. rehabilitate impacted soils to allow new gardens, fire breaks, wind barriers or other green areas.	As above. Avoid exacerbating existing impacts by ensuring they are well understood.	As above. Education and maintenance activities should address historic and existing impacts as well as the new ones.	As above. Include alternative infrastructure options for use in future before demolishing the existing infrastructure.

Activity	Example	Avoidance actions			
		Design and plan	Preventative monitoring	Preventative actions	Transformative actions
Maintenance activities associated with existing infrastructure	Clearing vegetation to maintain a firebreak or security perimeter; removing sediment from water stores; replacing pipelines.	As above, considering maintenance and access requirements. Avoid impacts, e.g. manual cutting of plants instead of herbicide application.	Time maintenance monitoring to reduce impact, e.g. conduct fire break burning only when risk of spread is low (low wind or high moisture).	For example, include silt traps ahead of dirty water dams to reduce the area needed and cleaning frequency.	Innovation and synergies in landscape, e.g. community policing to reduce need to clear large areas. Circular economy approaches, e.g. dam sludge used for rehabilitation.
Demolition, removal, repurposing, rehabilitation and/or restoration of historic impacts	Removal, repurposing and rehabilitation of assets.	Assess all rehabilitation and restoration options (e.g. ameliorate and repurpose existing soil rather than removing it from natural areas). Leave infrastructure in place that may be useful for post-mining land uses. Avoid disturbing sites multiple times; rehabilitate only once all impact drivers in the company's control are sufficiently addressed.	As above. Comprehensive monitoring and maintenance to detect issues early.	As above. Education, awareness and legally binding agreements or other measures to ensure third party support.	Work with other land users to arrive at integrated closure strategies that enhance community resilience and adaptability, ensure the sustainability of the closure objectives and provide support to allow for the continuation of socio-economic activities in harmony with nature-related objectives.

Activity	Example	Avoidance actions			
		Design and plan	Preventative monitoring	Preventative actions	Transformative actions
Post-closure maintenance activities, including monitoring and maintenance of residual and latent impacts, as well as post-closure land uses.	Ongoing management and maintenance of pumping and water treatment infrastructure to address acid rock drainage plume over the next 50 years.	Consider the socio-economic conditions and future needs when planning closure to avoid conflicting land uses (e.g. protecting an area that communities use for subsistence agriculture). Obtain Free, Prior and Informed Consent (FPIC) for all life cycle stages to optimise post-mining land use and ensure closure is achieved.	As above. Community champions may reduce resource requirements while elevating their profile within the community.	As above.	Establish local forums or committees with nature-related objectives that they can continue to progress after the company has left the area

P2 P2: Target setting and performance management

Guiding question:

How will we set targets and define and measure progress?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach, which includes additional guidance on target setting in this component P2.

Organisations may wish to refer to the target-setting methods developed by the Science Based Targets Network and the summary guidance on SBTN's methods for setting science-based targets for nature, which the TNFD has co-developed with the SBTN.

Table 21 provides a list of potential methods and standards that may support target setting in the metals and mining sector.

Table 21: Potential target considerations and guidance references

Type of target	Aspect	Comment	Potential guidance
Driver of nature change	Land use	Land management targets may cover land management and strategy considerations, such as land use planning and post-closure land use opportunities.	ICMM: Integrated good practice guide v2 and closure maturity framework SBTN: Step 3: Measure, Set, Disclose: Land (Version 0.3) Sustainable Development Goals 10, 11 and 12
	Water use and pollution	Water targets may include all aspects related to the responsible and efficient management of water from policy, sourcing, management, discharge to integrated catchment management.	BHP: Setting site wide water targets informed by catchment context CEO Water Mandate GRI 303: Water and Effluents 2018 ICMM: A practical guide to catchment-based water management for the metals and mining industry ICMM: Water stewardship position statement and associated guidance SBTN: Technical Guidance: Step 3 Freshwater: Measure, Set & Disclose Sustainable Development Goals 6, 9, 14 and 15 WRI: Toolbox for setting enterprise water targets

Type of target	Aspect	Comment	Potential guidance
Driver of nature change (continued)	Soil pollution	Targets may include any aspect related to the management and enhancement of soil properties for present and future uses, including post-mining activities.	FAO: Voluntary guidelines for sustainable soil management
	Air pollution	Targets may relate to air quality management measures and the associated quantifiable improvement in air quality.	National regulatory requirements ICMM: Risk management performance expectations
	Waste and material management	Waste and material management targets may be related to the actual management and/or reduction of the use of high impact materials, as well as reduced waste generation and circular economy initiatives.	CEIC: Corporate target-setting for the circular economy: Mobilising measurable progress GRI 306: Waste 2020 ICMM: Circular economy factsheet UNEP: Guidance on resource efficiency and circular economy target setting – Version 2
State of nature	Biodiversity (species and ecosystems) management	Various indicators may be used related to species, ecosystem extent, ecosystem state and ecosystem services, as well as associated management activities.	CDSB: Framework application guidance for biodiversity-related applications CSBI: A cross-sector guide for implementing the mitigation hierarchy CSBI: Timeline tool Global Biodiversity Framework GRI 101: Biodiversity 2024 IFC: Performance standard 6 SBTN: Target-setting guidance for companies Sustainable Development Goals 14 and 15 UNEP-WCMC: Biodiversity indicators for extractive companies

Type of target	Aspect	Comment	Potential guidance
State of nature (continued)	Species	Comprehensive species targets that aim not only to address presence or absence indicators, but also complex habitat, genetic and population considerations.	CDSB: Framework application guidance for biodiversity-related applications IFC: Performance standard 6
	Ecosystems	Integrated state of nature metrics where factors such as ecosystem type, extent, condition and other factors are consolidated into measurable and trackable targets. This may include outcomes such as no net loss, net gain and net positive impact.	CDSB: Framework application guidance for biodiversity-related applications Priority ecosystems and targets can be informed by National Biodiversity Strategies and Action Plans or land degradation neutrality targets
Management actions	Action plans	Targets may be set for progress against action plans, particularly as an interim step, such as for scope and completeness of a LEAP assessment or value chain coverage.	Set internally
	Other management targets	Other management targets may relate to the following: • Socio-economic requirements; • Resourcing; • Management processes; and • Responsible sourcing.	ICMM: Social and economic reporting framework and guidance

Type of target	Aspect	Comment	Potential guidance
Social interactions with nature	Human rights and sustainable development	Targets to address nature-related human rights topics, such as: • Equity and diversity; • Free, Prior and Informed Consent; and • Modern slavery.	ICMM: Human rights due diligence IFC: Performance standard 6 UN: Guiding principles on business and human rights And others as listed in the TNFD recommendations
Continuous improvement	Data sharing, reporting and collaboration	Targets to improve contributions to public databases, value chain data sharing initiatives and global targets, to align with global protocols and good practices, and for landscape engagement.	Global Biodiversity Information Facility

P3

P3: Reporting

Guiding question:

What will the organisation disclose in line with the TNFD recommended disclosures?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

P4

P4: Presentation

Guiding question:

Where and how do our organisations present our nature-related disclosures?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

List of datasets and tools

Table 22 provides a list of tools that metals and mining sector organisations may find useful for the Prepare phase of LEAP to identify actions and platforms for sharing information. Organisations should also refer to tools in the LEAP guidance and TNFD Tools Catalogue.

Table 22: Additional tools for metals and mining sector organisations in the Prepare phase of the LEAP

Tool name	Use in this Prepare phase	Link to tool
Global Biodiversity Information Facility	International network and data infrastructure holding open-access nature data.	GBIF
GRI Standards	Global sustainability reporting standards for nature-related impacts. Includes a sector standard for the mining sector (GRI 14: Mining 2024).	Consolidated set of the GRI Standards
iNaturalist	Open platform for scientists and citizens to share nature-related observations and discuss findings.	iNaturalist
Nature Commitments	Global nature-related commitments platform.	Nature Commitments
Nature Metrics eDNA GIS tool	GIS-based reporting tool for eDNA results and metrics.	Nature Metrics eDNA GIS tool
Projects for Nature	UK-focused collaborative platform for nature restoration projects.	Projects for Nature
World Benchmarking Alliance (WBA): Nature Benchmark	Benchmark of companies' nature-related strategies and impact disclosures.	WBA Nature Benchmark

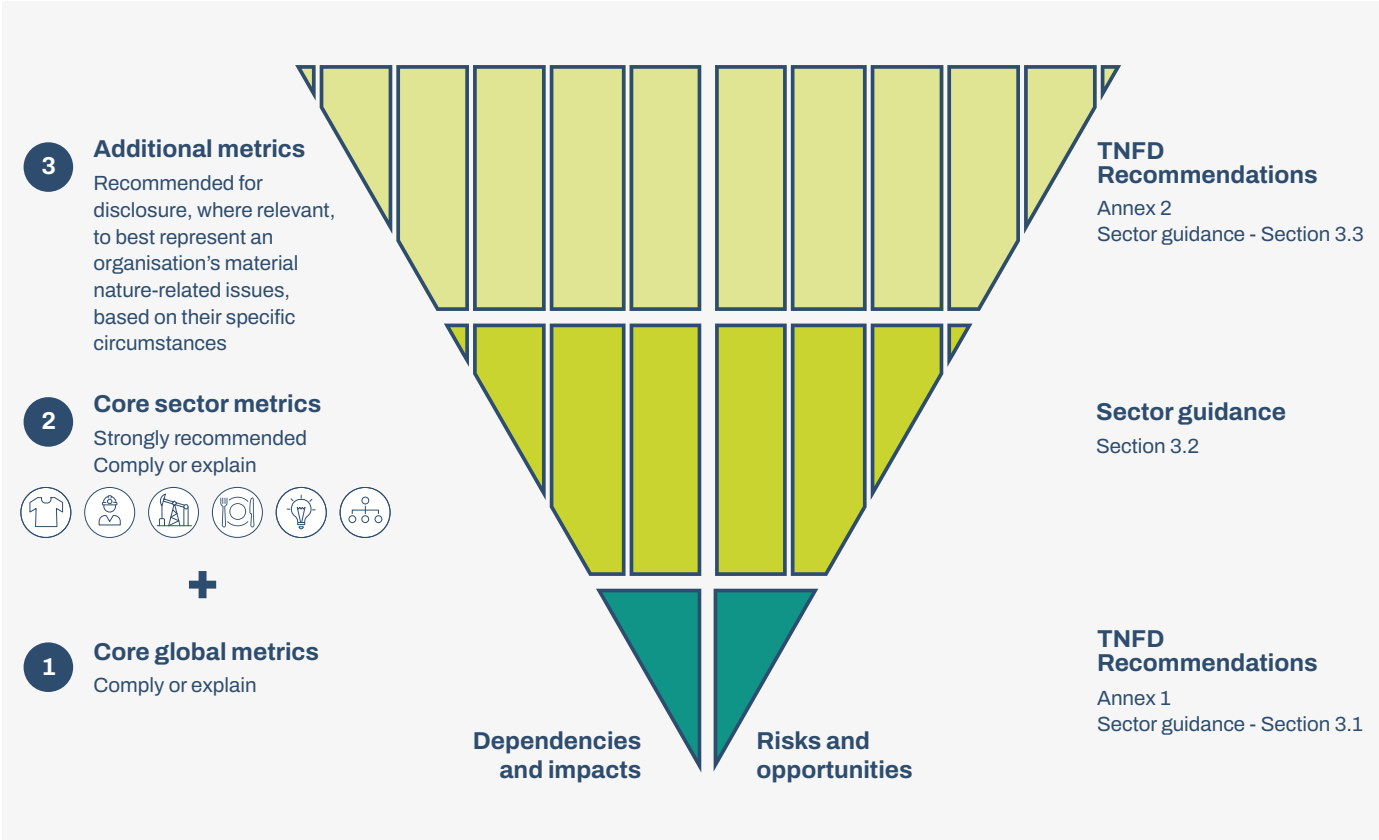
3. Sector-specific disclosure metrics – metals and mining

Sector-specific metrics form an important part of the TNFD's measurement architecture (see Figure 8). This reflects the diversity of business models across value chains and their interface with nature across and within sectors. Sector-specific metrics help financial institutions to compare organisations within the same sector, which often face similar nature-related issues.

This section provides the TNFD sector-specific metrics for the metals and mining sector. It includes:

- Guidance on the application of the core global disclosure indicators and metrics to the metals and mining sector (Section 3.1); and
- Core and additional disclosure indicators and metrics for the metals and mining sector (Sections 3.2 and 3.3).

Figure 8. TNFD disclosure measurement architecture



Where available, the TNFD's recommended metrics for disclosure draw from a range of existing standards and frameworks including the IFRS Sustainability Disclosure Standards, SASB Standards, GRI Standards, the CDP disclosure platform, the Kunming-Montreal Global Biodiversity Framework and other relevant UN frameworks, ESRS and others. A number of organisations, including standard-setting organisations, continue to work on identifying relevant sector-level assessment and reporting metrics. The Taskforce recommends that report preparers stay engaged with year-on-year progress on these developments and implement the latest definitions within their risk management processes and disclosures. The TNFD is working closely with standard-setting organisations and others and will periodically update this guidance on recommended sector metrics for disclosure in line with these ongoing initiatives.

Organisations in the metals and mining sector should refer to Annex 1 of the TNFD Recommendations for further information on the core global disclosure metrics. As outlined in the TNFD Recommendations, core global disclosure metrics should be reported on a comply or explain basis, with the exception of the placeholder metrics.

Where organisations are unable to report against any of the core global metrics, they should provide a short explanatory statement as to why they have not reported those metrics. An organisation should report on the core global disclosure metrics unless:

- It has not been identified as relevant and material to the organisation, e.g. not relevant to business activities or the location the organisation is operating in, or not found to be a material issue for the organisation; or
- It has been identified as relevant and material, but the organisation is unable to measure it due to limitations with methodologies, access to data or because the information is commercially sensitive. In this case, organisations should explain how they plan to address this in future reporting periods.

Companies should report on the same basis for the core sector disclosure metrics outlined in Section 3.2.

Organisations are also encouraged to draw on the TNFD additional sector disclosure indicators and metrics outlined in Section 3.3 and any other relevant metrics to represent most accurately the organisation's nature-related dependencies, impacts, risks and opportunities.

1 Core global metrics

3.1. Guidance on the application of the core global disclosure metrics

This section provides guidance, where relevant, on how to apply the TNFD core global disclosure metrics in the metals and mining sector. If no further sector specific guidance is provided, organisations should refer to the core global disclosure metrics.

As outlined above, core global disclosure metrics should be reported on a comply or explain basis following the guidance for the metals and mining sector where provided.

For the placeholder indicators on invasive alien species and the state of nature, the TNFD encourages organisations to consider and report against these indicators where possible, but are not expected a comply on explain basis. There are not yet widely accepted metrics for these indicators, but the Taskforce recognises their importance, and will continue to work with knowledge partners to develop further guidance on these metrics.

Table 23: Proposed guidance on the application of the core global disclosure metrics

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Land/freshwater/ ocean-use change	C1.0	Total spatial footprint	Total spatial footprint (km^2) (sum of): • Total surface area controlled/ managed by the organisation, where the organisation has control (km^2); • Total disturbed area (km^2); and • Total rehabilitated/restored area (km^2).	In reporting this core global disclosure metric, area controlled/managed should include the area owned, leased or managed. In reporting this core global disclosure metric, organisations should also report the following: Total disturbed area (km^2) should be disclosed as: • Total area disturbed, not yet restored or rehabilitated (km^2). To provide further context, the following optional breakdowns can be provided: • Area of land disturbed that is unavailable for restoration or rehabilitation until the end of asset life (km^2); and • Area of land that is in preparation for restoration or rehabilitation (km^2). Total rehabilitated/restored area (km^2) should be disclosed as: • Area under restoration or rehabilitation split by status: in progress or post completion monitoring (km^2).	TNFD, Global Biodiversity Framework, GRI 12: Coal Sector (2022)

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Land/freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ ocean use change	Extent of land/freshwater/ ocean ecosystem use change (km^2) by: • Type of ecosystem;[12] and • Type of business activity.	If more appropriate, an organisation may provide information additional to the IUCN Global Ecosystem Typology (GET) to define the type of ecosystems they refer to, such as regional or local classifications.	GRI 101: Biodiversity (2024), IUCN Global Ecosystem Typology (GET)
Land/freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ ocean use change	Extent of land/freshwater/ ocean ecosystem conserved or restored (km^2), split into: • Voluntary; and • Required by statutes or regulations.	In reporting this core global disclosure metric, an organisation should include: • Area of land conserved under a form of formal protection, based on local, national or internationally recognised protection designations, e.g. IUCN Protected Area Management Categories III – VI or Other Effective Area-Based Conservation Measures (OECMs), as defined in the Kunming-Montreal Global Biodiversity Framework; • Conservation easements; and • Land restored (i.e. in post completion monitoring). An organisation should report area conserved and restored separately, if data is available.	TNFD, GRI 101: Biodiversity (2024), IUCN Protected Area Management Categories

12 When disclosing on ecosystem types, refer to Level 3 of the International Union for Conservation of Nature Global Ecosystem Typology.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Land/freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ ocean use change	Extent of land/freshwater/ ocean ecosystem that is sustainably managed (km^2) by: • Type of ecosystem;[13] and • Type of business activity.	In reporting this core global disclosure metric, sustainable management is defined as the area: • Demonstrating positive trends for ecosystem condition and extent and/or species extinction risk, following TNFD core global metric C5.0; and/or • Covered by a biodiversity management plan and/or strategy for no net loss or net gain of biodiversity.	TNFD

13 When disclosing on ecosystem types, refer to Level 3 of the International Union for Conservation of Nature Global Ecosystem Typology.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Pollution/ pollution removal	C2.0	Pollutants released to soil split by type	Pollutants released to soil (tonnes) by type, referring to sector-specific guidance on types of pollutants.	In reporting this core global disclosure metric, an organisation should include: • Total volume (m^3) of moderate and high impact spills to soil, according to the GRI 306-3 material spill classifications, including oil, fuel, wastes and chemicals; and • Number of incidents of significant pollution to soil within the reporting period associated with hazardous materials and waste management. Tailings (unless a spill comes from a tailings facility), and mineral waste with acid rock drainage or metal leaching potential, should be reported under waste generated (C2.2). Any pollutants to water bodies from these sources should be reported under water pollution (C2.1). Emissions that may settle and become soil pollutants (e.g. dust) should be reported under non-GHG air pollutants (C2.4). A significant incident is an incident that exceeds volume and concentration limits of local regulatory requirements or industry-accepted codes, or is otherwise included in the entity's financial statements (e.g. due to resulting liabilities) or recorded by the entity as an incident required to be reported by local jurisdictions, or is an event that is significant in the judgement of the operator, even though it did not meet the criteria above.	GRI 306: Effluents and Waste (2016); SASB Standards (2023) Disclosure EM-MM150a.9

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Pollution/ pollution removal	C2.1	Wastewater discharged	Volume of water discharged (m^3), split into: • Total; • Freshwater; and • Other.[14] Including: • Concentrations of key pollutants in the wastewater discharged, by type of pollutant, referring to sector-specific guidance for types of pollutants; and • Temperature of water discharged, where relevant.	In reporting this core global disclosure metric, the volume of water discharged should be broken down by: • Discharge destination category (surface water, groundwater, seawater and third party); and • Pollutant type category (high and low water discharge quality, as defined in ICMM Water Reporting Guidance).	ICMM (2021) Water Reporting: Good practice guide; GRI 303: Water and Effluents (2018) Disclosure 303-4 Water discharge.

14 Freshwater: (≤1,000 mg/L Total Dissolved Solids). Other: (>1,000 mg/L Total Dissolved Solids). Reference: GRI (2018) GRI 303-4 Water discharge.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Pollution/ pollution removal	C2.2	Waste generation and disposal	Weight of hazardous and non-hazardous waste generated by type (tonnes), referring to sector-specific guidance for types of waste. Weight of hazardous and non-hazardous waste (tonnes) disposed of, split into: • Waste incinerated (with and without energy recovery); • Waste sent to landfill; and • Other disposal methods. Weight of hazardous and non-hazardous waste (tonnes) diverted from landfill, split into waste: • Reused; • Recycled; and • Other recovery operations.	In reporting the type of waste under this core global disclosure metric, an organisation should include mineral waste and non-mineral waste. Mineral waste should include: • Tailings and other sludges; • Waste rock with metal leaching and/or acid rock drainage potential, radioactive material or asbestiform content; and • Overburden. An organisation should also report the composition of the waste diverted from disposal.	Adapted from GRI 306: Waste (2020); SASB Standards (2023) Disclosure EM-MM-150a

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Pollution/ pollution removal	C2.3	Plastic pollution	Plastic footprint as measured by total weight (tonnes) of plastics (polymers, durable goods and packaging) used or sold broken down into the raw material content.[15] For plastic packaging, percentage of plastics that is: • Re-usable; • Compostable; • Technically recyclable; and • Recyclable in practice and at scale.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

15 Raw material content: % of virgin fossil-fuel feedstock; % of post-consumer recycled feedstock; % of post-industrial recycled feedstock; % of virgin renewable feedstock.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Pollution/ pollution removal	C2.4	Non-GHG air pollutants	Non-GHG air pollutants (tonnes) by type: • Particulate matter ($PM_{2.5}$ and/or PM_{10}); • Nitrogen oxides (NO_2, NO and NO_3); • Volatile organic compounds (VOC or NMVOC); • Sulphur oxides (SO_2, SO, SO_3, SO_x); and • Ammonia (NH_3).	In addition to pollutants listed in the core global disclosure metric, pollutants from the following list should be reported for each site where they are relevant to the operations: • Carbon monoxide (CO), ground level ozone (O_3) and hydrogen sulphide (H_2S); • Mercury (Hg); • Lead (Pb); • Hydrogen cyanide (HCN); • Dust fallout (under particulate matter); • Persistent organic pollutants (POP); • Hazardous air pollutants (HAP); and • Other standard categories of air emissions from relevant regulations. These categories of pollutants are not mutually exclusive. For example, substances contained in PM_{10} must also be reported where applicable in other categories. Quantitative concentration of non-GHG air pollutants should be measured by month and then annually by the company.	GRI 305: Emissions (2016) Disclosure 305-7; GRI 101: Biodiversity (2024)

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Resource use/ replenishment	C3.0	Water withdrawal and consumption from areas of water scarcity	Water withdrawal and consumption[16] (m^3) from areas of water scarcity, including identification of water source.[17]	In reporting this core global disclosure metric, an organisation should report water withdrawal broken down by use category – operational water and other managed water – and by quality, as defined in ICMM Water Reporting Guidance. Water consumption should include the volume of water removed by evaporation, entrainment (in waste or product) or other losses and not released back to surface water, groundwater, seawater or a third party. In addition to the core global disclosure metric, organisations should report: • Water withdrawal in areas of water scarcity as a percentage of the total water withdrawn; • The number and share (%) of sites located in areas of water scarcity; and • Operational water reuse/recycle volumes.	ICMM (2021) Water Reporting: Good practice guide; SASB Standards (2023) Disclosure EM-MM-140a.1; GRI 303: Water and Effluents (2018), Disclosures 303-3 and 303-5

16 Water consumption is equal to water withdrawal less water discharge. Reference: GRI (2018) GRI 303-5.

17 Surface water; groundwater; seawater; produced water; third-party water. Reference: GRI (2018) GRI 303-3.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Resource use/ replenishment	C3.1	Quantity of high-risk natural commodities sourced from land/ ocean/ freshwater	Quantity of high-risk natural commodities[18] (tonnes) sourced from land/ocean/ freshwater, split into types, including proportion of total natural commodities.	In reporting this core global disclosure metric, organisations should note: • The metric only applies to procured volumes; and • High-risk natural commodities refer to commodities or products where production has significant negative impacts on nature. High-risk natural commodities can be identified through reference to the SBTN High Impact Commodity List or identified by the organisation as high-risk through a LEAP-aligned assessment process.	TNFD
Resource use/ replenishment	C3.1	Quantity of high-risk natural commodities sourced from land/ ocean/ freshwater	Quantity of high-risk natural commodities[19] (tonnes) sourced under a sustainable management plan or certification programme, including proportion of total high-risk natural commodities.	In reporting this core global disclosure metric, an organisation should: • Note that this metric only applies to procured volumes; and • Disclose the specific sustainable management plans/ certifications included in the metric, and/or the criteria for inclusion.	TNFD

18 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL) and indicate what proportion of these commodities represent threatened and CITES listed species.

19 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL) and indicate what proportion of these commodities represent threatened and CITES listed species.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Invasive alien species and other	C4.0	Placeholder indicator: Measures against unintentional introduction of invasive alien species (IAS)[20]	Proportion of high-risk activities operated under appropriate measures to prevent unintentional introduction of IAS, or low-risk designed activities.	In reporting this core global placeholder metrics, an organisation should include: • Proportion (%) of sites where activities pose a risk of alien and/or invasive species introduction that have presence/absence assessments completed; and • Proportion (%) of sites where the presence of alien and/or invasive species has been identified and poses a risk to biodiversity that have eradication plans in place and that are on track to meet targets. Alien and/or invasive species are those defined as high priority by relevant local or global authorities, including the Global Register of Introduced and Invasive Species. For alien and/ or invasive species plans, these should include comparison to one or more reference sites.	TNFD

20 Due to the measurement of levels of invasive species for organisations being a developing area, the chosen indicator focuses on whether an appropriate management response is in place for the organisation. The additional sets of metrics contain measurement of the level of invasive species within an area. The TNFD intends to do further work with experts to define 'high-risk activities' and 'low-risk designed activities'.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
State of nature	C5.0	Placeholder indicator: Species extinction risk	For those organisations that choose to report on state of nature metrics, the TNFD encourages them to report the following indicators, and to refer to the TNFD additional guidance on measurement of the state of nature in Annex 2 of the LEAP approach: • Level of ecosystem condition by type of ecosystem and business activity; • Species extinction risk. There are a number of different measurement options for these indicators. The TNFD does not currently specify one metric as there is no single metric that will capture all relevant dimensions of changes to the state of nature and a consensus is still developing. The TNFD will continue to work with knowledge partners to increase alignment.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
State of nature	C5.0	Placeholder indicator: Ecosystem condition	For those organisations that choose to report on state of nature metrics, the TNFD encourages them to report the following indicators, and to refer to the TNFD additional guidance on measurement of the state of nature in Annex 2 of the LEAP approach: • Level of ecosystem condition by type of ecosystem and business activity; • Species extinction risk. There are a number of different measurement options for these indicators. The TNFD does not currently specify one metric as there is no single metric that will capture all relevant dimensions of changes to the state of nature and a consensus is still developing. The TNFD will continue to work with knowledge partners to increase alignment.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD Annex 2 of Guidance on the identification and assessment of nature-related Issues: The TNFD LEAP approach (2023)

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for this sector	Source
Climate change		GHG emissions	Refer to IFRS S2 Climate-related Disclosures	In reporting this core global disclosure metric, an organisation should refer to the ICMM Scope 3 Accounting and Reporting Guidance, which provides a standardised framework for the calculation and reporting of an organisation's Scope 3 emissions aligned with the GHG Protocol.	ICMM (2023) Scope 3 Emissions Accounting and Reporting Guidance

2 Core sector metrics 

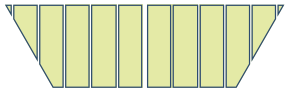
3.2. Core sector disclosure indicators and metrics

The TNFD core sector disclosure metrics for the metals and mining sector are outlined below. These metrics are recommended by the TNFD to be disclosed by all report preparers in the sector on a comply or explain basis.

Table 24: Core sector disclosure indicator and metrics

Metric category	Metric subcategory	Metric no.	Indicator	Sector metric	Source
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	MM.C23.0	Area of sites with plans in place to manage impacts on sensitive locations.	Area (km^2) and proportion (%) of land owned, leased, managed in or adjacent to, or potentially impacting on, sensitive locations. Area (km^2) and proportion (%) of land owned, leased, managed covered by plan to manage impacts on sensitive locations. Area (km^2) and proportion (%) of land owned, leased, managed covered by plan to manage impacts on sensitive locations that has been verified or approved by a third party.	Adapted from: GRI 101 Biodiversity (2024); TNFD

3 Additional metrics



3.3. Additional sector disclosure indicators and metrics

The TNFD additional sector disclosure metrics for the metals and mining sector are outlined below. The TNFD encourages all report preparers in the sector to draw on these and any other relevant metrics where relevant to best represent an organisation's material nature-related dependencies, impacts, risks and opportunities.

Table 25: Additional sector disclosure indicators and metrics

Metric category	Metric subcategory	Metric no.	Indicator	Sector metric	Source
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	MM.A23.0	Additional conservation and restoration activities	Total area (km^2) or species population (no. of individuals) covered by collaborative conservation or restoration initiatives supported by the company in the wider landscape (i.e. not on land owned, managed or leased or as part of actions required to achieve no net loss of biodiversity). Proportion (%) of the total area for which Free, Prior and Informed Consent (FPIC) protocols, and/or effective stakeholder engagement, and/or human rights due diligence, and/or agreement-making protocols are in place.	Adapted from GRI 101-2; CDP Biodiversity 11.18; ESRS S3-2
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	MM.A23.1	Circular economy	Quantification of the degree of circularity in the organisation's operations, such as: • The proportion of materials used in direct operations from recycled sources; • Proportion of waste that is recycled; or • The proportion of secondary metals recovered and resmelted.	Pace (2022) Corporate target-setting for the circular economy: Mobilizing measurable progress

Metric category	Metric subcategory	Metric no.	Indicator	Sector metric	Source
Response	Dependency, impact, risk and opportunity management: Dependency, impact, risk and opportunity assessment	MM.A25.0	Extent of site level ecosystem service assessments	Proportion (%) of priority sites that have conducted a site level ecosystem services assessment.	Adapted from GRI 101 Biodiversity 101-8; ESRS 2 IRO-1 (b)
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	MM.A23.2	Extent of transformative actions taken	Quantification of actions to catalyse broader industry change, such as: • Value of green finance instruments used, such as green bonds and sustainability-linked bonds split by nature related issue addressed; • Number of research initiatives/ technology development supporting nature positive outcomes engaged in/ volume of financial support provided to such initiatives; and • Number of species occurrence records shared with global/national data platforms or initiatives.	Adapted from TNFD based on ICMM (2024) Nature Position Statement Booth et al (2024) Operationalising transformative change for business in the context of nature positive – pre print
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	MM.A23.3	Impact management	Number and proportion (%) of mine sites that: • Have closure and rehabilitation plans in place; • Are undergoing closure and rehabilitation activities (rehabilitation is in progress); and • Have been closed and rehabilitated (i.e. post completion monitoring is in place). Note that these may not be mutually exclusive.	Adapted from: GRI 14: Mining Sector (2024)

Metric category	Metric subcategory	Metric no.	Indicator	Sector metric	Source
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	MM.A23.4	Suppliers screened for nature-related risks	Proportion (%) of tier 1 suppliers screened on nature-related issues. Proportion (%) of tier 1 suppliers screened that were identified as high priority using a transparent methodology, i.e. following TNFD's value chain guidance, by spend and/or volume.	Based on ICMM Nature Position Statement (2024); ESRS G1-2 (c)
Response	Strategy: capital allocation/ investment	MM.A21.0	Capital Allocation	Monetary value of financial provisions made by the organisation for the closure and rehabilitation, including environmental and socioeconomic post-closure monitoring and aftercare for priority locations, by financial instrument used to guarantee the adequate financial provision, and indicating whether the monetary value is discounted or undiscounted. The calculation of this metric should be in line with local regulations.	Adapted from GRI 12: Coal sector (2023); GRI 14: Mining Sector (2024)
Response	Strategy: policies commitments & targets	MM.A19.0	Water impacts and state of nature	Proportion (%) of priority locations with context-based water targets. Proportion (%) of priority locations with water management plans.	ICMM Water Reporting: Good practice guide (2nd Edition) ICMM (2017) Water Stewardship Position Statement

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