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Environmental Management in Mine Action

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Content

Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 References.....	1
3 Terms, definitions and abbreviations.....	1
4 General requirements.....	2
5 Environmental management.....	2
5.1 Environmental Policy.....	2
5.2 Understanding the environmental context.....	3
5.3 Identifying and assessing environmental aspects.....	3
5.4 Determining environmental protection and mitigation measures.....	4
5.5 Environmental Impact Assessment.....	4
5.6 Planning and tasking of mine action operations.....	4
5.7 Implementing operations.....	5
5.8 Monitoring of environmental aspects.....	5
5.9 Review and improvement.....	6
6 Responsibilities and obligations.....	6
6.1 NMAA's responsibilities.....	6
6.2 Mine action organisation's responsibilities.....	6
6.3 Donors and other stakeholders' responsibilities.....	7
Annex A (Normative) References.....	8
Annex B (Informative) International Treaties.....	9
Annex C (Informative) Guidance on protection and mitigation measures against adverse environmental impacts.....	10
Annex D (Informative) Guidelines for Environmental Impact Assessment (EIA).....	17
Annex E (Informative) Environmental management checklist.....	19
Amendment record.....	21

Foreword

International standards for humanitarian demining programmes were first proposed by working groups at an international technical conference in Denmark, in July 1996. Criteria were prescribed for all aspects of demining, standards were recommended and a new universal definition of 'clearance' was agreed. In late 1996, the principles proposed in Denmark were developed by an UN-led working group and the International Standards for Humanitarian Mine Clearance Operations were developed. A first edition was issued by the UN Mine Action Service (UNMAS) in March 1997.

The scope of these original standards has since been expanded to include the other components of mine action and to reflect changes to operational procedures, practices and norms. The standards were re-developed and renamed as International Mine Action Standards (IMAS) with the first edition produced in October 2001.

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS, therefore, is the office within the United Nations responsible for the development and maintenance of IMAS. IMAS are produced with the assistance of the Geneva International Centre for Humanitarian Demining.

The work of preparing, reviewing and revising IMAS is conducted by technical committees, with the support of international, governmental and non-governmental organisations. The latest version of each standard, together with information on the work of the technical committees, can be found at <http://www.mineactionstandards.org/>. Individual IMAS are reviewed at least every three years to reflect developing mine action norms and practices and to incorporate changes to international regulations and requirements.

Introduction

Effective management of environmental aspects of mine action operations is important from the perspectives of mine action operating organisations themselves, affected communities, national authorities, donors and the wider global community. Protection of the environment receives growing attention from national governments and international institutions, and is reflected in the increasingly rigorous demands associated with national legislation in many countries and the terms of international treaties. Mine action operations are entirely subject to applicable national environmental legislation and the terms of international treaties.¹

Mine action improves not only safety and security of population, but also opportunities for socio-economic development as its aims is to “reduce social, economic and environmental impact of mines, and ERW including unexploded submunitions.”² Mine action activities have a positive impact on environment, but this does not exclude potential to adversely impacts on the environment. It is thus important to prevent and mitigate possible adverse impacts through an appropriate environmental management that takes into account the specific activities conducted by a mine action organisation and the the context in which operations are conducted.

Environmental management is meant to strengthen mine action effectiveness and efficiency in achieving its aim. Shortcomings in environmental management in mine action can: reduce or prevent the results and outcomes expected to arise from mine action operations; lead to short and long term adverse impacts on land, water, soil and air and the communities living in the vicinity of mine action work sites; result in direct harm to people, damage to the environment and infrastructure; and give rise to legal action against mine action organisations and substantial claims for compensation. Adverse impacts on the environment can lead to associated negative social, economic and political impacts at local, regional and national levels. Environmental management therefore calls for holistic solutions which assess different impacts and an increased awareness towards environmental protection among all mine action organizations.

This standard sets a number of generic and minimum requirements for environmental management in the mine action sector. The standard do not enforce specific practical mitigation measures but is a framework giving the tools for the NMAA to define these. Annex C provide a list of some practical measures which may be used by the National Mine Action Authority (NMAA), Mine Action Centre (MAC) and mine action organisations. The standard reflects important elements of ISO 14001:2015 as well as of ISO 9001:2015, but does not adopt as comprehensive an approach as the ISO standards do. Organisations seeking to go beyond implementation of operations in compliance with this IMAS are encouraged to consider adoption of ISO 14001.

National authorities and mine action organisations have the responsibility to ensure that all mine action activities, falling under any of the 5 pillars of mine action, but especially Explosive Ordnance Disposal (EOD), survey and clearance as well as stockpile destruction operations, are carried out in accordance with applicable legislation, safely, effectively and efficiently, but also in a way that minimises any adverse impact on people, wildlife, vegetation and other aspects of the environment. Most concerns should be given to mechanical clearance and bulk demolition since these processes have the ability to severly impact the environment. The general aim on environmental management in mine action is to leave the environment in a state that is similar to, or where possible better than, before mine action operations commenced, and that permits the intended use of land once mine action operations have been completed.

¹ Annex B provides a list of international conventions.

² IMAS 4.10, para 3.176.

Mine action takes place in different contexts as it can be an emergency intervention during a conflict, be part of stabilisation operations in the immediate post-conflict phase or support longer term development after the end of the conflict. Environmental management should be adapted to these different contexts. In particular, when present, national authorities need to understand the cost-benefit implications of preventing and mitigating environmental adverse impacts based on the specific type of mine action operations conducted. NEMAS therefore need to be tailored according to the national conditions by developing mitigation measures and address how different mine action operations could impact the environment (eg. Clearance method or emergency clearance/development clearance).

Managing environmental aspects of mine action however need not be a burdensome task. There are many parallels with quality management (QM) and basic principles of risk management – the QM principles of the process approach, improvement, involvement of people and evidence-based decision-making are all wholly applicable to environmental management; they are described in further detail in IMAS 07.12 and 07.40. It is also important to note that one of the main, and most effective, ways of reducing the direct impact of mine action technical operations on land is through the application of land release (LR) principles (as per IMAS 07.11, 08.10 and 08.20) to minimise the number of square metres that are processed.

Environmental management in mine action

1 Scope

This standard details the minimum requirements for environmental management of all mine action operations on land and underwater including planning, protection and mitigation measures. These requirements shall be complied with to ensure that the environment is not degraded by mine action work and land is returned in a state that is similar to, or where possible better than, before mine action operations commenced, and that permits its intended use.

2 References

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

Note: Special attention shall be given to national legislation as requirements for protection of the environment are often embedded in the national policy and law. International treaties can provide additional requirements on how the environment shall be protected (See Annex B).

3 Terms, definitions and abbreviations

A complete glossary of all the terms, definitions and abbreviations used in the IMAS series of standards is given in IMAS 04.10.

In the IMAS series of standards, the words 'shall', 'should' and 'may' are used to indicate the intended degree of compliance. This use is consistent with the language used in ISO standards and guidelines:

- a) 'shall' is used to indicate requirements, methods or specifications that are to be applied in order to conform to the standard;
- b) 'should' is used to indicate the preferred requirements, methods or specifications; and
- c) 'may' is used to indicate a possible method or course of action.

The term 'National Mine Action Authority (NMAA)' refers to the government entity, often an inter-ministerial committee, in a mine-affected country charged with the responsibility for the regulation, management and coordination of mine action.

Note: In the absence of a NMAA, it may be necessary and appropriate for the UN, or some other recognised international body, to assume some or all of the responsibilities, and fulfil some or all the functions, of a MAC or, less frequently, an NMAA.

The term 'Mine Action Centre' (MAC) refers to an organisation that, on behalf of the NMAA where it exists, typically is responsible for planning, coordination, overseeing and in some cases implementation of mine action projects.

The term 'mine action organisation' refers to any organisation (government, military, commercial or NGO/civil society) responsible for implementing mine action projects or tasks. The mine action organisation may be a prime contractor, subcontractor, consultant or agent.

The term 'environment' refers to the "*surroundings in which an organization operates, air, water, land, natural resources, flora, fauna, humans and their interrelationships*" (ISO 14001:2015).

The term 'environmental aspect' refers to an "element of an *organization's* activities or products or services that interacts or can interact with the *environment*" (ISO 14001:2015).

The term 'environmental impact' refers to "change to the environment, whether adverse or beneficial, wholly or partially resulting from an *organization's environmental aspects*" (ISO 14001:2015). The term 'adverse impact' refers to any harmful effect imposed on the environment. The reference to requirements set by national legislation, if existing, and the intended future use of the cleared area are key factors for determining the adverse impacts.

The term 'environmental impact assessment' (EIA) refers to "*the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant environmental impacts of activities prior to and during operations*".

The term 'environmental mitigation measures' refers to actions taken before, during and/or after mine action operations to lower adverse environmental impact.

The term 'environmental management system' (EMS) refers to the "part of the *management system* used to manage *environmental aspects*, fulfil *compliance obligations* and address *risks and opportunities*" (ISO 14001:2015).

4 General requirements

Mine action operations shall be conducted in a manner that minimises the adverse impact on the environment and is safe for mine action staff and men, women and children.

Planning for mine action operations shall identify and assess relevant environmental aspects and determine appropriate and effective measures to mitigate adverse environmental impacts.

NMAA, MAC and operators shall take all reasonable measures to ensure that the environment in which mine action operations take place is left in a state whereby it is suitable for its intended use once mine action operations cease. NMAA shall define reasonable mitigation measures based on cost-benefit considerations of different methods and end products.

Particular attention shall be given to environmental conditions that are required for subsistence or economic purposes to ensure that these activities can continue after mine action operations have been completed.

Note: 'Environments in which mine action operations take place' include land used for administrative, logistic, training and/or support purposes.

5 Environmental management

Having an environmental management system is a requirement for NMAA and mine action organisations. It is the NMAA who has the responsibility to assess the impact on the environment and to establish mitigation measures reflecting the needs on a local and/or national scale. The operator has the responsibility to meet the needs, criteria and mitigation measures given by the NMAA and has an easily accessible and transparent quality management system documenting the procedures and non-conformities.

5.1 Environmental Policy

NMAA, MAC and operators shall establish, review and maintain an environmental policy that:

- Is appropriate to their specific activities;
- Includes a commitment to protect the environment;
- Includes a commitment to comply with applicable legal and other obligations;
- Includes a commitment to the continual improvement of their environmental management;
- Is communicated to relevant internal and external stakeholders; and
- Is reviewed and, where appropriate updated, at least annually.

The NMAA, MAC's and operator's senior management shall ensure that:

- Adequate resources are allocated to enable effective environmental management in accordance with the environmental policy;
- Staff members are adequately trained and have a clear understanding of their role in the protection of the environment;
- Management of environmental aspects is adequately incorporated into SOPs and other relevant documentation;
- Documentation relating to environmental management is openly and transparently available, including in additional languages where necessary to aid understanding, and is kept up to date; and
- Environmental management aspects of the mine action organisations' activities are monitored, reviewed and improved.

5.2 Understanding the environmental context

The NMAA shall:

- Identify and assess environmental obligations, relevant to the national mine action programme, contained in applicable national and international legislation;
- Understand the cost – benefit of environmental protection;
- Define and communicate environmental obligations in national mine action standards (NMAA) and normative references relevant for mine action work;
- Identify and liaise with other Government Ministries, Agencies and Departments relevant to environmental management in mine action;
- Coordinate with national/international stakeholders to support/improve environmental protection/mitigation measures, avoid duplication of effort and identify and address gaps in environmental management within the mine action programme.

The mine action organizations shall take all reasonable measures to understand the environmental needs and expectations of mine action stakeholders including women and men from local communities.

Understanding of the physical environment and the needs and expectations of mine action stakeholders shall inform the planning for, and establishing of, environmental protection and mitigation measures.

5.3 Identifying and assessing environmental aspects

As a minimum, the NMAA shall identify, assess and document environmental aspects of mine action activities, inputs, products and services arising from those activities, including:

- emissions to air;
- releases to water;
- releases to land;
- use of raw materials and natural resources;
- use of energy;
- emission of energy; and
- generation of waste.

NMAA shall identify those aspects that may give rise to an adverse environmental impact, including, as a minimum, the following potential environmental impacts:

- erosion and soil degradation;
- pollution of air, water and soil;
- disruption, disturbance or harm to local stakeholders and communities, infrastructure, wildlife and vegetation;
- litter, debris, residual waste and other degradation of the visible environment; and
- damage to heritage sites and objects.

When assessing the significance of environmental aspects NMAA should take into account the following criteria:

- the type of mine action activity;
- the size of the mine action operation;
- the frequency of mine action operations;
- relevant legal or standards requirements;
- the expectations of environmental stakeholders;
- the potential for one environmental aspect to lead to more than one adverse environmental impact; and
- the potential legal liability associated with impacts arising from environmental aspects.

Environmental aspects shall be documented in plans, SOPs and/or other records as appropriate.

The NMAA should assess and respond to opportunities to protect the environment indirectly through procurement or tasking, logistic, storage and waste disposal processes.

5.4 Determining environmental protection and mitigation measures

NMAA shall determine appropriate and effective mitigation measures in relation to environmental aspects assessed as bringing a significant risk of adverse environmental impact.

Environmental protection and mitigation measures shall be documented in task orders, operational plans, SOPs and other relevant documentation.

Environmental protection and mitigation measures shall include emergency response plans for potential critical/major environmental incidents.

5.5 Environmental Impact Assessment

Under some circumstances a formal Environmental Impact Assessment (EIA) may be appropriate or required. An EIA should be made whenever:

- mine action operations are expected to take place within, or close to, designated protected environmental areas, or other areas known to be environmentally sensitive;
- there is a legal or contractual obligation to do so;
- the NMAA determines that an EIA is necessary; and/or
- any other occasion when there is uncertainty about the scale or significance of environmental impact.

Guidelines on the conduct of an EIA are provided in Annex D.

5.6 Planning and tasking of mine action operations

When planning mine action operations NMAA shall take into consideration the guidelines in Annex C to this standard and consult with operators about the use of such guidelines.

Planning of mine action operations shall:

- be appropriate to the environmental context;
- take into account legal and other compliance obligations;
- take into account future intended land use;
- understand cost – benefits of possible mitigation measures;
- incorporate identified environmental mitigation measures, including any emergency response; and
- be consistent with the environmental policy.

Tasking and/or contracting of mine action operations shall include relevant environmental requirements. Environmental protection and mitigation measures should be a part of the task order, implementation plan, statement of work and/or other documentation detailing operational requirements for mine action work.

5.7 Implementing operations

NMAA, MAC and operators shall comply with the requirements of this IMAS and other standards that may be relevant in their operations, and refer to them in their SOPs. When implementing mine action operations NMAA shall take into consideration the guidelines in Annex C to this standard.

NMAA, MAC and operators shall designate a person responsible for environmental protection at mine action worksites. All mine action organizations shall ensure compliance with all environmental requirements through project, contract and operational management processes.

All mine action organisations shall promote knowledge, awareness and competence for protection of the environment of their staff through education and training. They shall ensure training for emergency preparedness and response in case of environmental incidents.

Mitigation measures shall be taken to prevent adverse environmental impacts and to prevent pollution and degradation of soil, air and waterways. In addition all reasonable effort shall be taken to prevent the adverse impact on wildlife and vegetation during mine action operations.

The destruction of mines and other ERW using open burning and open demolition (OBOD) techniques shall be carried out in accordance with IMAS 11.20, IATG 10.10, and shall include consideration of the aspects outlined in section C.4 of Annex C to this standard.

Human waste shall never be discharged into watercourses or onto the soil surface. NMAA, MAC and operators shall minimise the environmental impact of mine action operations and shall take all reasonable measures to remove waste from mine action work sites on completion of operations and prior to handover of released land. Rubbish removed from the site shall be disposed of at approved rubbish dumping sites. Any rubbish spilled during the removal process shall be cleaned up. Wastewater shall not to be released onto the ground surface or into watercourses.

The operation, repair, maintenance and servicing of mine action equipment shall be carried out in a manner that minimises the adverse impact on the environment and in accordance with the requirements of the EIA, management requirements and the NMAA.

Mine action operations may occur in locations where there are areas of cultural or historical significance. Where this occurs, NMAA, MAC and operators shall take all practicable steps to prevent damage to these sites.

All relevant environmental mitigation measures detailed in national standards, SOPs, task orders or otherwise documented, shall be fully and effectively implemented during mine action operations and shall be confirmed to be completed before land is handed over and/or the operator departs any mine action worksite.

5.8 Monitoring of environmental aspects

NMAA, MAC and operators shall implement a monitoring system in accordance with IMAS 07.40 and shall ensure that environmental requirements are included.

Environmental nonconformities shall be managed in accordance with IMAS 07.12 and 07.40. Environmental incidents and accidents should be treated as nonconformities and, additionally, investigated in accordance with IMAS 10.60.

Impact assessments/surveys undertaken after release of land should include assessment of environmental aspects including the effectiveness of any agreed environmental remediation measures.

5.9 Review and improvement

Management reviews, as per IMAS 07.12, should include environmental aspects and be conducted by the senior management of NMAA, MAC and operators to ensure the continued effectiveness, suitability and alignment of environmental management with the organization's environmental policy.

Management reviews should be conducted at least annually, or more frequently in light of prevailing circumstances and conditions. Management reviews should take into account:

- the status of actions arising from previous reviews;
- changes in the mine action environmental context;
- the environmental management performance of the mine action organization including:
 - satisfaction of stakeholders' environmental needs and expectations;
 - compliance with environmental policy;
 - environmental nonconformities and corrective actions;
 - environmental monitoring, measurement, audit and evaluation results.
- opportunities for improvement of environmental management.

Management reviews shall include decisions and actions related to:

- opportunities for improvement of environmental management;
- changes to environmental management;
- what action will be taken, who is responsible, schedule for completing and verification of effective implementation.

The results of management reviews shall be communicated to workers, managers and stakeholders.

6 Responsibilities and obligations

6.1 NMAA's responsibilities

The NMAA, or organisation acting on its behalf, shall:

- a) Document the environmental management in its policy, national mine action standards, contracts, tasking orders and other relevant publications;
- b) Monitor compliance with documented environmental management requirements;
- c) Ensure the implementation of an EIA if required as per article 5.5;
- d) Ensure that protection of the environment is taken into account during planning for mine action operations;
- e) Maintain records of reported environmental incidents;
- f) Where necessary, conduct investigations into environmental incidents; and
- g) Promulgate information about significant environmental aspects of mine action, including recommendations for best practices and details of environmental incidents to other stakeholders within the national mine action programme;
- h) Coordinate environmental protection with national and international stakeholders.

6.2 Mine action organisation's responsibilities

Mine action organisations shall:

- a) Establish, maintain and communicate an environmental policy that is consistent with the environmental policy established by the NMAA for the national mine action programme;
- b) Document their environmental management in SOPs or other relevant documents and ensure that all personnel are trained and aware of relevant environmental requirements;
- c) Ensure that the protection of the environment is a factor in the planning and conduct of all mine action operations;
- d) Maintain records of environmental nonconformities and incidents and manage nonconformity in accordance with IMAS 07.12 and IMAS 07.40; and

- e) Report any significant environmental incidents to the NMAA or organisation acting on its behalf.

In the absence of a NMAA or other authority, the mine action organisation shall assist the host nation in the development of national standards for the protection of the environment.

6.3 Donors and other stakeholders' responsibilities

- a) Donors shall understand environmental aspects of mine action and its potential impacts.
- b) Donors should promote awareness and understanding of the role of environmental protection and mitigation in improving the social and economic situation on a local, regional and national scale;
- c) Donors should emphasise the need to protect the environment among authorities and operators;
- d) Organizations active in the protection of the environment may contribute with resources to improve the awareness, understanding and implementation of environmental protection and mitigation measures;
- e) Stakeholders should be aware of the challenges of protecting the environment in mine action operations when developing tools or requirements.

Annex A (Normative) References

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this part of the standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid ISO or EN:

- a) IMAS 04.10 Glossary of mine action terms, definitions and abbreviations;
- b) IMAS 07.12 Quality Management in Mine Action
- c) IMAS 07.30 Accreditation of demining organisations and operations;
- d) IMAS 07.40 Monitoring of mine action organisations;
- e) IMAS 08.10 Non-Technical Survey;
- f) IMAS 08.20 Technical survey;
- g) IMAS 08.30 Post-clearance documentation;
- h) IMAS 10.50 S&OH - Storage, transportation and handling of explosives;
- i) IMAS 10.60 Reporting and investigation of demining incidents
- j) IMAS 11.10 Guide for the destruction of stockpiled anti-personnel mines;
- k) IMAS 11.20 Principles and procedures for open burning and open detonation operations
- l) IATG 10.10 Demilitarization and destruction of conventional ammunition
- m) TNMA 10.10 (Informative) Guidelines on the management of human remains located during mine action operations;
- n) TNMA 09.30.02 (Informative) Clearance of depleted Uranium (DU) hazards;.

The latest version/edition of these references should be used. GICHD hold copies of all references used in this standard. A register of the latest version/edition of the IMAS standards, guides and references is maintained by GICHD, and can be read on the IMAS website (<http://www.mineactionstandards.org/>). NMAA, employers and other interested bodies and organisations should obtain copies before commencing mine action programmes.

Annex B (Informative) International Treaties

The list below gives a number of important international treaties and agreements on the environment. The treaties and agreements encompass recommendations on how to protect the environment and offer a starting point to identify key organizations which can be important resources. The list is not comprehensive:

- a) Paris Pledge for Action, 2015;
- b) Sendai Framework for Disaster Risk Reduction 2015-2030, 2015;
- c) Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), 1998;
- d) United Nations Convention to Combat Desertification, 1994;
- e) Convention on Biological Diversity, 1993;
- f) Rio Declaration on Environment and Development, 1992;
- g) Convention on wetlands (or Ramsar convention), 1971;
- h) Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, February, 1972 and subsequent amendments;
- i) London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 29, December 1972 and subsequent amendments.

Annex C (Informative) Guidance on protection and mitigation measures against adverse environmental impacts

C.1 Introduction

A number of general recommendations from lessons learned provide further guidance for protection of the environment and mitigation measures against the main adverse environmental impacts associated with mine action. This Annex provides additional guidance on the nature of different impacts and mitigation measures that may be taken to reduce adverse impacts. This information is provided for guidance purposes and is not definitive or comprehensive. NMAA should assess each situation, using an EIA where appropriate, before determining appropriate mitigation and emergency response measures.

One of the primary methods by which direct impacts upon soil and vegetation are mitigated is through the effective implementation of land release principles and practice, as detailed in IMAS 07.11, 08.10 and 08.20.

C.2 Erosion and soil degradation

Soil erosion is caused by natural processes, which move, re-move or deposit sediment. The erosion can be initiated by human activities, which destabilise the top soil surface. The sediment on the surface is here by transported by wind, water, waves or slope instability.

Soil degradation occurs when the changes in the depth of soil or its physical or chemical properties reduce its quality. Soil degradation includes loss of the nutrient-rich topsoil through erosion, loss of organic matter, salinization, acidification and loss of structural stability.

Mitigation measures shall assure that survey and clearance operations do not lead to further erosion or soil degradation. If the area is already exposed to erosion, measures should aim to mitigate this effect. These measures may include:

- a) Minimising the area subject to direct intrusive technical investigation using manual or mechanical methods through well targeted survey and clearance operations;
- b) Re-seeding and re-planting (e.g. grass, trees, ground cover) as soon as possible after mine action operations or when appropriate;
- c) Construction of terracing as part of the site handover process, after consultation with local beneficiaries;
- d) Preparation of drainage systems;
- e) 3 to 4 meter-wide strips of vegetative cover across the site horizontal to the likely route of erosion;
- f) A schedule for technical survey and clearance operations that allows cultivating the site as soon as possible after such operations are completed;
- g) Scheduling mine action activities in a period, when the soil and vegetation is less vulnerable;
- h) Deep tracks or detonation craters can be filled to reduce erosion or left unfilled to be used as habitat for local wildlife;
- i) Return of processed soil to the affected site (e.g. soils that have been mechanically sifted, or gone through remediation, etc.);
- j) Soil is stored in areas where it is not subject to erosion, while it is processed;
- k) Top soil structures are not broken over large areas;
- l) Local communities are involved in the process of implementing mitigation measures;
- m) Technical survey and clearance take place at a time when the climate does not contribute further to erosion;
- n) The natural flow of watercourses is not permanently obstructed or diverted by mine action operations;
- o) If it is necessary to divert or dam a watercourse, the landowner or the local community is consulted and their agreement obtained before work commences;

- p) Routine community liaison about mechanical operations, including advice to property owners, local authorities and local communities about any possible damage to the environment. If necessary, advice to minimise damage should be given to property owners/controllers of land adjacent to mine action worksites.

C.3 Pollution of air, water and soil by toxics and hazardous chemicals

Consideration shall be given to the possible contamination of the surrounding area (including vegetation and wildlife) by fragmentation, toxic or hazardous substances and provision shall be made for eliminating or minimising any contamination and disturbance of humans, wildlife and vegetation.

Different chemical compounds from mines and ERW (including unexploded sub-munitions and improvised explosive devices (IEDs)) could dissolve and enter waterways, crystalize into new components in the soil or be incorporated into existing soils and minerals. Being planted on the surface of land or just beneath it, landmines (especially improvised types) most direct impact is on soil quality and composition. Soil can be affected by the casing, explosions or leaking of toxic substances as a consequence of corrosion or decomposition.

Consequences of the corrosion of fragments may include the release of various alloy elements such as iron, manganese, chromium, zinc, copper etc. start emerging. A number of toxic and hazardous elements may appear as a pollutant after utilization of high-explosive weapons. In agricultural regions, toxic elements can penetrate the human food chain. Therefore, as toxic elements penetrate the soil, processes of bioaccumulation can start and affect human health.

To mitigate these processes the following should be considered:

- a) Survey and clearance operations do not contribute significantly to an increase of toxic components in soil, waterways or air;
- b) If degradation and corrosion have already taken place, investigate the composition of explosives in order to assess potential adverse impacts on waterways, soils and vegetation and identify possible mitigation measures to limit such impact.

C.4 Pollution from disposal of mines, ERW and hazardous waste

Mines and ERW shall be disposed of in a manner that minimises adverse environmental impacts. If mines or ERW must be destroyed in situ and there is a risk to the environment (noise, ground shock, damage to infrastructure, etc.), protective works should be used. If, even with protective works, there is still a risk of adverse impacts to the environment, the NMAA, local authorities and men and women in the local stakeholders should be consulted about the operation.

- a) Demolition should take place at a designated place or the mine/ERW should be rendered safe. If it is unsafe to move, it shall be disposed where it is found.
- b) All parts of heavy metals and explosives should be removed so that they will not dissolve and end up in waterways.

Further, to avoid hazardous contamination of safe areas NMAA should:

- a) Prohibit the movement of mines and ERW from worksites unless this is part of a disposal or other authorised activity;
- b) Provide adequate security for any mines or ERW that have to be moved from a worksite until such time as the mines or ERW have been disposed of;
- c) Conduct thorough 'Free From Explosives' (FFE) and hazardous substance inspections of any packaging material moved from a worksite or any mines or ERW that are to be used for training aids; and
- d) Thoroughly check the ground within the assessed danger area surrounding mechanical clearance or disposal worksites to ensure that no mines or ERW have been 'thrown' into these areas.

If explosives contents are open to the environment, the explosives or their residues can contaminate soil and water and can have a substantial effect upon the environment. In addition, asbestos, chemicals and liquid propellants can be found in missiles and fusing systems. Chemical weapons, including chlorine and mustard gas munitions, and depleted uranium projectiles may also be encountered. The latter should be handled in accordance with the TNMA 09.30 02.

Other examples of toxic and hazardous waste include:

- a) Flammable substances, oily wastes, lubricants, fuel filters (FOL);
- b) Batteries; and
- c) Medical waste, old medicine, and other chemicals.

Any toxic or hazardous waste products of mine action operations shall be disposed of in accordance with the requirements of the NMAA.

Toxic waste products of mine action operations shall not be buried at the work site but collected and removed to an approved disposal area.

Information on international standards, regulations, codes of practice and other advisory publications concerning environmental considerations relating to landmine stockpile destruction operations, is included in IMAS 11.10. IATG 10.10 covers the demilitarization and destruction of conventional ammunition. IMAS 11.10 covers:

- a) Internationally accepted standards for the determination and measurement of air pollution from industrial processes; and
- b) Guidelines for the measurement and assessment of exposure to noise in a working environment, which could be applied to open detonation stockpile destruction operations.

C.5 Pollution from transportation of hazardous materials

During the transportation of any hazardous, toxic or flammable materials with the potential to damage the environment, precautions shall be taken to ensure that risk is minimised. These should include:

- a) All materials to be transported in containers that will minimise or prevent spills or leakage;
- b) Materials to be securely loaded in the transport;
- c) Fire precautions to be taken relevant to the materials being transported;
- d) Vehicles carrying hazardous material to be driven in a safe and careful manner; and
- e) Vehicles meet NMAA and or host nation regulations for the transportation of these materials.

IMAS 10.50 Storage, transportation and handling of explosives provides specifications and guidelines for the safe storage, transportation and handling of explosives used by mine action organisations. In addition and where applicable, the transport of hazardous material should be in accordance with international standards. (See normative references, Annex A)

C.6 Degradation of air quality

Mitigation measures shall be put in place when conducting technical survey and clearance operations that can have an adverse impact on air quality. In this case, mine action organisations should remain aware of the location of local communities, the prevailing wind conditions in the area and the ability of prevailing winds to carry smoke, dust and toxic fumes to local communities. Mine action organisations should ensure that the adverse impact on local communities of any degradation of air quality is minimised.

When degradation of air quality is likely to affect local communities, mine action organisations should liaise with local communities and authorities to explain the scope, scale, duration of any likely air degradation and any evacuation requirements.

When ground shock or noise is likely to affect local communities, measures should be taken to minimise these affects. These measures may include:

- a) Siting disposal areas well away from inhabited areas;
- b) Limiting the size of individual disposal serials;
- c) Using pits to suppress noise;
- d) Using protective works to limit the effects of ground shock and noise; and
- e) Restricting the conduct of disposal activities when certain meteorological conditions, for example low cloud, may increase the effects of noise.

C.7 Impact on wildlife and vegetation

C.7.1 Wildlife

Wildlife should not, so far as is reasonably practicable, be impacted by mine action operations. Exceptions may be made towards invasive species, which is not naturally occurring or have a negative influence on the surrounding local environment.

NMAA shall enquire how protected nature may be influenced by the survey and clearance operations and consider:

- a) Scare off actions should take place before demolition.
- b) Whether demolition pits should be filled in or left open after clearance/destruction, taking into account their potential value as habitats for some species, as well as any increased erosion risk they may present;
- c) Limiting mine action operations to specific hours of the day during breeding/nesting periods in order to not disturb wildlife; and
- d) Limiting the timing of detonations to influence wildlife the least.

C.7.2 Vegetation

Removal of vegetation and deforestation may be necessary to allow detectors/locators to get close enough to the soil so that detection and removal of mines and ERW can take place. This process may also be linked to erosion. Clearing of vegetation may have a beneficial impact, since it can remove invasive species and improve the conditions for natural occurring plants and trees. In contrast, it can remove trees, which create shade or act as wind barriers for crops or it can remove slow growing vegetation used by the local population. NMAA, MAC and operators should consider the following:

- a) Slow growing vegetation used by the local communities should if possible not be removed/cut during clearance;
- b) Vegetation that stabilizes the soil and prevents erosion should be left alone especially on steep slopes and along streams and irrigation channels;
- c) The removal of vegetation should take into account what the site will be used for after release (housing, grazing, agriculture or industry);
- d) The area may be subdivided into fields, leaving trees on boundaries. This will give shade and lead to decreased wind erosion;
- e) Clearing of vegetation may remove invasive species and improve the condition for natural occurring plants;
- f) If possible, turn over the wood to communities; and
- g) Introducing new crops that would grow better or adapt towards climate change.

C.8 Impacts from burning of vegetation

Burning of vegetation should generally be avoided. However, the condition of some vegetation is improved when burned. This should be identified before burning. When mine action organisations and relevant stakeholders agree that vegetation burning is to be carried out, the following procedures and control measures should be applied:

- a) Plans for burning vegetation should be discussed with and approved by the land owners/users, local authorities and local communities;
- b) Burning of vegetation should take place after wildlife scare off actions and not during breeding periods;

- c) Ensure that the land owners/users and local authorities are aware of the type of mines/ERW and their likely hazards (fragments, shocks, toxic, smoke etc.) in the event of burning vegetation;
- d) Burning should not to be carried out at night or continue into the night;
- e) No burning should be started unless there are sufficient personnel and firefighting equipment on site to control, and if necessary, stop the burning;
- f) Wind and moisture conditions should be considered before any burning operations;
- g) All personnel involved in the burn should be briefed on the burning plan, including any safety procedures;
- h) Consideration of the direction of the prevailing wind should be made when determining the direction of the burn; both as a means of controlling the burn and of minimising the effect of smoke and ash on local communities;
- i) Access areas should be available around the complete perimeter of the burn area for control purposes; and
- j) Burning should only be carried out towards natural firebreaks such as roads, tracks etc. However, if this is not possible and the perimeter of an area to be burned is vegetated, the vegetation should be dampened before the burn is started and personnel should be positioned there with firefighting equipment to control the burn.

C.9 Pollution from waste in worksite facilities

Protection of the environment should be considered during site selection and when planning the layout of worksites and temporary accommodation facilities.

The establishment and operation of worksites and temporary accommodation facilities should be carried out in a manner that minimises any contamination of the land or water systems (including ground water systems) and has minimal effect on flora and the natural habitats of wildlife.

Where applicable, temporary accommodation facilities should be located in consultation with men and women in the local communities to ensure that they do not adversely affect local conditions, economic activities or social and cultural values.

Temporary accommodation facilities should comply with all national or local regulations concerning the construction of temporary facilities.

C.9.1 Toilets

Human waste should never be discharged into watercourses or onto the soil surface.

Where possible, temporary toilets should be used on all mine action worksites and temporary accommodation facilities. Temporary toilets should be equipped with holding tanks that can be pumped to sewage trucks for disposal, or connected to septic tanks and safe drainage. Sex-segregated facilities should be made available taking into consideration the needs of both men and women.

Where latrines are used, there should be at least one for every 20 persons. They should be located at least 6m from any accommodation or food preparation area and 20m from any watercourses or wells.

All latrines should be constructed in such a way that they do not contaminate the surrounding water supply.

Shallow trench latrines (for a few days) should be a minimum of 30 x 75cm and 1.5m deep. Deep latrines (for a few months) should be a minimum of 2 - 2.75m deep. When filled in there should be at least 0.5m of earth cover over the toilet pit.

C.9.2 Domestic rubbish

Rubbish removed from the site should be disposed of at approved rubbish dumping sites. Any rubbish spilled during the removal process shall be cleaned up.

Rubbish should only be buried with the approval of the local communities/authorities and then in locations agreed to by them.

Rubbish pits should be located away from watercourses and wells, and be located and constructed so as not to contaminate groundwater. Pit bottoms should be at least 2m above the water table. Rubbish pits should be deep enough to allow 1m of earth cover over the rubbish when they are filled in.

Consideration should be given that no hazardous wastes, (e.g. petroleum products, hazardous metals, etc.) is buried.

C.9.3 Wastewater

Wastewater from washing, bathing or kitchen areas should be drained into soak pits large enough to take the amount of wastewater generated. Soak-away pits should be at least 75cm x 75cm and 1m deep.

C.10 Domestic water supply

The supply of domestic water should be carried out in a manner that does not affect the supply of water to the local communities; unless the local communities have been consulted on this matter and have agreed to any arrangements made.

C.11 Fuel, Oil and Lubricant (FOL) areas

The operation, repair, maintenance and servicing of mine action equipment should be carried out in a manner that minimises the adverse impact on the environment and in accordance with the requirements of the EIA, management requirements and the NMAA.

Mine action organisations should ensure that procedures are in place to contain and quickly clean up any spills of FOL. Contaminated materials containing spilled FOL should be collected and disposed of at controlled landfill. Alternatively, the material should be disposed of at a specific site approved by the NMAA, where the leakage to the soil is prevented.

Where it is necessary to establish fuel storage facilities, precautions should be taken to ensure that FOL is stored safely and does not contaminate the soil or groundwater. These precautions should include:

- a) No fuel storage facilities are positioned closer than 30m to a watercourse;
- b) All storage tanks, containers and fuel dispensing equipment are regularly maintained to ensure that there are no leaks; and
- c) Vehicle and equipment fuelling is undertaken on a hard surface or over drip pans to ensure that any spilled FOL is contained and disposed of in an environmentally acceptable manner.

C.12 Maintenance areas

When maintenance, repair or washing of vehicles, machines and equipment is required on worksites, specific areas should be designated for this activity. The environmental precautions to be taken include:

- a) Waste water shall not be released so that it will enter watercourses;
- b) Drained oil shall be contained using a drip pan or other suitable receptacle and disposed of in an environmentally acceptable manner; and
- c) Used parts, by-products of maintenance or other rubbish (except waste oils) shall be disposed of as for domestic rubbish.

C.13 On completion of mine action operations

On completion of mine action operations, all buildings, equipment, surplus materials, fencing (except the marking of not cleared hazardous areas) and other such items should be removed. Toilets, soak pits and rubbish pits should be filled in, covered with soil and the surface stabilised to prevent erosion and to allow natural regeneration of vegetation.

If local communities can re-use or find the use of any no longer required material or equipment, it should be handed over.

Site office and clearance areas should be cleaned up including removal of all material and equipment lying at the surface after clearance including the recovering and disposal of all large items of scrap. All disturbed areas should be restored to their original condition.

When EOD operations cease the area used should be refurbished in accordance with the requirements of the NMAA and in consultation with local authorities and communities. If required, land used for ammunition and explosive disposal by detonation operations may be formally handed over in accordance with the provisions of IMAS 08.30.

C.14 Risk to heritage

Where mine action operations take place in locations where there are areas of cultural or historical significance, mine action organisations should take all practicable steps to prevent damage to these sites.

Such action may dictate that any mines or ERW found at the worksite are removed to another area for destruction. If these items are unsafe to move and in situ demolitions are necessary, protective works should be used.

If any article is located during mine action operations and is suspected of being of cultural or historical significance, work in that area should cease and the matter be reported to the NMAA.

Where human remains are encountered during mine action operations, action in accordance with International Humanitarian Law should be followed. TNMA 10.10 provides additional guidance.

Annex D (Informative) Guidelines for Environmental Impact Assessment (EIA)

D.1 Use of an EIA

The EIA is instrumental in gaining knowledge of potential environmental impacts and making informed decisions about protection and mitigation measures. It also facilitates engagement with local communities and other stakeholders. The EIA is a comprehensive, formal process providing stakeholders with confidence that relevant environmental aspects have been fully identified, properly assessed and that effective mitigation measures have been determined. While a full EIA may only be used on occasions when the scale, value, duration or proximity of mine action operations to locations of known environmental sensitivity, justifies it, the same underlying principles are valid at every mine action work site. Mine action organisations are encouraged to familiarise themselves with the EIA approach and adopt appropriate principles and elements whenever it is appropriate to do so on any mine action work site.

D.2 For NMAA

The NMAA is responsible for ensuring the effective implementation of the EIA in order to provide operators with requirements and goals to protect the environment and mitigate adverse consequences. The checklist below gives the main points to which a NMAA should pay attention in fulfilling its responsibilities:

1. Preliminary work:
 - a. Identify policy documents and environmental legislation at a national and international level which can influence survey and clearance operations;
 - b. Conduct a desk study on environmental aspects of relevant SHAs and CHAs;
 - c. Identify requirements and goals for the protection of the environment and mitigation measures;
 - d. Identify local, national and international stakeholders concerned by mine and ERW clearance and environment;
 - e. Identify sources for additional capacity or funding about environmental issues.
2. Field work:
 - a. Identify and appoint the organisation implementing the EIA in the field (if it cannot be done by the NMAA or MAC because capacity is not available);
 - b. Contact local stakeholders and communities, including men and women from diverse groups, and enquire about their environmental concerns;
 - c. Identify point of contact (PoC) among stakeholders;
 - d. Complement the EIA with additional knowledge and information from local stakeholders;
 - e. Check the validity of the desk study's findings;
 - f. Check the validity of the proposed requirements and the feasibility of goals.
3. Tasking or tendering:
 - a. Policy and legal documents are available and accessible to those tasked to do the work or that are tendering;
 - b. Task order or tender includes specified requirements towards protection of the environment identified in the EIA;
 - c. Task order or tender documents include goals for the protection of the environment identified in the EIA;
 - d. Tender selection criteria include assessment of the extent to which tendering operators intends to fulfil the requirements and goals identified in the EIA;
 - e. Tendering/tasked operators submit an environmental protection and mitigation plan and other relevant documents (policy, SOPs);
 - f. The liability of the work concerning the environmental impact has to be an integrated part of the tasking or tendering;

4. Monitoring and evaluation during mine action operations:
 - a. Monitor compliance with requirements and progress to fulfil goals identified in the EIA;
 - b. Evaluation is made by considering requirements and goals identified in the EIA;
 - c. A debriefing and feedback on protection of the environment is provided to the operator;
 - d. Field assessment is made one year after completion in order to evaluate EIA requirements and goals.

5. Documentation:
 - a. Establish, maintain, secure and retain records of EIA findings, protection of the environment requirements and goals;
 - b. Establish, maintain, secure and retain records of environmental incidents;
 - c. Establish, maintain, secure and retain records of lessons learned and best practices;
 - d. Establish, maintain, secure and retain records of operators' documents (plan, policy, SOPs).

D.3 For operators

Operators have the responsibility to conduct operations according to the requirements and goals determined by the EIA. All stakeholders need to make sure that such requirements are understood, satisfied and documented. The checklist below provides the main points to which operators should pay attention to in fulfilling their responsibilities.

1. Tasking or tendering:
 - a. Requirements and goals for the protection of the environment in the tender/task order are based on a EIA;
 - b. Requirements and goals are understood and documented (policy, legislations, EIA findings), if not request explanation and documentation;
 - c. Make sure internal documentation on the protection of the environment is ready and available to the NMAA (policy, SOPs, plan);
 - d. Submit an environmental protection and mitigation plan showing how the organization will meet the requirements and fulfil the goals given in the EIA.

2. Planning:
 - a. Ensure that capacities for, and awareness of, protection of the environment match the requirements and goals identified in the EIA;
 - b. Make sure plans satisfy the requirements established in the EIA;
 - c. Provide feedback (lessons learned and best practices) to the NMAA on requirements and goals for protection of the environment.

3. Monitor and evaluation:
 - a. Requirements and goals identified by the EIA and included in the tender/contract/task order are integrated into the internal quality management system (QMS);
 - b. Appoint a PoC for implementation of requirements and goals for protection of the environment;
 - c. Include information relating to protection of the environment within reporting systems.

4. Documentation:
 - a. Establish, maintain, secure and retain records of policy and legislative documents provided by the NMAA;
 - b. Establish, maintain, secure and retain records of reports on the protection of the environment;
 - c. Establish, maintain, secure and retain records of lessons learned and best practices.

Annex E (Informative) Environmental management checklist

The following checklist can be used to assist managers and operational staff as a reminder or to confirm whether environmental aspects have been addressed or not when temporary facilities are occupied or used.

Note: When community leaders are only represented by men, or when women's participation in male dominated meetings is not meaningful, specific measures need to be taken to ensure women's representation in the consultation process. This could for example be enlarging the target audience for consultation by including representatives from women's organisations, traditional birth attendants, and/or midwives or holding separate consultations with women and men as a way of ensuring qualitative participation of both sexes.

E.1 Location

- Selected in consultation with local community leaders.
- Preference given to existing access roads and sites.
- Avoids agriculturally productive or environmentally sensitive areas.
- Ensures the safe: provision of drinking water, disposal of human excreta, wastewater and garbage; control of insects and rodents; conduct of food handling and preparation; and drainage of the site.
- Avoids vegetation clearing, or uses hand clearing if practical, and avoids soil disturbance or grubbing.
- Site is stable, well drained and, if necessary, have sufficient soil depth to permit the digging of latrines, wastewater soak-away pits, and garbage pits.

E.2 Water supply

- Arranged to avoid disrupting supplies to nearby land users/owners and communities.
- Supply is safe for human consumption.

E.3 Solid waste

- All areas are kept clear of litter and garbage.
- All personnel are instructed to properly dispose of food and other wastes.
- Solid waste containers are:
 - Large enough to contain all wastes generated between collection periods.
 - Sufficient to permit the separation of combustible and other waste.
 - Animal- and insect-proof, especially for rodents.
 - Designed to contain spilled liquids.
 - Regularly serviced.
- Waste is hauled away for recycling or disposal at approved dumping sites wherever possible. Any waste materials or litter deposited along access routes is cleaned up.
- Unavoidable on-site disposal:
 - Combustible solid wastes are regularly burned and disposed of in a pit. Ashes are covered with soil after each burning/deposition.
 - Other wastes are buried in a pit and covered daily.
 - All burial pits are located well away from watercourses such that contamination of any stream, lake or groundwater system is avoided. Pit bottoms are at least 2 m above the water table.
- Toxic or hazardous wastes are collected and removed to an approved disposal site.

E.4 Human waste

- Human waste is not discharged into watercourses or on the soil surface.
- Where possible, temporary toilets are used that are equipped with (1) holding tanks that can be pumped to sewage tanker trucks for disposal at an approved site, or (2) septic tanks and safe drainage.
- Where latrines must be used – sex-segregated facilities should be considered:
 - There is at least one for every 20 persons.

- They are at least 6 m from any accommodation or food preparation area, and at least 20 m from watercourses, wells or other drinking-water sources.
- Surface water should drain away from and not into pits.
- Shallow trench latrines (for a few days) are in the order of 30 cm by 75 cm by 1-1.5 m deep.
- Deep latrines (for a few months) are in the order of 2-2.75 m deep.
- They are limed regularly.

E.5 Wastewater

- Excess water from washing, bathing and kitchen areas is drained to soak-away pits unless the quantities are quite small.
- Wastewater is not permitted to enter watercourses or latrines.
- Soak-away pits are:
 - Of sufficient number and size to readily accommodate the volumes of wastewater generated, and at least 50 cm above the water table.
 - Covered with hessian or geotextile or similar material and secured around the edges, and lined with gravel and rocks.
 - Treated regularly with disinfectant.

E.6 Demobilization

- All temporary support facilities and camp infrastructure, including buildings, equipment, lumber, refuse, surplus materials, fencing and other such items are completely removed.
- Latrines, wastewater soak-away pits, and garbage disposal pits are filled and covered with soil, and the surface stabilised to prevent erosion and allow natural re-vegetation.
- Roadbeds, temporary culverts, buried water lines, etc. are removed and the sites similarly stabilised. If necessary, suitable substitute material is brought in to replace removed material.
- The original drainage pattern is re-established.
- As far as is practicable and desirable, all disturbed areas are restored to their original condition.

