NATO STANDARD

ATP-104

WATER PRODUCTION, STORAGE AND DISTRIBUTION

Edition B, Version 1
MONTH YEAR
RATIFICATION DRAFT 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED TACTICAL PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

INTENTIONALLY BLANK

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

[Date]

1. The enclosed Allied Tactical Publication ATP-104, Edition B, Version 1, WATER PRODUCTION, STORAGE AND DISTRIBUTION, which has been approved by the nations in the MILITARY COMMITTEE LAND STANDARDIZATION BOARD (MCLSB), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2629.

2. ATP-104, Edition B, Version 1, is effective upon receipt and supersedes ATP-104, Edition A, Version 1, which shall be destroyed in accordance with the local procedure for the destruction of documents.

3. This NATO standardization document is issued by NATO. In case of reproduction, NATO is to be acknowledged. NATO does not charge any fee for its standardization documents at any stage, which are not intended to be sold. They can be retrieved from the NATO Standardization Document Database ((https://nso.nato.int/nso/) or through your national standardization authorities.

4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

INTENTIONALLY BLANK

RESERVED FOR NATIONAL LETTER OF PROMULGATION

INTENTIONALLY BLANK

RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

INTENTIONALLY BLANK

RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

INTENTIONALLY BLANK

PREFACE

1. During NATO Operations water production is a national responsibility. However, the scarce resource of water production and distribution assets raises the necessity to consider creating, punctually, multinational capabilities for water production, storage and distribution and as a consequence the need for increased interoperability. This publication ATP-104 aims to provide a tool for planners from the strategic to the tactical levels and covers all aspects of water production. This document takes into account existing NATO doctrinal publications and STANAGs. This Publication does not supersede STANAG 2885 – Emergency Supply of Water in Operations, STANAG 2136, AMedP-4.9 – Requirements for Water Potability During Field Operations and in Emergency Situations, or STANAG 2582/AJEPP-2 – Environmental Protection Best Practices and Standards for Military Camps in NATO Operations. Check the NSO website www.nso.nato.int/nso/ for the most recent edition of the publications as mentioned above to ensure most current information.

INTENTIONALLY BLANK

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION 1-1
CHAPTER 2 WATER PLANNING 2-1
CHAPTER 3 WATER OPERATIONS ROLES AND RESPONSIBILITIES 3-1
CHAPTER 4 WATER SOURCE RECONNAISSANCE AND CHARACTERIZATION 4-1
CHAPTER 5 WATER PRODUCTION 5-1
CHAPTER 6 STORAGE AND DISTRIBUTION 6-1

ANNEX A WATER RISK ANALYSIS FLOWCHART A-1
ANNEX B ESTIMATED WATER QUANTITIES PER DAY FOR PLANNING B-1
ANNEX C QUALITY CONTROL REPORT C-1
ANNEX D WATER SITE RECCE REPORT D-1
ANNEX E SUGGESTED STANDARD WELL CAP FOR BOREHOLES E-1
ANNEX F SUGGESTED INFORMATION PLATE FOR WELL CAP F-1

REFERENCES AND RELATED DOCUMENTS REF-1

INTENTIONALLY BLANK

CHAPTER 1 INTRODUCTION

1.1 WATER OVERVIEW

1. Water is a vital resource for host nation's (HN) populations and deployed NATO Forces. Mismanagement of this resource has a significant impact on the short-term operational readiness of a force and long-lasting effects on the host nation's populations. Water is a significant operational requirement, and all planning and orders must be in accordance with STANAG 2582/AJEPP-2 concerning environmental protection best practices and standards for military camps in NATO operations. Commanders, NATO command organizations, ad hoc entities and troop contributing nations (TCNs), are responsible for integrating operational, military engineering (MILENG), logistics, force protection and force health protection (FHP) in all aspects of water planning, and management in their assigned mission area. The following factors must be considered:

a. Water planning;

b. Water reconnaissance and analysis;

c. Water category and water treatment approvals;

d. Water production; and

e. Storage and distribution.

1.2 Scope

This document is linked to other water relevant standards like STANAG 2885, STANAG 2136, and STANAG 2582. It is meant to be a singular source reference to assist commanders and planners in water operations and must be referred to when a nation is named the lead nation (LN) or role specialist nation (RSN) in any NATO multinational setting. This document also covers Tier 1 and 2 NATO camps in accordance with Bi-SC Directive 85-5 NATO Approved Criteria and Standards for Airfields as detailed in ATP-3-12-1 / STANAG 2394.

1.3 DEFINITIONS

Approved source for bottled water
An approved source for bottled water is a production plant that has been approved by the competent national military authority based on a performed audit (e.g. Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement), existing accepted certificates (ISO 22000, BRC, IFS, NSF) or information received by a partner nation based on STANAG 2556.

Approved source for packaged water
An approved source for packaged water is a production plant that has been approved by the competent national military authority based on the following criteria:

Initially performed audit with extended sampling; and

Production and distribution according to the HACCP principles; and

Existing monitoring plan of the source performed or controlled by a competent military authority assuring that the quality of the produced water is in compliance with the Long-Term Standards of ANNEX B of AMedP-4.9.

Black water
Black water is wastewater containing fecal matter and/or urine.

Bottled water
Bottled water is potable water that is sealed in plastic or glass bottles by commercial businesses and produced for human consumption.

Bulk water
Bulk water does not refer to a type of water but to the larger volume. Bulk water is transported/distributed by trucks, trailers, flexible tanks or containers.

Contaminated water
Water which contains disease-producing organisms, poisonous substances or NBC agents and is therefore unfit for human consumption.

Domestic water (see technical water)

Drinking water
Drinking water is potable water authorized for drinking consumption by JFC and/or DDH. Drinking water must also be palatable so personnel will be willing to drink it in adequate quantities.

Emergency potable water
Water that is from a medical point of view, safe to drink with respect to performance degradation during a maximum period of 7 days.
More about emergency potable water can be found in STANAG 2885.

Emergency water (see STANAG 2885)

Grey water
Water that is the leftover from baths, showers, kitchens and washing machines.

Hygienic water (see sanitary water)

Non-potable water
Water that is not safe to drink. In the operational environment, it is water from any source that has not been approved by the local medical authority for use as drinking water.

Packaged Field water
Water that is treated to make it potable and sealed in plastic pouches or bottles by military units or contracted services for ultimate distribution to individual personnel for drinking.

Palatable water
Palatable water is cool, aerated, significantly free from colour, turbidity, taste, and odour, and is generally pleasing to the senses. Palatable water is not necessarily potable and may contain disease- or illness-causing substances.

Polluted water
Water that contains substances such as garbage, sewage, industrial/agriculture waste or mud which makes it objectionable because of appearance, taste or odour.

Potable water
Water authorized for human consumption and therefore safe to drink by JFC and/or DDH. This water from a medical point of view, is suitable for drinking and can be used in the preparation of food and all other domestic uses, including personal hygiene. It does not contain chemical, microbiological, radiological or other contaminants in concentrations that may result in adverse health effects.

Raw water
Raw water is fresh, brackish or seawater, taken from the natural environment and that has not been previously used, treated, or purified. Raw water must be treated and/or disinfected prior to use as potable or sanitary water.

Remineralization
Restoring the depleted mineral content of water that results after it has been processed in a ROWPU or in other mineral filtration process. It is best to remineralize water after these types of treatment and before chlorination. For example, water too high in calcium and magnesium can causing scaling on equipment and pipes.

Sanitary water
Sanitary water is water temporarily authorized for personal hygiene by JFC and/or DDH.

Technical water
Water that is required for a variety of purposes such as firefighting, decontamination (other than human CBRN decontamination), washing or cooling of vehicles and machinery, as well as construction work. This water is generally not potable.

Water disinfection
Water treatment process in which pathogenic (disease producing) organisms are killed, destroyed or otherwise inactivated. Common methods of disinfecting drinking water include boiling, ultraviolet (UV) radiation, and various procedures using chlorine, chlorine dioxide, iodine, or ozone.

Water purification
Process used to remove suspended solids, undesirable chemicals and (micro)biological contaminants.

Water treatment
Process used to make the water acceptable for its intended use.

1.4 PLANNING REQUIREMENTS

1. While water production is a national responsibility, water planning is a deployed commander's responsibility and requires coordination and planning with HN and TCN. To plan effectively, commanders rely on their staffs to provide them with detailed requirements based on planning factors and estimates needed in each phase of the operation. Water management is an iterative process and a part of the overall operations risk assessments conducted by the planning team. Moreover, this planning has to encompass the water chain operations which consists of:

a. estimated the qualities and quantities of water needed for the operation;

b. identification of existing water infrastructure and natural resources that can be used by deployed formations and units;

c. environmental concerns; and

d. host nation's water regulations.

2. Also, water studies need to be performed by water experts before deployment to identify and characterize existing water resources (surface water, subterranean water, existing boreholes, water networks). The results of the water study help determine the type and quantity of water production units/equipments needed. Reconnaissance team/s need to verify the above-mentioned water planning information. Furthermore, units initially deployed can also participate in the information feedback to commanders.

1.5 WATER STUDIES

During the initial planning phases, all aspects of water operations must be considered from early deployment to the sustainment phase with the goal of minimizing any adverse effects. During the initial deployment, individual nations or a lead nation are responsible for producing water, but as the mission matures and with the completion of advanced water studies, the water production and distribution might become a multinational issue.

1.6 WATER RECONNAISSANCE

The initial water characterization studies are completed by a multidisciplinary reconnaissance team (for example military engineers, logisticians, security personnel, medical personnel, and hydrologists). These water characterization studies must follow the Environmental Baseline Study (EBS) AJEPP-6/STANAG 6500. The water characterization studies are used to create the water characterization report, which is completed by the reconnaissance team. When defining water categories reconnaissance teams should follow the flowchart found in Annex A. The reconnaissance team provides the characterization report to the Deputy Chief of Staff Support (DCOS support). These reports include:

- a risk assessment;
- the recommended water treatment and purification processes to mitigate identified risks in accordance with STANAG 2136;
- the definition of the protection perimeters of the assessed resource;
- the availability of the source of raw water and the operating pumping rate to preserve the resource while preserving needs of surrounding populations.

During operations, the water characterization studies and reports must be updated as often as necessary. Depending on the outcome of the water characterization study update, Subject Matter Experts (SMEs) may choose to define a new level of acceptable risk regarding water and submit it to the Commander.

1.7 WATER CATEGORY APPROVAL

Based on the characterization report drafted by the reconnaissance team and the advice of water experts, the commander decides the water category, the treatment and purification process, the protection perimeters and the maximum pumping rate.

1.8 WATER PRODUCTION

Water production starts with the extraction of raw water from surface, boreholes and/or water networks, this extracted water requires treatment in accordance with its intended use and composition. The point of extraction should be as close as possible to established camps to enhance security. Also before any water production can start a vulnerability risk assessment must be conducted to ensure the site can be secured. Furthermore, water production intended for human consumption must be in accordance with STANAG 2136, Requirements for Water Potability during Field Operations and in Emergency Situations. All material in contact with water must be suitable and sanitary to guarantee water quality.

1.9 STORAGE AND DISTRIBUTION

The type of water distribution should be chosen in accordance with the kind of camp (Tier 1, 2, 3 and 4). For more information on Tier 1 to 4 camps refer to Bi-SC Directive 85-5 NATO Approved Criteria and Standards for Airfields as detailed in ATP-3-12-1. Methods for the distribution of water are but not limited: portable/mobile tanks, tanks trucks, pipeline networks and bottled/packaged water. Whatever the configuration, the water distribution must adhere to the requirements in STANAG 2136 and 2582. Also, all material in contact with potable water must be suitable and sanitary to guarantee water quality. Possible long-term chemical reactions must be considered as well.

1.10 WATER CHAIN

1. The Commander needs to understand the water chain and needs to receive feedback on all aspects of water operations. This vital information is required for the commander to manage this critical resource and ensure water is continually provided to all TCNs. A major factor in the water chain is the maintenance of the water quality during the distribution process. The logistic (distribution) chain should always be as short as possible. See annex D – Water Quality Control Report. The chart below presents a basic water chain example in accordance with medical standards. Nations must agree to a common program of surveillance.

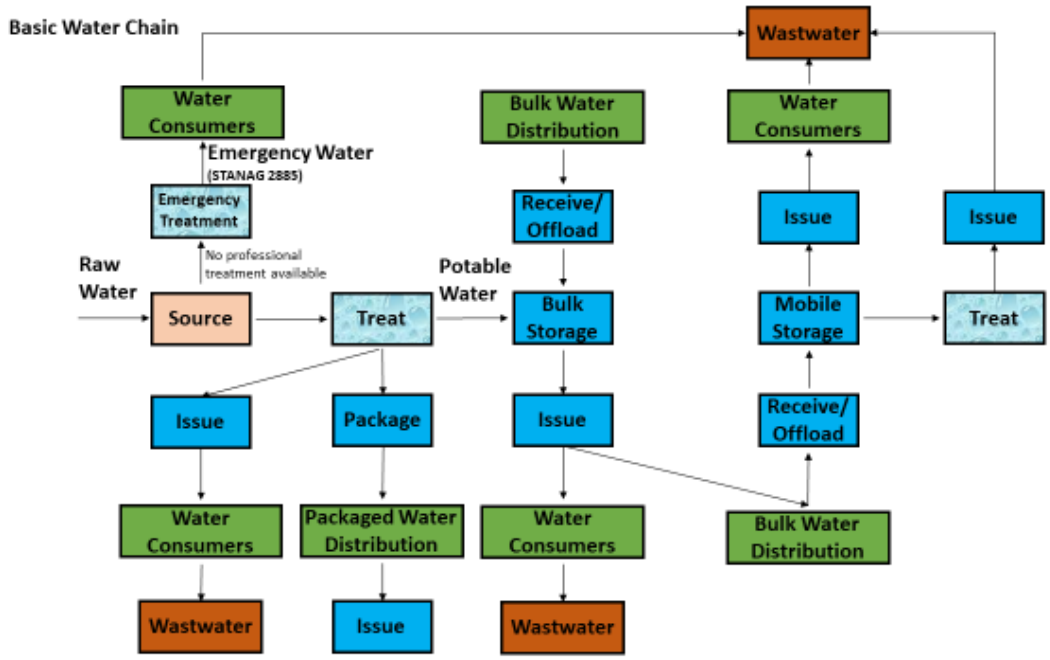


Figure 1.1: Water Chain Example

INTENTIONALLY BLANK

CHAPTER 2 WATER PLANNING

2.1 GENERAL

1. Water management is a command responsibility. MILENG, Logistics, Medical and Force Protection must be involved in all aspects of water planning to provide water during operations from the beginning to the end.

2. Based on the preliminary planning and the study of the operational area, water management will identify potential water sources. The studies will determine potential methods of providing potable water and other types of water for troops. These methods have to leave as few traces as possible while ensuring safe and sanitary water. A lack of water cannot compromise the operation, and the ratios in Annex B must be used to estimate the global volume needed. Finally, wastewater management must be integrated into any planning.

3. This preliminary planning should be updated by a reconnaissance mission, which validates the first hypothesis and provides commanders with an update on water planning and on the water characterization report. The reconnaissance team should identify the best water resource for fixed water points. Reconnaissance teams will characterize the level of vulnerability (natural, anthropic and operational threats), in order to determine a water treatment that will cover the risks identified to guarantee health and environmental protection. This study is called the risk management process and is in accordance with STANAG 2136.

2.2 PLANNING CONSIDERATIONS

1. Water SMEs' study of the Area of Operations (AOO) for water availability should include:

a. climatic data: Weather report can be collected to provide data about quantity of water (and variability linked with seasonality) which may be expected (water aquifer recharge, evaporation, flood risk of the water point);

b. maps can be collected to localize surface water sources (river, lake…) and, in addition with climatic data, determine the sustainability of water surface which could change depending on the season;

c. aerial photography (aircrafts, UFVs, satellite) studies can confirm map data and can be used to pre-identify potential polluting activities in the area. It can provide information about a communication network which can be used by logistic units;

d. geological maps and hydrogeological maps can be used to locate and possibly characterize ground water in the area considered to be the area of operation;

e. geological or hydrogeological studies from university or military services;

f. Environmental Baseline Studies (EBS) and environmental health site assessment (EHSA), previously perform by other nation in accordance with STANAG 6500; and

g. host nation water infrastructures, to include cultural implications, land access real estate and ownership, and an estimation of the use of water around the camp (to estimate if a lack of water could happen due to big quantities of water pumped for the camp).

2. Some additional planning considerations are as follows:

a. estimate water requirements across all phases of the operation and their possible evolution;

b. security requirements (to include but not limited to: force protection, safety, medical, environmental, etc.);

c. ensure reconnaissance team includes water experts;

3. Determine the distribution network to distribute potable water could include:

a. bottles from national companies;

b. bulk or bottles from NATO host nation;

c. bulk or bottles from host nation companies; or

d. from military treatment plant;

e. tank trucks.

4. Planning must include wastewater management, AJEPP-2/STANAG 2582 details responsibilities and best practices for wastewater management. Some considerations are:

a. a risk assessment should be conducted to determine options for the discharge of effluent created during water production. Options for effluent discharge are a wastewater treatment plant or discharge;

b. water sources downstream of the camp operations ;

c. direct discharge onto the ground or into a lake should be avoided;

d. wastewater-recycling, especially in regions with water shortage;

e. all necessary precautions need to be taken to ensure host nation environmental regulations are met;

f. A plan to minimize the water related logistic burden, including petroleum, oil, lubricants (POL) and power generation requirements;

g. CBRN (Chemical Biological Radiological and Nuclear) threat to include decontamination water requirements;

h. units will deploy with basic load of water; and

i. bottled water maybe the primary source for potable water during the initial phase of deployment and for drinking in general.

INTENTIONALLY BLANK

CHAPTER 3 WATER OPERATIONS ROLES AND RESPONSIBILITIES

3.1 ROLES AND RESPONSIBILITIES COMPONENTS

1. The fundamental act of production and distribution strategy for water that is intended for human consumption is safety and security of the potable water. Commanders should consider the following criteria to ensure proper control:

a. Operational context and Area of Operations (AOO);

b. The analysis of the hazards; and

c. Followed by an evaluation of the risks.

2. At the end of this evaluation, the logistic or technical means are implemented according to the availability of equipment and resources.

3.2 THE JOINT FORCE COMMANDER (JFC)

1. Following assessments by the Joint Force Engineer (JFEng), the Joint Force Medical Advisor (JFMed) and Joint Force Logistic Advisor (JFLog), the JFC and/or the Duty Delivery Holder (DDH) are the only approved military authority entitled to authorise the distribution of potable water. Water production and developments solutions are operational decisions and, within a multi-national framework, pre-arranged technical agreements will delineate the responsibilities.

2. The JFC is responsible for the sanitary security of water and establishing the water organization. The JFC is also responsible for environmental protection and should take into account the impact of the water chain (water production, treatment, storage, distribution, consumption and effluent discharge). In particular, treatment and effluent discharge must be controlled and managed.

3.3 THE DEPUTY CHIEF OF STAFF SUPPORT (DCOS)

1. DCOS is the coordinator of the water chain. The DCOS defines the role and responsibilities of each/formation/unit to control water quality, in particular for potable water. The DCOS relies on qualified experts to ensure that the water production, storage, and distribution hazard analysis is conducted in the following manner:

a. promptly, inform the sanitary control authority (DCOS) of an incident that could compromise the water quality, and could have a health impact on consumers;

b. setup remedial actions if water restrictions and dysfunction are in place;

c. ensure consumers are informed of any risks identified in the water chain; and

d. in case of decentralization water operations, ensure all water producers are aware of the technical specification and set up a safety and security inspections of decentralized water systems.

3.4 ENGINEERS, LOGISTIC SUPPORT AND CBRN DEFENCE FORCE

Water supply in general is a logistic task. However, depending on the national implementations, engineers, logistic support and/or CBRN force or a combination of them can be involved in the technical realization of the water supply chain. Independent which kind of troops are assigned for water supply, the following activities must be fulfilled:

RECONNAISSANCE

1. In the reconnaissance of water resources, it is of importance to determine the quantity and quality of the water available, as well as the effort required for development, extraction and treatment at the water points. In principle, all surface water resources in a contaminated area are suspicious.

2. Information on the following points is required for all water resources:

a. The type of water resource with map reference and sketch.

b. The amount of water available.

c. The quality as determined by chemical, physical and microbiological examination.

d. Origin of the water with special consideration as to possible pollution.

e. Existing facilities for extraction, storage and distribution.

f. In the case of springs, streams and rivers, information as to the feasibility of impounding water by construction of dams or infiltration trenches is required.

g. Road access to the designated water point and dispersal areas for vehicles.

3. To the extent possible, this information shall be assembled in peacetime by the regionally responsible commands of the host nation and kept ready for the time it is needed.

ACCEPTABILITY

4. The establishment of the acceptability may only be effected by a medical officer (physician veterinary office (N0)) after chemical, microbiological and radiological examination of the water eligible as potable water. Purified water is to be re-examined prior to making it available.

DEVELOPMENT/EXTRACTION

5. Equipment for the Development and Extraction of Water Sources. Drilling equipment as well as pumps and filters are required for the development and extraction of sub-surface water. As a rule, the extraction of surface water requires less effort.

6. Wells. Wells drilled by field units are to be closed in accordance with Annex E 1 and marked in accordance with Annex F.

TREATMENT

7. Purification is required when the quality of the available raw water does not meet the minimum requirements laid down in STANAG 2136.

8. Depending on the equipment available polluted raw water can be purified and converted into potable water in the field by different procedures (boiling, chlorination, sedimentation, coagulation, filtration, reverse osmosis filtration, distillation and treatment with activated charcoal).

a. Sedimentation. Sedimentation results by leaving water standing quietly for a few hours in a tank or container with the suspended matter sinking to the bottom. The process of sedimentation can be accelerated by adding coagulants. Nevertheless, it is a lengthy process that should be applied in case of serious impurities.

b. Coagulation. By adding coagulants to the raw water, impurities of colloidal magnitude can be converted into bigger, more easily subsiding or more easily filterable particles. The colloidal organic impurities especially, which are otherwise difficult to remove, can be eliminated. Moreover, the coagulation contributes to the removal of micro- organisms and viruses.

c. Filtration. With most filter devices the raw water is massed through fine-meshed sieve membranes coated with filter powder by means of a pump.

If the raw water contains much suspended matter, it is useful to arrange for a certain sedimentation prior to filtering since otherwise the filters clog too fast. Depending on the quality, the material, the thickness and the pore size of the filter membrane different levels of filtration can be reached. Reverse osmosis is a special kind of filtration where the osmosis effect of the membrane is revered by high performance pumps, which provide a higher pressure than the natural osmosis pressure. The following table shows different kinds of filtration and its expectable results.

	Reverse osmosis	**Nanofiltration**	**Ultrafiltration**	**Microfiltration**
Membrane	Asymmetrical	Asymmetrical	Asymmetrical	Symmetrical
				Asymmetrical
Thickness	150 µm	150 µm	150–250 µm	10–150 µm
Thin film	1 µm	1 µm	1 µm	
Pore size	<0.002 µm	<0.002 µm	0.2–0.02 µm	4–0.02 µm
Rejection of	HMWC, LMWC	HMWC	Macromolecules,	Particles
	Sodium chloride	Mono-, di- and oligosaccharides	Proteins,	Clay
	Glucose	Polyvalent neg. ions	Polysaccharides	Bacteria
	Amino acids		Vira	
Membrane material(s)	CA	CA	Ceramic	Ceramic
	Thin film	Thin film	PSO, PVDF, CA	PP, PSO, PVDF
			Thin film	
Membrane module	Tubular,	Tubular,	Tubular,	Tubular,
	Spiral wound,	Spiral wound,	Hollow fiber	Hollow fiber
	Plate-and-frame	Plate-and-frame	Spiral wound,	
			Plate-and-frame	
Operating pressure	15–150 bar	5–35 bar	1–10 bar	<2 bar

d. Chlorination. Most of the micro-organisms are killed or inactivated by adding chlorine or compounds releasing chlorine to the raw water. Under normal climatic conditions a time of reaction or contact time of 15 minutes is sufficient; in very cold water 30 minutes is required. In order to ensure optimum potability 2 mg/1 (2 ppm) of free chlorine should not be exceeded in the water at the filling taps. A chlorination or super-chlorination causes on the one hand, the chemical removal of numerous noxious chemical substances, and on the other hand, the development of other noxious substances, such as chlorophenol.

11. Treatment with Activated Charcoal. A series of noxious substances can be eliminated or reduced by bringing raw water into contact with activated charcoal or similarly adsorptive substances.

STORAGE

12. Units in the field carry only a limited supply of water. In some armies, units may hold a reserve of 5 days supply.

13. Non-potable water must not be stored or transported in potable water containers.

14. In contaminated areas, only water from closed containers is usable provided the outside of the container is decontaminated before use. Some plastic containers do not offer any effective protection against liquid chemical agents.

15. The filler necks of all potable water containers will be marked with white paint. In addition, each nation may add some national identification. Containers not used for potable water remain unmarked.

DISTRIBUTION

16. Water for emergency supply is collected from water points normally established in the rear areas - possibly in the vicinity of logistic facilities. The number of water points depends on the deployment of troops to be supplied and the available water sources.

17. As a rule, units should not have to cover more than 30 km to collect water.

18. The water is purified at the water point as required and – if possible – stored in covered tanks.

3.5 ROLE SPECIALIST NATION

1. One nation assumes the responsibility for providing or procuring a specific capability and service for all or a part of the multinational force within a geographical area for the defined period. The water production site should have an RSN, which will provide instructions to supporting nations. The RSN is also responsible: to report to the lead nation on the accountability and operational capabilities daily and for the quality of water at the point of production. Additionally, supporting nations could report and provide to the lead nation upon request:

a. analytical results of produced water from each producing nation

b. total production;

c. consumables status;

d. any purification systems outages due to equipment failure or if water parameters are exceeded;

e. potable water on hand;

f. date produced by storage tank (mobile tanks not connected to circulation loop);

g. the amount issued with date and recipient;

h. all network modifications need to have an RSN authorization;

i. all personnel within the water treatment and storage facility are secure from contamination. Periodic surveillance should be conducted around the source, treatment complex and potable water storage tanks.

3.6 MEDICAL SERVICE

1. The Medical Service is responsible for authorizing the release of the water intended for human consumption. This release is carried out under the responsibility of the medical adviser of the JFC. The Medical Service ensures potable water sanitary control, provides expertise and advises on the restriction of use. Additionally, the Medical Services conduct the following critical evaluation of natural and bottled water sources:

a. provide raw water analysis in accordance with AMedP-4.9 – Annex B – Test A/STANAG 2136 to ensure it is not contaminated and to complete the risk analysis (annex A);

b. identify a certified and authorized local vendor for the procurement of bottle and/or bulk water;

c. identify a certified and authorized laboratory for primary or reserve for water testing, in accordance with relevant testing procedures, during the water production and development processes.

3.7 FORCE PROTECTION

This paragraph deal with only physical protection of water production. For more information refer to AJP-3.14/STANAG 2528. Force protection ensures that the location of water production sites all have the appropriate security measures available. It also provides an assessment of the local threat. Force Protection personnel will work with Engineers and Logisticians also complete a survey of the road networks to ensure transportation of the water can be delivered to the user.

3.8 CENTRALIZED AND DECENTRALIZED WATER PRODUCTION

The first phase of an operation may be a rapidly evolving situation, during this time it is advisable to implement a centralized and mobile means of water production. When the situation is stabilized, a decentralized water chain can be employed. Due to the diversity of local conditions, a “standard water-purification-plant” for all operations cannot be defined

3.9 COORDINATION BETWEEN NATIONS

Coordination between nations is essential during multinational military operations. The responsibility of water supply could be attributed to a specific nation RSN. The lead nation should coordinate and control the capabilities offered by different nations. In this case, the lead nation should take all necessary actions to deliver a standardized quality.

3.10 PROTECTION AND MONITORING OF WATER PRODUCTION AREAS (INCLUDING EXTRACTION, TREATMENT AND STORAGE)

The water extraction and purification installations, as well as the distribution net, should ideally be integrated inside a military installation (and thus be continually safeguarded). For this reason, depending on the tactical situation, it might be necessary to deploy forces for the protection of military water supply installations. Any well used for the production and supply of water to NATO personnel must be periodically and routinely monitored to ensure serviceability of the well and its associated production equipment

(e.g. pump, casing, controls, etc.).The integrity and condition of a well are subject to a number of adverse factors that require monitoring to ensure a sustainable supply of water from the source. Information on frequency of well inspections and servicing should be sought from the operations nations' water specialists, in conjunction with the medical services.

3.11 DISINFECTION TESTING FREQUENCIES

Military and contractor water treatment system operators, water delivery personnel, trained unit personnel, and medical personnel, as appropriate, should measure chlorine residuals, turbidity, pH and conductivity at the specified times and frequencies, depending on the location and function of the water supply. In addition, the water should be visually evaluated and tasted. The measurement times and results should be recorded, reported in accordance with unit and command policy, and be made available for inspecting and assessing by medical personnel.

Measurement Points	Frequency Requirements
Potable water purification points or as directed from the RSN	Operators required to measure and record the chlorine residual, turbidity, pH and conductivity at a minimum three times daily (during high demands) and maximum every hour during production operations
Bulk potable water distribution points	At times of receipt and bulk loading for further bulk transport or distribution
Non-potable shower and personal sanitation water treatment/chlorination points	At least twice daily or every hour during high demand. Also at the time of bulk loading for transport and point of delivery.
Field shower and personal sanitation water storage points	At the time of delivery/receipt and at least two additional times daily (recommend prior to periods of high use)
Potable water trailers or tank trucks	Measure chlorine residuals and conductivity at least twice daily
Food preparation areas	Food service personnel should measure chlorine residuals in their water supply prior to beginning food preparations for each meal, provided holding of appropriate devices.

Table 3.1 – Disinfection testing frequencies

CHAPTER 4 WATER SOURCE RECONNAISSANCE AND CHARACTERIZATION

4.1 GENERAL

1. Commanders are responsible for tasking SMEs to perform a water source reconnaissance and characterization, before the deployment of a NATO operation or exercise. Information needed for the water source characterization can be obtained from planning studies and Environmental Baseline Studies (EBS) as per STANAG 6500. If the EBS has not been conducted yet, the information of the water source characterization can be used in support of the EBS development.

2. Reconnaissance and water characterization members are generally engineers and medical personnel. This team can be augmented with the designated EP officer. Planners will ensure they have listed the capabilities of each TCN.

4.2 WATER SOURCE CHARACTERIZATION STUDY AND WATER TREATMENT PROPOSAL

1. This water source characterization study aims to identify, water source vulnerabilities, evaluation of the quantity and quality of the water, and to propose treatment options to provide potable water, and any other types of water needed by the deployed force. The release of water for consumption can be pronounced only after the water sources characterization study has been completed. The water characterization study includes.

a. **Survey of water sources.** The water reconnaissance team should complete a hydrological and hydrogeological survey of the area (existing supply networks, sub surface configuration, retention of water and natural filtration quality, groundwater recharge systems, direction of subsurface water flow, pollution risks, impacts of the use of water sources on/by the local population, etc.), road networks and logistical infrastructure.

b. **Gather environmental data.** The water reconnaissance team should gather environmental data (presence of sources of pollution in the catchment recharge area, local water network infrastructure, etc.) and determine the chemical and microbiological water resource vulnerability depending on the type of soil or watershed or other environmental features.

c. **Medical Staff survey.** Qualified medical staff need to perform a thorough assessment including analytical survey of potential sources of water. For more information, see (test A – Annex B – STANAG 2136/AMedP4.9). For groundwater, hydraulic pumping parameters (flow, dynamic level, turbidity) need to be stable before performing the analysis.

4.3 WATER SOURCE RISK LEVEL CLASSIFICATION

1. Depending on Engineering report containing risk analysis, security report and result of raw water analysis, three water resource categories are defined as described below and in the flowchart in Annex A.

a. **Water resource type 1:** Brackish water, sea water or water which does not meet, at least, one of the parameters of the STANAG 2136 (AMed-4.9, refer to Annex B, test A); or when wastewater a risk analysis, conducted by an appropriate and competent team, has identified vulnerability of the source (e.g. visible evidence of contamination such as dead fish, rotting vegetation, oil film/sheen, floating or submerged garbage, industrial discharge, sabotage or poor geological protection).

b. **Water resource type 2:** Results of raw water analysis identify that the source complies with all chemical parameters of STANAG 2136 (AMed-4.9, Annex B, test A), but does not comply bacteriologically. The risk analysis identifies a low water resource vulnerability.

c. **Water resource type 3:** Results of raw water analysis identify that the source complies fully with chemical and bacteriological parameters of STANAG 2136 (AMed-4.9, Annex B, test A). The risk analysis identifies a low water resource vulnerability.

4.4 HOST NATION MUNICIPAL WATER SYSTEM AS A SOURCE

1. Where a host nation municipal water system is identified as a potential water source for deployed forces, it must be considered as a raw water source until it has been characterized by reconnaissance team as any other water resource; even though there may be what appears to be an adequate water treatment system in place. All infrastructures of the HN municipal water system should be evaluated and the vulnerability assessment report should provide a conclusion for each segment of the water system, including the source in order to establish if there is a risk of pollution.

2. Water network and chemical products used for treatment and disinfection should be evaluated. The potential risk for accidental or intentional contamination of the water system by hostile individuals or groups should be considered, and the results should be recorded in the vulnerability assessment report.

3. Water coming from host nation municipal should be considered as a vulnerable resource because military forces cannot control each segment of the water chain and therefore cannot prevent acts of sabotage.

4. Medical personnel will request a sanitary survey of the identified municipal source, treatment, and distribution system, and test the water at the point designated as the source for the force water system.

5. The reconnaissance team should, if possible, assess the technical performance and the overall condition of the municipal treatment and distribution system to be used as the water source, and conduct as thorough an analysis and assessment as the tactical mission will allow. The potential for accidental or intentional contamination of the water system by hostile individuals or groups should be considered, and the results should be recorded in the vulnerability assessment report.

6. Whatever the results of the risk assessment included in the water characterization report, host municipal water used during a military operation should be considered vulnerable because of risk of sabotage.

4.5 CHARACTERIZATION DECISION

1. DCOS Support examines the water risk level proposal and the treatment associated and ensures the treatment is in place or treatment proposal is in accordance with the water risk analysis flowchart.

INTENTIONALLY BLANK

CHAPTER 5 WATER PRODUCTION

5.1 GENERAL

Water production covers raw water extraction and treatment for potable water. This chapter gives principles and information on how to manage water production during an operation also proposes a document to evaluate the quality of water sources available.

5.2 WELL DRILLING

1. Well drilling, borehole drilling, or “drilling” is the process of drilling a hole in the ground for the extraction of a natural resource to access groundwater in underground aquifers. Several factors affect drill bit selection and the method of drilling. Information from an adjacent well is most often used to make the appropriate choice. The knowledge of local geology can also be critical. A major factor in drill selection is the type of formation to be drilled.

2. Water from underground source is drawn by pump to the surface by mechanical process. In-depth analysis of source water cannot be obtained until water has been extracted from the well. Water treatment methods cannot be determined until extraction and testing has been accomplished. A sustainable supply of water can only be ascertained once yield testing of the source has been undertaken. All material in contact with water must be suitable and sanitary to guarantee water quality.

3. The personnel directly involved in the mechanical drilling must be trained, have the technical knowledge, skills and experience necessary for the proper execution of the work. Well drilling personnel should :

a. obtain HN approval for drilling and compliance with regulations;

b. conduct a hydrological and geological assessment of the area to determine a preferred drilling location;

c. produce a detailed borehole design;

d. ensure sufficient equipment/materials available for the drilling task;

e. account for support equipment needed. (example: generators, compressors);

f. provide analytical testing of the source and undertake water quality testing to inform future treatment requirements;

g. when necessary, ensure contractor oversight to verify compliance with applicable regulations;

h. provide well head protection (raised concrete seal, locked access);

i. provide security (fence around Borehole);

j. provide capability parameters for borehole operations (static level, dynamic, flow, conductivity, turbidity, PH, etc.);

k. ensure all disused boreholes are properly de-commissioned, adequately back-filled, sealed, capped and secured to prevent contamination and collapse;

l. conduct an environmental impact assessment if the nature of the drilling procedure or extraction from the source is likely to have impact on any environmental aspects.

5.3 WELL DRILLING PROTECTION MEASURES

Priority should be given to conducting well drilling inside a military camp. If not possible, passive (fence) and/or active (force protection) protection are highly recommended. Furthermore, well head protection should be established to prohibit all activity close to the well, and security perimeter should be implemented where actions may affect the well based on the vulnerability assessment report.

5.4 SURFACE WATER

Surface water includes all standing or flowing bodies of surface water, springs, and unused wells as well as water sources in solid form such as ice and snow. Sea and brackish water may only be used for the supply of potable water in particular cases, but it is always suited for fighting fires and decontamination (of vehicles, equipment, ground surfaces, etc.). Since, as a rule, raw water from surface water must be purified, this supply option is subject to restrictions. Public swimming pools may also be useful as a source of already chlorinated water for use in decontamination. For more information, see STANAG 2885.

5.5 PURIFICATION

1. Water Purification is the process to remove suspended solids, unwanted chemicals and (micro) biological contaminants. For more information, see STANAG 2136. Purification is required when the quality of the available raw water does not meet the minimum requirements referenced in STANAG 2136. The type of

treatment process that will be used will be determined from the results of the characterization study and analysis flowchart, which can be found in Annex A.

2. If a decision is made to purify the water with a Reverse Osmosis Water Purification Unit (ROWPU), particularly for type 1 water, a complementary analysis should be conducted to check if pollution can damage the ROWPU. Minimum performance standards for ROWPU and maximum pollution levels of the raw water must be identified.

3. When multiple water purification units must be used to meet the water requirements of a deployed force, the individual units/nations can be consolidated into water purification plants to collect into a single storage point. In low threat areas, where an enemy attack is unlikely, one central water plant is most efficient. Less human resources and logistic support are required to operate one facility than two separate units that produce an equal amount of treated water. Where an enemy attack is likely, multiple water plants should be established to enhance survivability. The number of water plants should cover water demand with the ability to expand for future operations.

a. all efforts should be taken to have single raw water pumping system for all nations to use as their source.

b. to prevent contamination of product water system, do not use hoses intended for potable water in the raw water system.

INTENTIONALLY BLANK

CHAPTER 6 STORAGE AND DISTRIBUTION

6.1 STORAGE

1. A camp should have the capacity to store a minimum of one-day supply during initial camp establishment and up to a five-day supply of water during full operations. The storage capacity should consist of potable water and untreated water based on the climate and use of water. Refer to Annex B for total amounts per day. At bases using multiple purification plants, the storage capacity should be as evenly split as possible between the plants.

2. Packaged water storage should be compliant with the manufacture's storage instructions and expiration dates unless cleared medically. This packaged water should be stored away from extreme weather with a sunshade to protect against the sun.

3. All potable water should only be stored and distributed in containers and vehicles that have been cleaned, inspected and approved for use by the local medical authority. See AMedP-4.9/STANAG 2136. All tanks should be cleaned at least once per year but frequency can be determined by local conditions. The water used to clean tanks must be potable water and after rinsing the tanks should be disposed of in accordance with the established wastewater management plan.

4. Storage tanks used for potable water need to be appropriately marked, see STANAG 2885. It is recommended that waste or brine water storage should not be located in the same immediate area where the potable water is stored.

5. Prevention of contamination of water within the treatment and storage facilities is the responsibility of all personnel within or responsible for those facilities. Periodic surveillance should be conducted around the source, treatment facility and potable water storage tanks.

6.2 DISTRIBUTION

1. Water distribution consists of two main methods of delivery. The first is through a system of piping or hoses that will be directly feed to points of use and strategically placed fill stations. This type of system should be designed and constructed in a loop back to the main storage facility. This loop design will ensure constant residual disinfection with the circulation of potable water. Also, the distribution loop should be monitored for usage to prevent water loss and the hoses should be protected from potential malicious acts. The second method is the delivery of water to points of use by truck. Using this method requires additional personnel and vehicles but is necessary when the water production site is dislocated from main operations/points of use. An additional option of delivery is the use of bottled/packaged water.

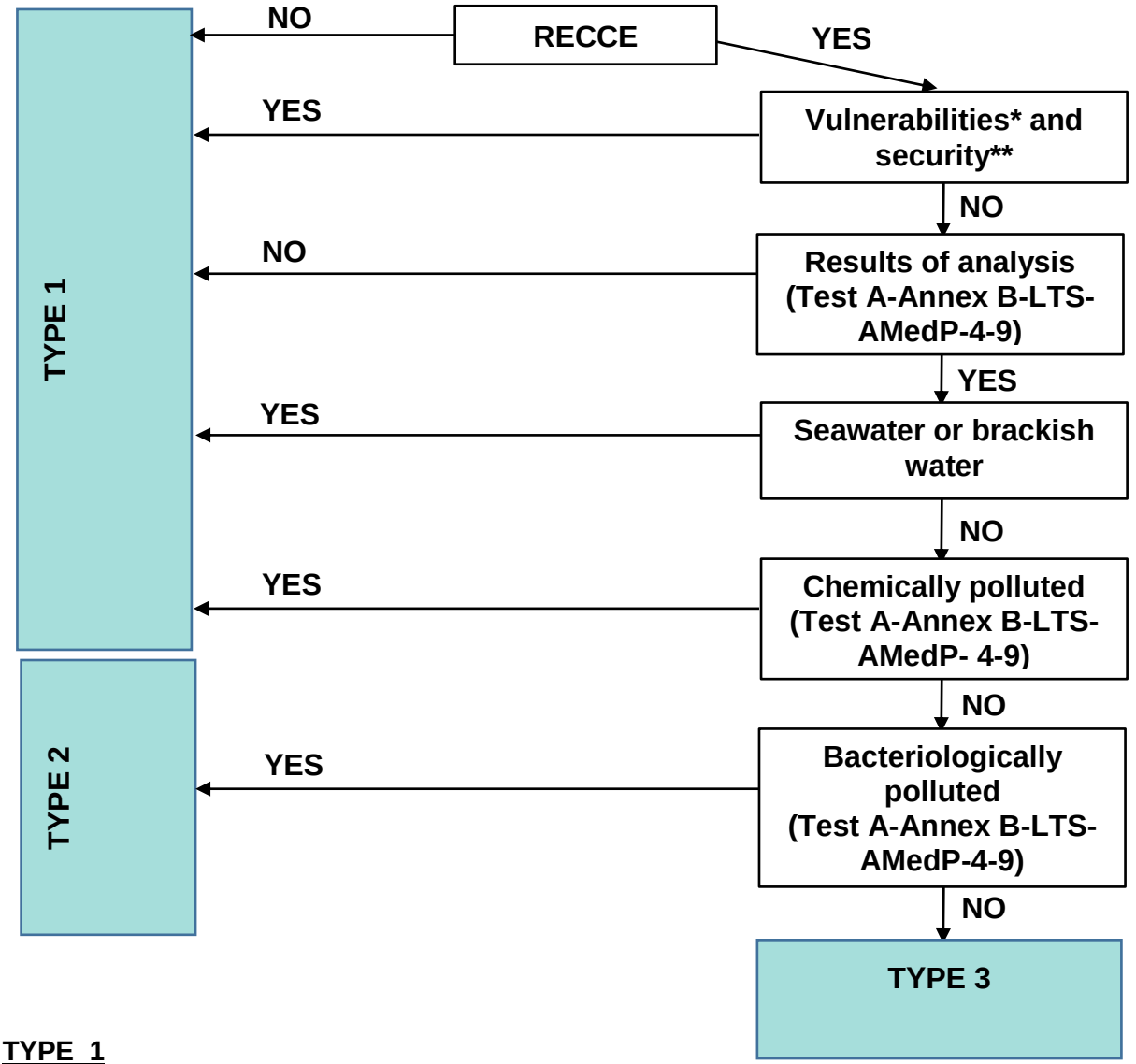
2. Volume meters should be installed on distribution loop and truck loading is recommended to ensure water accountability. Also, one-way valve or backflow devices should be installed to prevent contamination to the systems.

3. Potable water must be checked by medical personnel before water can be distributed to points of use for consumption. Additional disinfection testing frequencies are needed when water is being loaded for delivery and at points of use. Refer to table 3.1 for the various frequencies and locations.

4. A report of the quality control at production should be available for nations receiving the water and specify: Time/date/place sampling, identification production point, used by producing nation for drinking/ shower, water quality (potable or non-potable), result per constituent/parameter, standards for quality, laboratory responsible for analyses. See Annex C-1.

5. Water should be conserved to the greatest extent possible, reference STANAG 2582 for conservation best practices.

ANNEX A WATER RISK ANALYSIS FLOWCHART



TYPE 1
-Micro or ultrafiltration + Reverse Osmosis (RO) (or same result as RO) + Remineralisation* (optional) + chlorination
-Typical treatment designed for the risk previously identified (as deferisation i.e. iron removal) if the risk analysis identifies a low water vulnerability

TYPE 2
-Biological process (minimum ultrafiltration) + chlorination

TYPE 3
-Chlorination

***Vulnerabilities**: degree of natural protection of groundwater, presence/absence of industries close to water point or in the watershed of the surface pumping, military camp activities...
****Security**: forces control the raw water point. If borehole or surface pumping area is not within the immediate camp area, security must be provided for the entire chain from local water source to distribution.

INTENTIONALLY BLANK

ANNEX B ESTIMATE WATER QUANTITIES PER DAY FOR PLANNING

WATER QUANTITIES (L) PER PERSON/DAY

Types of Use	Phase		Qualitative Water Characterization
	Arrival in Theater	Full Ops in Theater	
Drinking and summary ablutions	15	15	Potable
Kitchen	10	10	Potable
Showers	20	40	Potable
Laundry	10	10	Potable
WC	10	10	Technical
Cleaning Premises	10	10	Technical
Cleaning Equipment	-	50	Technical
TOTAL	75	145	

Figure B.1 – Cold Weather requirements per person/day

Types of Use	Phase		Qualitative Water Characterization
	Arrival in Theater	Full Ops in Theater	
Drinking and summary ablutions	30	30	Potable
Kitchen	10	10	Potable
Showers	20	40	Potable
Laundry	10	10	Potable
WC	10	10	Technical
Cleaning Premises	10	10	Technical
Cleaning Equipment	-	50	Technical
TOTAL	95	165	

Figure B.2 – Warm/Hot Weather requirements per person/day

The minimum individual requirements per person/day is 10 liters drinking and 1 liter for food preparation

SPECIFIC NEEDS

Medical requirements

Serial	Use	Requirement (litres/individual/day)
1.	Battalion Aid Station	120
2.	Clearing Station (Brigade-Corps Level)	170
3.	Evacuation Hospital	270

Refer to STANAG 2885

CBRN

Water use for human CBRN decontamination should be potable. In justified emergency situations, a risk analysis must be carried out. STANAG 2358.

Dog requirements

10 per dog, per day.

ANNEX C QUALITY CONTROL REPORT

Resource
Raw water analysis
- Water resource category

Water production
- Different treatment used
- Product and process used for water remineralisation
- Chlorine process and quantity of chlorine

Storage
- Material used for storage
- Sanitary agreement

Distribution
- Material used for distribution
- Sanitary agreement

The report should be simple for proper application, one page only.

The lead nation should plan and conduct periodic audits to control the compliance of the water chain.

INTENTIONALLY BLANK

ANNEX D WATER SITE RECCE REPORT

This report template aims to give the necessary information (not exhaustive) for planning purposes.

This report will be drafted during the first phase of the operation and is provided before the sustainment phase.

It can be used to draft the characterization report as a support, as well as the Environmental Baseline Study.

Water Site RECCE Report			Date :
Drafter: Name, Rank, Unit			Duration : Season :
Location : Map :		Local Name : Grid coordinates :	
I – WATER SITE TYPE			
(1) ☐ Stream (2) ☐ Lake (3) ☐ Well (4) ☐ Network Water (5) ☐ Sea Water (6) ☐ Other (precise)	☐ River ☐ Pond ☐ Source ☐ Brackish water (tide variation)	☐ ☐	☐ Canal ☐
(1) Running Water Width : Depth : Assessed Speed : Level Variation : Tide influence : Brackish water :	**(2) Stagnant Water** Surface (m²) Depth : Level Variation:		**(3) Underground Water** Height to access water : Water gauge : Water flow Importance: Level Variation: Geological section (if available):
(4) Water Supply Network Pipes general state : Diameter : Used materials : Water Tower (height) : Reservoir : Tank : Pumps state : Water booster : Fire Hydrant		**(5) Sea Water** Brackish water (tide variation) Rmks :	

II - PRODUCTION CAPACITY ESTIMATE

(a) PRODUCTION

☐ Immediate Production capacity:
Required works :

☐ Production capacity after works :
Dedicated means estimate :

(b) WATER QUALITY

Date :

Hour :

Location :

Presence of floating :

Smell :

Colour :

Turbidity :

Mineralisation :

PH :

Ammonium :

Conductivity

Specific remarks

Sampling :

Temperature :

(c) WATER ANALYSIS

Date :

Controller :

Conclusions :

III – SITE FEATURES

Banks :

Soil type :

☐ Gravel
☐ Sand
☐ Sludge
☐ other (to be specified)

Suction height / treatment unit (m) :
Distance water point / treatment unit (m)
Drop :

Concrete platform :
Dock :

(d) VEGETATION

Importance :
Type :

(e) DRAINAGE

Water sewage possibilities :

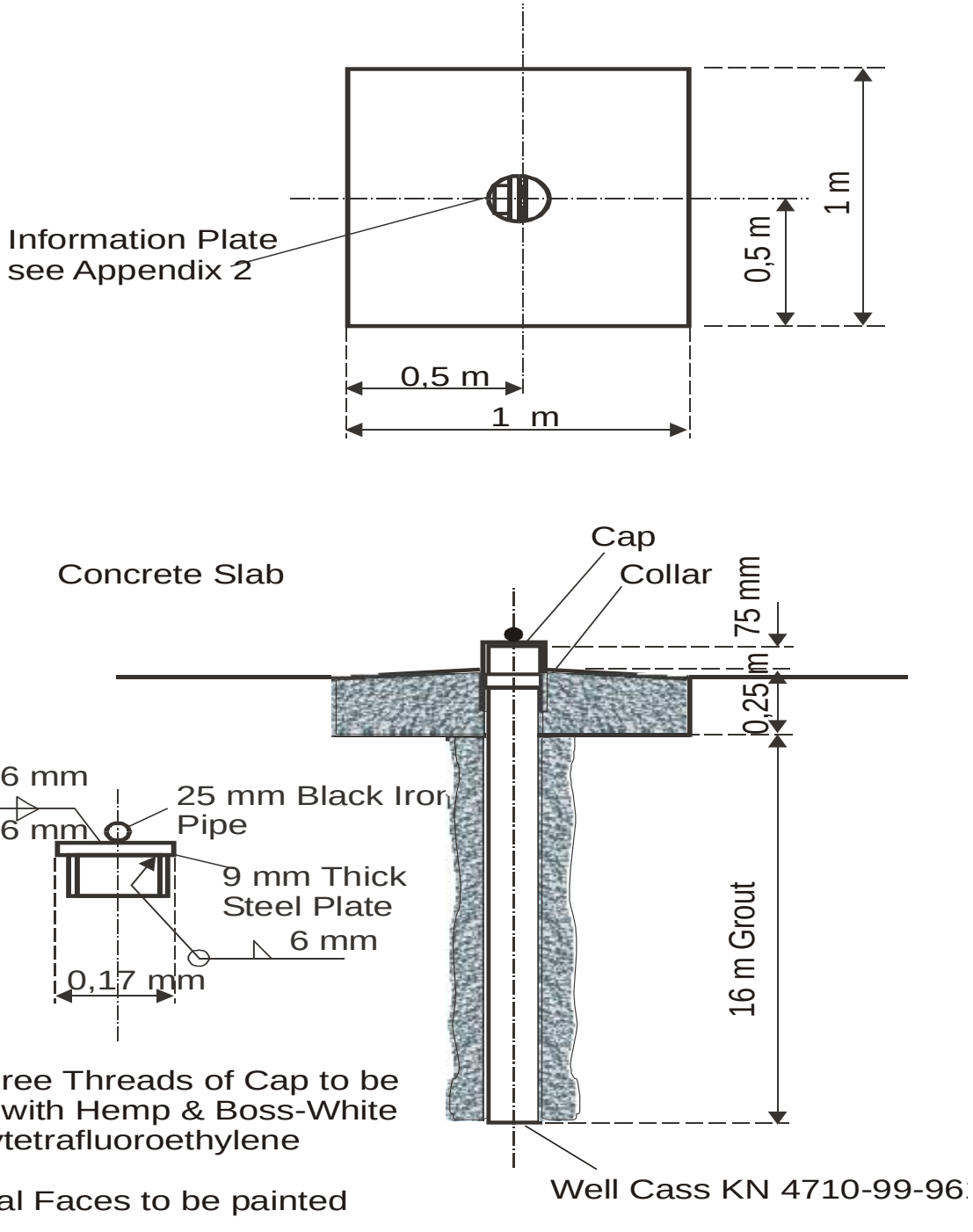
IV – ENVIRONMENT	
(f) POLLUTION / CONTAMINATION POSSIBLE SOURCES ☐ Factories : ☐ Sewers : ☐ Landfills :	☐ Agriculture : ☐ Mines : ☐ Airstrips : ☐ Maintenance workshops : ☐ Miscellaneous :
(g) SITUATION RELATIVE TO HABITAT	**(h) IMPORTANCE OF HABITAT** (city, village, locality)
(i) ACCESSIBILITY Distances : Paves roads : Path : Rail road :	Bridges: One way : Bypass :

V – HUMAN ENVIRONNEMENT	
USE BY INDIGENOUS ☐ Consumption ☐ Fishing ☐ Wash, grooming ☐ Leisure ☐ Breeding ☐ Irrigation ☐ Other	**FREQUENTATION RATE** ☐ Regular ☐ Occasional ☐ None in appearance
POPULATION : Sensitivity : Traditions : Received welcome :	**POPULATION HEALTH STATUS:**
V – SECURITY ENVIRONMENT	
Own troops area : Protected area :	Hostile area : Clashes / Skirmish :
Distribution	

CONCLUSION	
Production capacity : Site layout improvement :	Possible production assets : Necessary means :
Free text, site layout (drainage, sanitation, effluent disposal)	

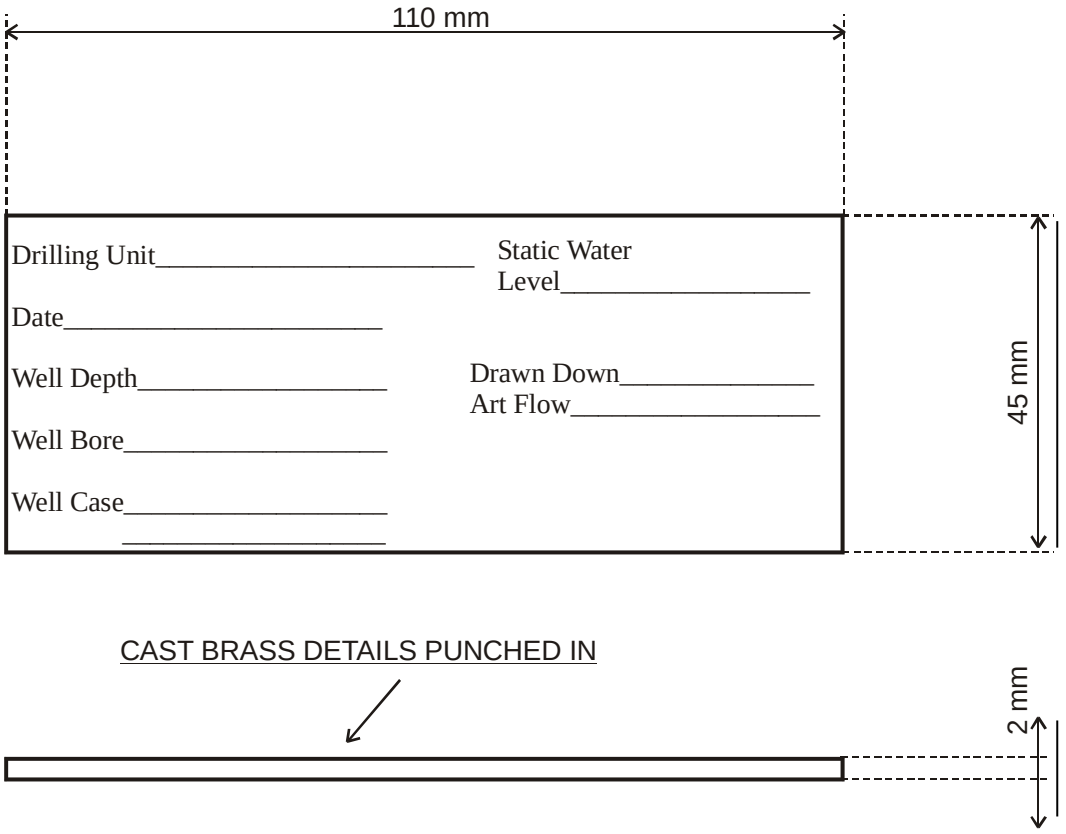
INTENTIONALLY BLANK

ANNEX E SUGGESTED STANDARD WELL CAP FOR BOREHOLES



INTENTIONALLY BLANK

ANNEX F SUGGESTED INFORMATION PLATE FOR WELL CAP



INTENTIONALLY BLANK

REFERENCES AND RELATED DOCUMENTS

STANAG 2136	REQUIREMENTS FOR WATER POTABILITY DURING FIELD OPERATIONS AND IN EMERGENCY SITUATIONS (AMedP-4.9)
STANAG 2406	LAND FORCES LOGISTICS DOCTRINE (ALP-4.2)
STANAG 2528	ALLIED JOINT DOCTRINE FOR FORCE PROTECTION (AJP-3.14)
STANAG 2885	EMERGENCY SUPPLY OF WATER IN OPERATIONS
STANAG 2582	ENVIRONNEMENTAL PROTECTION BEST PRACTICES AND STANDARDS FOR MILITARY CAMPS IN NATO OPERATIONS (AJEPP-2)
STANAG 2556	FOOD SAFETY, DEFENCE, AND PRODUCTION IN SUPPORT OF NATO OPERATIONS (AMedP-4.5, AMedP-4.6, AMedP-4.7, AMedP-4.12)
STANAG 2358	CBRN FIRST AID HANDBOOK (AMedP-7.2)
STANAG 2561	ALLIED JOINT MEDICAL FORCE HEALTH PROTECTION DOCTRINE (AJMedP-4)
STANAG 6500	NATO ENVIRONMENTAL FILE DURING NATO-LED ACTIVITIES (AJEPP-6)
STANAG 2238	ALLIED JOINT DOCTRINE FOR MILITARY ENGINEERING (AJP-3.12)
STANAG 2182	ALLIED JOINT DOCTRINE FOR LOGISTICS (AJP-4)
MC 0560/2	MILITARY COMMITTEE POLICY FOR MILITARY ENGINEERING
MC 0469/1	NATO MILITARY PRINCIPLES AND POLICIES FOR ENVIRONMENTAL PROTECTION (EP)
MC 0319/3	NATO PRINCIPLES AND POLICIES FOR LOGISTICS

ATP-104(B)(1)