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Manual

WATER & WASTEWATER MANUAL FOR PEACEKEEPING & SPECIAL POLITICAL MISSIONS

In the context of field operations

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WATER AND WASTEWATER MANUAL FOR PEACEKEEPING AND SPECIAL POLITICAL MISSIONS IN THE CONTEXT OF FIELD OPERATIONS

A. PURPOSE AND RATIONALE

1. This Manual is meant to provide strategic and operational direction to UN Peacekeeping Operations and relevant Special Political Missions[1] in relation to water and wastewater management, recognizing the need for guidance on water resource development, management and control as well as on wastewater treatment, treated effluent quality standards and risk management with the following objectives:
    1.1. Defining requirements for water and wastewater management in field missions, in supporting the implementation of the mandate for each mission to reduce their environmental footprint (A/RES/70/286).
    1.2. Defining practical steps and guidance to address water supply and wastewater management challenges in the field, with a focus on the how and why so as to ensure that Missions are operating at minimum risk to personnel, local communities and ecosystems, from a water and wastewater management perspective.
    1.3. Defining roles and responsibilities, including management responsibilities as they relate to water supply and wastewater treatment in the field for environmental protection practices.
2. This document aims at supporting the implementation of the Environmental Strategy for Peace Operations by unifying the approaches and providing clarity in all matters related to water supply and wastewater management across Peacekeeping Operations and relevant Special Political Missions[1]. It responds to the call to both strengthen water governance given rising global pressures on water resources and prioritise wastewater management so that personnel, local communities and ecosystems are protected from harm and any negative impact.
3. Regarding water supply, the overall principle is to move away from a supply-based attitude towards an integrated supply and demand management approach which incorporates the value of multiple uses of water, as well as demand management, to sustainably meet the needs of peacekeeping operations.
4. Regarding wastewater management, the overall policy directive remains that there shall be *no discharge of wastewaters directly into streams, rivers or other bodies of water without prior treatment*[2]. Further, this document provides detailed and strengthened requirements for risk management so that missions can operate at minimum risk to personnel, local communities and ecosystems, leaving a positive legacy wherever possible.
5. This document also supports the implementation of the Sustainable Development Goal 6 (SDG 6) “Clean Water and Sanitation”, and aims at contributing more specifically to reach Target 6.3 and 6.4 :
    - *Target 6.3:” By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.”*
    - *Target 6.4: “By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.”*

[1] This manual does not apply to the following SPMs: non-resident envoys and advisers; panels, monitoring groups and similar expert bodies; or regional offices.
[2] Waste Management Policy for UN Field Missions (2018.14)

B. SCOPE AND APPLICABILITY

6. This manual applies to all personnel in Peacekeeping Operations and relevant Special Political Missions[3], both civilian and uniformed, and in DOS, DPO and DPPA, as well as any other departments and offices of the Secretariat that support the field. The primary audience is listed in the section on Roles and Responsibilities.

7. This Manual is intended to provide a useful reference in achieving best practice in the management of water and wastewater in the context of field operations. It provides detailed instructions on how to meet obligations and requirements in relation to water and wastewater management set out under various UN rules and regulations, mandates, environment [4] and other applicable policies, and (where applicable) local laws and regulations. It therefore contains language that is highly prescriptive (e.g., shall/shall not, must/must not) for activities considered as obligatory, as well as language less prescriptive for recommended approaches (e.g., should/should not) or discretionary/ optional (e.g., may/may not). Where mandatory, footnotes referencing the applicable obligation are provided.

8. Responsibilities related to Environmental Impact Assessment SOP implementation, water and wastewater management planning, water resources monitoring, water consumption reduction efforts, compliance with treated effluents quality standards before discharge or reuse, and periodic wastewater risk assessment, reporting and control are expected to be implemented.

9. Other responsibilities such as those related to daily per capita water consumption rates, which apply to civilian, military, police and any hosted personnel, carry the expectation of compliance but may be implemented with flexibility, in accordance with specific mission factors including the degree of water stress in the Area of Operations and considerations of the conflict dynamics surrounding water and wastewater.

10. Guidance on the development of Wastewater Management Plans is covered in a Standard Operating Procedure (currently under development).

[3] This manual does not apply to the following SPMs: non-resident envoys and advisers; panels, monitoring groups and similar expert bodies; or regional offices.

[4] An updated Environmental Policy is expected to be promulgated in 2021. In the meantime, reference remains the Environmental Policy for UN Field Missions (2009.6) and the Waste Management Policy for UN Field Missions (2018.14)

C. PROCEDURES/GUIDELINE

C.1. WATER SUPPLY SCALES

11. In UN provided living/accommodation quarters for civilian staff and for all military/formed police unit camps, bulk water, of suitable quality, should be supplied at 80 – 100 litres/person/day. In offices, bulk water of suitable quality should be supplied at 20 litres/person/day. These scales may need to be adapted for camps hosting special facilities (e.g., hospital, clinics). Storage requirements should ensure the availability of bulk water for a minimum of three days. Significantly higher storage duration may be warranted under special circumstances (e.g. conflict area, lockdown, distant water source, etc.).

12. Drinking water, of potable quality should be supplied so as to ensure 5 litres/person/day in accommodations and 2 litres/person/day in offices.

13. Storage requirements should ensure the availability of drinking water for a minimum of two days. Water designated as drinking water should not be stored longer than 72 hours (except bottled water). This provision for drinking water is independent of/distinct from the 14 days emergency rations storage requirements.

14. Each of the recommended levels for the provision, supply and storage of bulk and drinking water are expected to be adjusted to meet the specific prevailing field conditions based on hazard identification and risk assessment. These requirements are specified in the Mission's Water Safety Plan (WSP)[5].

15. Missions need to develop an Emergency Plan that should be adopted as and when needed. Precautions are be taken to ensure availability of water as far as is reasonably practicable. Emergency Plans are expected to include, to the extent needed, stakeholder communication and advisory, rationing, use of alternate water supply sources or sourcing methods, secondary treatment options, as well as providing additional storage for raw, bulk and drinking water. The Emergency Plan should be revised, especially following its application, to reflect lessons learnt and to make improvements.

C.2. THE FIELD MISSION WATER SUPPLY CONCEPT (FMWSC)

16. This manual introduces the Mission Water Supply Concept document that henceforth should be the requirement of all field missions, existing and future. This is a mission-specific statement that presents a holistic approach to the sustainable supply of water[6] for the mission based on objective field data.

17. In the case of new missions, the FMWSC is expected to be initiated during mission start-up and planning by the Water Specialist assigned to the Technical Assessment Mission (TAM) for further development and implementation by the Water Specialist in the Advance Team (AT) and handed over to the WatSan Unit/Engineering Section for mission start-up and sustenance.

18. The FMWSC should be developed in accordance with the requirements set forth in Annex A.

[5] A Water Safety Plan comprises system assessment and design, operational monitoring and management plans (including documentation and communication). The objectives of a water safety plan are to ensure safe drinking water through good water supply practices (i.e., to prevent contamination of source waters; to treat the water to the extent necessary to meet water quality targets; and to prevent re-contamination during storage, distribution and handling of drinking water).

[6] The term water is used in general to encompass raw, bulk and potable water as well as all available alternative sources such as recycled water and rainwater.

C.3. WATER SOURCING AND PRODUCTION

C.3.1. Source selection

19. Procedures for source selection, during any stage of mission operations, should be in accordance with those detailed in the Mission Water Supply Concept of this document (Annex A). The specific requirements are expected to include, but not be limited to, those listed in Annex A paragraphs 3 and 5.

C.3.2. Water sources

20. Mission water sources are to be considered with respect to sound environmental practice and wherever practicable, adequate priority should be given to sustainable resources. A cost-benefit analysis should be included as part of the feasibility study for the mission water supply system. In cases of sensitive or vulnerable context (e.g. highly stressed water resource, high groundwater table, etc.), an Environmental Impact Assessment (EIA) will be undertaken and mitigation measures have to be proposed with their implementation cost evaluated. Water source options and factors that need to be considered in selecting a water source for development are as per Annex B.

C.3.3. Water Production and Development of Water Sources

21. Where the development of a water source requires the introduction of large schemes (e.g., construction of dams, large rainfall harvesting schemes, water intakes, river diversion works, pumping stations, well drilling and/or groundwater abstraction), an Environmental Impact Assessment is required, and the local regulations have to be strictly adhered to and all necessary permits obtained. At site closure, the Guidelines for Environmental Clearance and Handover of Mission / Field Entity / Field Entity Sites (2018.28) are expected to be followed to ensure proper handover or site restoration.

22. The water source chosen for development needs to be both reliable and sustainable (i.e., not consumed faster than it can be replenished). Sustainable water sources only remain sustainable if action is taken to preserve them; in their natural state all water sources are essentially sustainable, although with unchecked human usage, sustainability is difficult. Efforts should be made to make sure that activities that affect the sustainability of the water sources are checked and corrected (e.g., groundwater level and quality monitoring in zones potentially subject to saline intrusion or in shallow aquifer contexts).

23. Rehabilitation of existing water sources and options for recycled water use, either rainwater or treated wastewater, should be considered, where feasible, in tandem with developing new water sources.

24. Water source security needs to be given due attention to preserve its integrity and to ensure safe access. Source security should include restricted access controls, as far as practicable, to guard against malicious acts (e.g., poisoning). Boreholes also need to be protected from vehicular collisions (e.g., surround borehole with bollards).

C.3.4. Source Water Protection

25. Water is critical to all aspects of our lives and it is important to protect source water to ensure a safe and reliable water supply for present and future uses. Source water protection ensures safe drinking water, in accordance with WHO drinking water quality guidelines and the Water Safety Plan (WSP) concept. It is imperative that field missions put in place measures to protect the source waters and possible tools include educational or pollution prevention activities and implementation of tailored best management practices (BMPs) (e.g., proper water point protection and maintenance of the surroundings and sharing of acquired knowledge on the water resource with the local authorities such as geological, water quality, and groundwater level data).

26. Missions should to the extent possible use simple environmental indicators to track and monitor changes in their fresh water resources. Indicators should be chosen to aid in gaining an appreciation of conditions and trends and changes in the quantity and quality of freshwater resources without having to capture the full complexity of the system. These indicators may include pH, temperature, conductivity and piezometry for groundwater; and flow for surface water sources.

27. Groundwater level monitoring shall be implemented in host countries deemed to be water stressed [7] as per the Sustainable Development Goal (SDG) 6.4.2 [8] and is highly recommended in any other context, preferably through a dedicated observation well.

28. Water abstraction should be monitored through the installation of meters at each collection point and integration with the Field Remote Infrastructure Management (FRIM) program or an equivalent remote monitoring system can be used if available. The FRIM program allows remote monitoring and recording of parameters measured automatically in the field.

29. Field missions are also expected to develop and implement source water pollution prevention and control measures as given in Annex C.

C.4. WATER PURIFICATION AND QUALITY CONTROL

C.4.1. Field Water Purification Techniques

30. Widely varied techniques are available to remove fine solids, micro-organisms and some dissolved inorganic and organic materials that are found in varying quantities in water. The choice of method will depend on the quality of the water being treated (e.g., salinity, natural high concentration of some chemical components), the cost of the treatment process and the quality standards expected of the processed water.

31. The filtration and reverse osmosis equipment used in field missions produces water treated to a standard suitable for drinking and other domestic purposes. The Water Specialist assesses and develop fit-for-purpose treatment procedures whereby the water quality achieved meets the specific requirements for given purposes, while optimizing costs and performance.

32. The water rejected from the raw water treatment process should not be sent to the wastewater treatment plant(s). It should instead be reused for non-potable purposes on site in conformance with the recommendations of Chapter C.9.7. Where the salinity of the rejected water from water treatment plants is too high to allow reuse of any kind (e.g., for highly saline water from Reverse Osmosis treatment process), the following options should be considered for disposal:

- Dilute with other water streams before disposal (e.g., with treated blackwater, with greywater or with stormwater);
- Infiltrate in shallow pits or trenches near the shores of inland saltwater lakes or ocean;
- Send to evaporation pond and incinerate dried residue with solid waste.

If none of the above disposal solutions are feasible, technical assistance can be requested to UNGSC through the Environmental Technical Assistance Request SOP (GSC/SOP/165.00) to determine the best preferable option (e.g., construction of shallow ponds with endemic halophytic vegetation to absorb the salinity from the water) depending on the local context and regulations.

[7] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)
[8] https://sdg6data.org/indicator/6.4.2

33. Depending on the established MoU, where military/police contingents are responsible/reimbursed for their water treatment equipment (COE), such contingents are responsible for meeting the requirements in Annex D. In those cases where the MoU establishes that a contingent is not self-sustained under the water treatment category, treated water is expected to be provided to them, as well as to all offices, from mission operated and maintained water treatment plants (UNOE) in line with the water supply scales in sub-section A, in two categories: general purpose bulk water supply and drinking water supply.

C.4.2. Water Quality

34. Drinking water (i.e., water for human consumption), is expected to conform to the most up-to-date WHO Guidelines for Drinking Water Quality[9]. Water quality should be assessed by use of any, or a combination, of the following:

    34.1. portable critical water quality parameters laboratories that are supplied with the water treatment plant equipment

    34.2. a mission-established/contingent owned/medical laboratory facility

    34.3. an external laboratory

35. At source selection and development, raw water quality is a determining factor in accepting the source and/or designating to what purposes water can be used and further, to establish what treatment requirements need to be employed to meet fit-for-purpose water quality. Mission raw water sources are expected to comply with the minimum standards for water potability in the field (Annex E).

36. Critical on-site parameter testing should be carried out on a daily basis for all drinking water in accordance with Annex F, Table 1.

37. Critical parameter testing as listed in Annex F, Table 2 is recommended to be carried out for all drinking water at a laboratory facility, on a monthly basis as a minimum.

38. The WHO Guideline for chlorine residual at point of treatment is 0.2 – 0.5mg/l; this needs to be increased to 1mg/l during, and closely following, outbreaks of waterborne disease, or similar circumstances. The WHO Guideline for chlorine residual at point of use is 0.1 – 0.2mg/l; this needs to similarly be increased to 0.5mg/l in the event of a waterborne outbreak.

39. Raw water testing should be carried out at the same time as treated water samples are collected for comparison to be possible and to confirm that equipment is being operated competently and that the treatment process is effective. Raw water analysis should also be carried out to monitor any raw water fluctuations, especially in surface water sources.

40. Field water quality testing should be carried out at water storage tanks and along chosen points in the distribution system (e.g., outlet of treatment unit(s), control valves, yard taps) at least once every 3 days to establish the pH, residual chlorine, turbidity and suspended solids levels. Where this testing frequency can't be respected, stored water should not be used for drinking.

41. Independent verification, as a means of quality assurance (QA) testing, should be carried out by an identified independent entity on a bi-monthly basis for all drinking water.

42. The complete list of water quality parameters, recommended maximum levels and testing frequency are as per Annex G. Samples are recommended to be taken from raw water sources, at the water treatment plant, from storage tanks, along the distribution system and at points-of-use.

[9] Currently 4th Edition 2011

43. Integration with the Field Remote Infrastructure Management (FRIM) program or an equivalent remote monitoring system should be used if available. The FRIM program allows remote monitoring and recording of parameters measured automatically in the field.

44. In order for recycled water to be deemed acceptable, all of the standards[10] and conditions detailed in paragraphs 137 and 167 to 171 need to be met and adhered to.

C.4.3. Water Quality Control

45. A multi-barrier approach needs to be taken to address threats to water quality – from water source through to the point-of-use; water sources have to be protected, adequate treatment (including disinfection) needs to be provided, distribution systems need to be well maintained, water quality standards are expected to be enforced, regular inspection, testing, monitoring, operator training and reporting should all be included in the supply of water for human consumption.

46. Only competent (i.e., trained and qualified) personnel should be assigned responsibilities associated with water treatment plant operation and maintenance and water quality analysis. The recommended skills to match expected responsibilities in treatment and quality control are provided in Annex H.

C.5. STORAGE AND DISTRIBUTION

47. The purpose of water storage and distribution design and planning is to deliver water to UN personnel of appropriate quality and quantity and at an adequate pressure. Water supplied should meet normal personnel water needs set out in user scales (A), meet peak demand and remain of acceptable quality in the whole distribution and storage system. Leakages have to be kept to the minimum through routine inspection and rectification and the facilities should be of food-grade quality and located centrally or not too far from users.

48. A camp zero-leakage policy should be adopted. Water metering, using FRIM or an equivalent remote monitoring system wherever available, should be effected at logical control points to aid in monitoring. Preventive maintenance and inspections need to be carried out for each component of the system to identify losses in efficiency, signs of wear, sources of contamination, leaks, etc.

C.5.1. Storage

49. Water storage reservoirs/tanks should be provided in every water supply network to reduce pump running costs, smoothen hourly water demand, supply water during pipeline repair periods and break-up pressure in some instances. Reservoirs/tanks that contain treated water need to be covered and vented. Wherever possible, gravity distribution system should be adopted to reduce pumping capacities and save energy.

50. The recommended minimum water storage capacities should be in line with paragraphs 11 to 15.

C.5.2. Distribution

51. Water should be distributed through a network comprising pipelines under pressure, however where this is not possible, dedicated water trucks or trailer mounted water tanks may be used with water usage monitored with FRIM or an equivalent remote monitoring system if available. The selection and sizing of the network need to be based on sound engineering design to ensure that the system is economical and reliable. It is important

[10] Urban Wastewater Treatment Directive (91/271/EEC)

that no materials that can promote microbial growth and/or introduce contamination come into contact with the treated water in the network.

52. If the available supplies of water are insufficient, especially at the start of the mission, actions to ration supplies and to ensure equitable distribution should be given due consideration.

53. In order to conserve water, every mission must prepare a Water Conservation Program (WCP) [11]. The freshwater points of use have to be equipped or retrofitted with high efficiency equipment and fixtures (e.g., high efficiency toilets, reduced flow shower heads and faucets, faucet aerators, etc.). A deliberate effort is expected to be made to harvest rainwater to cover part of the bulk water needs wherever possible. Refer to Annex I for details on the contents of the WCP, on minimum required standards for water fittings and other examples of water saving measures.

54. Wherever achievable, water recycling should be undertaken to save on bulk water requirements in line with the requirements in paragraphs 137 and 167 to 171.

55. Water demand management should be conducted in every circumstance to reduce as much as possible the volume of wastewater generated. As a minimum, missions should implement the following actions:

- Introduction of awareness messaging in the mission's induction package.
- Regular awareness campaign targeted towards the entire mission's personnel.
- Permanent awareness messaging broadcasting.

C.6. WASTEWATER GENERATION

C.6.1. Sources

56. The table below summarizes the sources of wastewater in field missions.

<table>
<tr><th>Effluent Type</th><th colspan="2">Facilities</th><th>Sludge and/or solid residues</th><th>Main expected pollutants</th></tr>
<tr><td>Blackwater</td><td rowspan="2">Ablutions</td><td>Toilets</td><td>Fecal Sludge</td><td>Pathogens germs</td></tr>
<tr><td rowspan="3">Greywater</td><td>Sinks, showers</td><td rowspan="2">-</td><td rowspan="2">Detergents</td></tr>
<tr><td colspan="2">Laundry</td></tr>
<tr><td colspan="2">Kitchens</td><td>FOG: Fats Oil and Greases</td><td>Detergents, grease</td></tr>
<tr><td>Oily water</td><td colspan="2">Transport workshops, car washing bays, machinery, engines/generators, fuel farms, fuel storage tanks areas, fuel dispensing areas and used oil storage areas</td><td>Oil, lubricants, contaminated mud</td><td>Oil, hydrocarbons, heavy metals, etc.</td></tr>
</table>

Table 1: Sources of wastewater in field missions

57. Flowchart on Figure 1 illustrates the processing line typically followed for each effluent type from point of origin to final end process. The treatment needed for liquid and solid streams

[11] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

as well as the quality standards to attain before disposal or reuse are detailed in subsequent chapters.

58. Blackwater and greywater, if conditions allow, should have separate drainage systems. If blackwater and greywater are combined in the same drainage system, wastewater will be handled as blackwater.

C.6.2. Other Effluent Types

59. Stormwater runoff from roofs, roads and natural soil drainage are not considered as wastewater to be treated. They need to, however, be properly channelled and managed wherever necessary to avoid soil erosion and draining into wastewater network infrastructure[12].

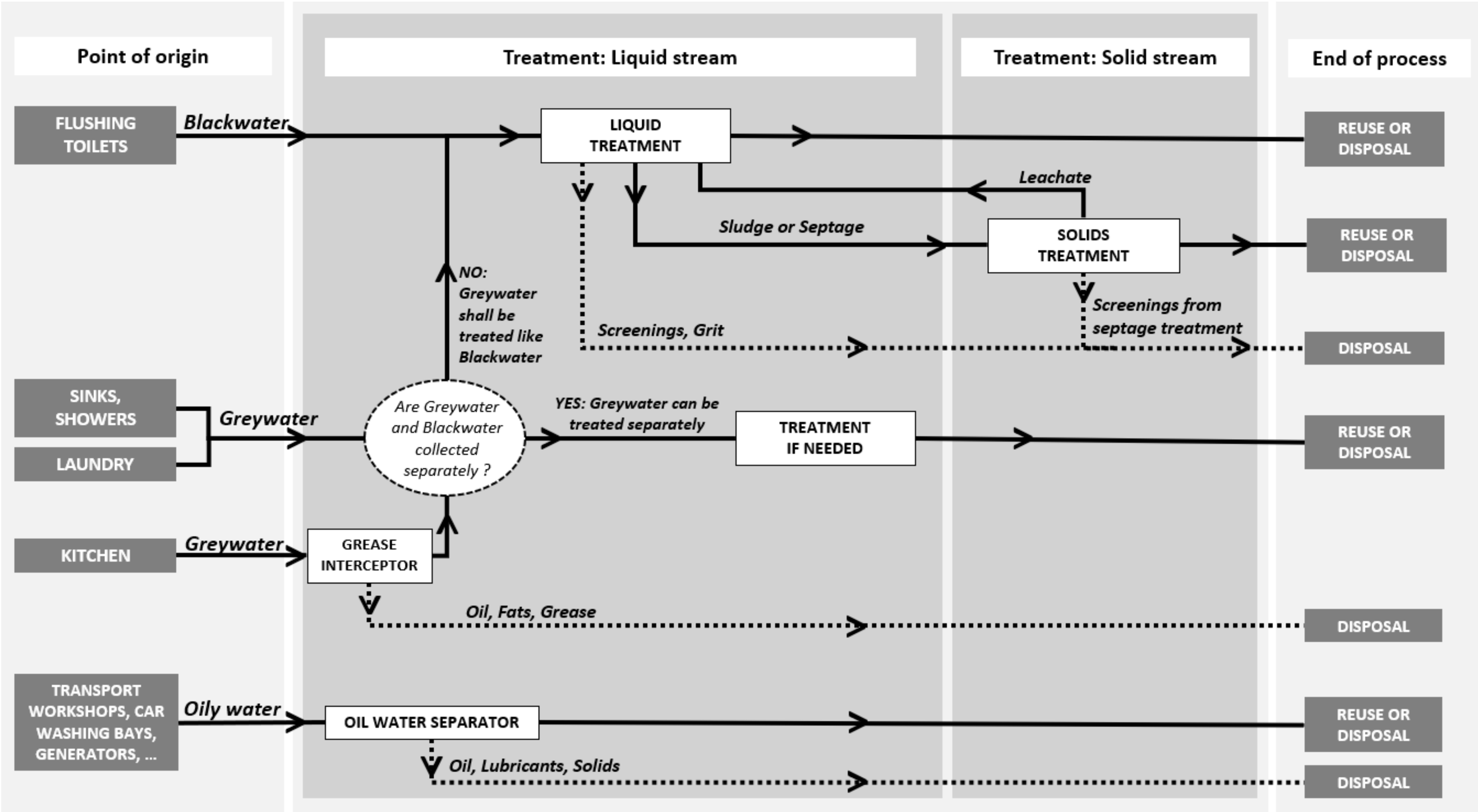
60. Leachates and contaminated mud from landfill, waste storage and composting sites are not covered under this manual. Refer to available waste management guidance [13] for specific recommendations related to these waste streams.

61. Rejected water from Water Treatment Plant(s) is not considered as wastewater to be treated and is covered in paragraph 32.

[12] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

[13] DOS Solid and Hazardous Waste Management Guidance and Training Manual for UN Field Missions (under development, planned to be issued in 2021) or request Technical Assistance through UNGSC for detailed guidance.

Figure 1: Typical Effluent Process Streams Flowchart



C.6.3. Volumes and Strength

62. The volume of wastewater to handle for infrastructure sizing considerations should be calculated as 80 percent of the water consumed.

63. Water consumption has to be measured and monitored at every site. In absence of measurement (e.g., for temporary bases), however, the average per capita per day value of other comparable mission sites, or mission's average water consumption rate should be considered for sizing purposes. In absence of any data, the following water consumption figures are considered:

- 100 litres/capita/day should apply for living accommodation sites
- 25 litres/capita/day should apply for offices only

64. The strength of the wastewater (organic loading) is calculated using the following figures:

- 60 grams BOD5 (5-day Biochemical Oxygen Demand)/capita/day should apply for living accommodation sites
- 15 grams BOD5 (5-day Biochemical Oxygen Demand)/capita/day should apply for offices only

C.7. WASTEWATER COLLECTION, STORAGE AND CONVEYANCE

65. Wastewater and sludge will be managed safely to prevent any health hazard at any step of the sanitation chain, from collection to final disposal or reuse, at any point in time between mission/camp installation until its closure/handover[14]. Although full compliance with this manual may not be possible under extraordinary circumstances (e.g., for expeditionary camps at mission start-up when facing potential logistical and supply constraints), safe excreta management remains a priority and the use of basic interim sanitation methods (e.g. simplified pit latrines) will be implemented wherever necessary to protect health and the environment.

C.7.1. Personnel health and security

66. Workers in contact with sanitation effluents should wear, at a minimum, the following Personal Protective Equipment: rubber gloves, rubber boots, and protective clothing. Wearing a mask and safety googles is recommended.

67. A water point with soap or a hand sanitizer solution needs also to be made available to them.

C.7.2. Wastewater Collection

68. Toilets have to be constructed and well maintained so that the user is safely separated from excreta and the risk of hydric disease is minimized, including passive transmission by flies and other vectors. They also need to be accessible (including for disabled persons if and where appropriate), ensure security and privacy for all users, and suitable for proper menstrual hygiene management. Bin(s) and signage (with messaging about not throwing other solid material such as sanitary napkins, paper towel, wipes, condoms, etc. in the toilets) should be installed. A water point and soap need to be provided within the toilet facility or installed in the vicinity to ensure proper hygiene. The toilets will be compatible with the subsequent containment, conveyance and treatment technologies chosen.

69. Toilets, sinks, showers and kitchens taps have to be equipped with water efficient fittings. For the other water points within mission facilities, it is recommended to use the Technical

[14] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

Specifications material developed in the Sourcing Support Unit Database (SSU Database) to support local procurement process.

70. Kitchen taps have to be equipped with water efficient fittings as well. Wastewater from kitchens will be channelled through a grease interceptor, or through a grease trap if less than 20 users, to prevent fats, grease and others frying oil residues to enter the sanitary sewer and septic systems.

71. Wastewater from designated car washing bays have to be channelled through an oil water separator before being reused or discharged into the stormwater drainage network. If recycled water is used, water efficient fittings are not necessary.

C.7.3. Wastewater Storage

72. Holding tanks:

- Holding tanks are different from septic tanks and may be used to temporarily store wastewater prior to treatment. Septic tanks are used, and specifically designed, to partially treat wastewater.
- Holding tank(s) will be sealed and sized to store incoming wastewater until it can be safely emptied without risk of overflow. The minimum recommended storage capacity is for 5 days based on calculated usage.

C.7.4. Wastewater Conveyance

73. Sewage system has to be inspected, and any leak or clogging needs to be addressed and repaired immediately.

74. When greywater and blackwater have separate drainage systems and are treated separately, both piping networks should be clearly identified by different colors, from the collection point until treatment and final disposal.

75. In case of direct piping to a sewerage network transporting wastewater to an external treatment site[15], mission will ensure that:

- Network is connected to a functional wastewater treatment facility, which will be inspected at least once every 6 months (refer to paragraphs 77 to 79 for guidance on connection to an external facility).
- No leak of untreated sewage occurs from the network between the UN site and the external treatment site. This includes eventual temporary overflow(s) due to stormwater penetration in the external network.

76. If wastewater is treated or disposed off-site, the truck(s) collecting and removing the wastewater should comply with the following requirements:

- Being regularly maintained, both pumping system and general operation. A maintenance book needs to be made available for control at any moment;
- Hosed connections between trucks and septic tanks should be regularly inspected and changed to prevent leakage when the truck pump is turned on or off;
- Exterior surfaces exposed to wastewater should be cleaned, and if needed, properly disinfected at the point of collection.
- Equipped with a volume meter and a logbook controlled by the WatSan Unit recording date, origin, destination and volume of wastewater transported;
- Drivers and operators equipped with PPE as per para C.7.1.

15 Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

77. When wastewater is treated or disposed off-site, the movement of wastewater and subsequent treatment/disposal have to be monitored to ensure proper transfer of wastewater/septage from its origin to the designated treatment site or disposal and not to non-approved locations[16].

16 Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

C.8. WASTEWATER TREATMENT AND QUALITY CONTROL

C.8.1. Treatment levels

A. BLACKWATER

78. Blackwater must be treated before disposal or reuse, either on or off site. Refer to the flowchart on Figure 2 and to the sections below for guidance in determining the level of treatment required.

a. Treatment and/or disposal at external treatment facilities

79. An external treatment/disposal facility is defined as not operated under the control of a UN field mission. It can be either municipal, private, or operated by another entity such as other UN entities (e.g., IOM, UNICEF, etc.).

80. If an external wastewater treatment facility (meeting the below criteria) is accessible to a UN field mission, its use should be preferred to the construction and operation of onsite treatment infrastructure[17].

- External wastewater treatment facility is secured from random access or natural hazard.
- External wastewater treatment facility is licensed and authorized to operate by the host government.
- Access for visiting the site is granted to mission's personal before signature of written agreement and twice a year afterward. Visits should be conducted preferably by both the Environment Officer and Water/Sanitation Engineer.
- The treated effluent complies with the standards applicable for tertiary treatment, restricted reuse. These standards may be found below in the section on quality control, paragraph 137.

b. Onsite treatment

i. For existing facilities

81. If existing facilities do not conform to this manual, they should be modified or replaced to conform with it.

ii. For Contingent Owned Equipment (COE)

82. Depending on the established MoU, where military/police contingents are responsible/ reimbursed for their wastewater treatment equipment (COE), such contingents are also responsible for meeting the requirements in paragraph 137 and ensuring that wastewater is treated in conformance with this manual, including the treated effluents quality standards[17].

83. All use of COE for wastewater treatment would be required to meet minimum risk requirements based on the most up-to-date wastewater risk indicators included in the Performance and Risk Management Framework reported annually to Member States in the Environmental Scorecard. TCC/PCC units should engage with the Mission expert units (i.e., EFMS / Watsan, Environment, etc.) to ensure proper wastewater risk management. Technical assistance to support the planning, assessment, implementation, monitoring and

17 Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

risk management of any COE process is available from the Environmental Technical Support Unit in the Global Service Centre (ETSU/GSC).

iii. For new facilities to be constructed, the following should be considered during planning, design, and construction

84. New facilities projects fall under the scope of the Environmental Impact Assessment SOP[18] (EIA SOP).

85. If one (or more) of the following conditions exist, an EIA will be conducted to determine the most appropriate disposal option, the treatment level to be reached, and identify any additional treated wastewater quality standards needed:

- Drinking/domestic water source is < 100 m from the wastewater facility site.
- Flooding risk or other natural disaster risk is present (e.g., earthquake, forest fires, land/mud slides, etc.).
- Located in an urban/peri-urban area.
- Rural area but local communities are located at less than 200 meters from the treatment facility.
- Surface water bodies sensitive to eutrophication are present.
- Located in special sensitive area (fauna/flora, cultural, etc.).

iv. Required treatment level

86. The level of treatment to attain on site depends on the final destination of the treated effluent. It is determined following the below logic illustrated by Flowchart 2.

87. If treated blackwater is to be reused, it must be treated up to tertiary treatment level. The type of reuse (unrestricted or restricted) will determine further the Quality Standards to conform with. Refer to paragraph 137 for more details regarding quality standards.

88. If treated blackwater is not to be reused and is to be discharged directly into groundwater or surface water body, it shall also be treated up to tertiary treatment level but the effluents quality will have to conform with the Quality Standards for restricted reuse (unless specified otherwise after an EIA and/or if local Host Country regulations are more stringent)[19].

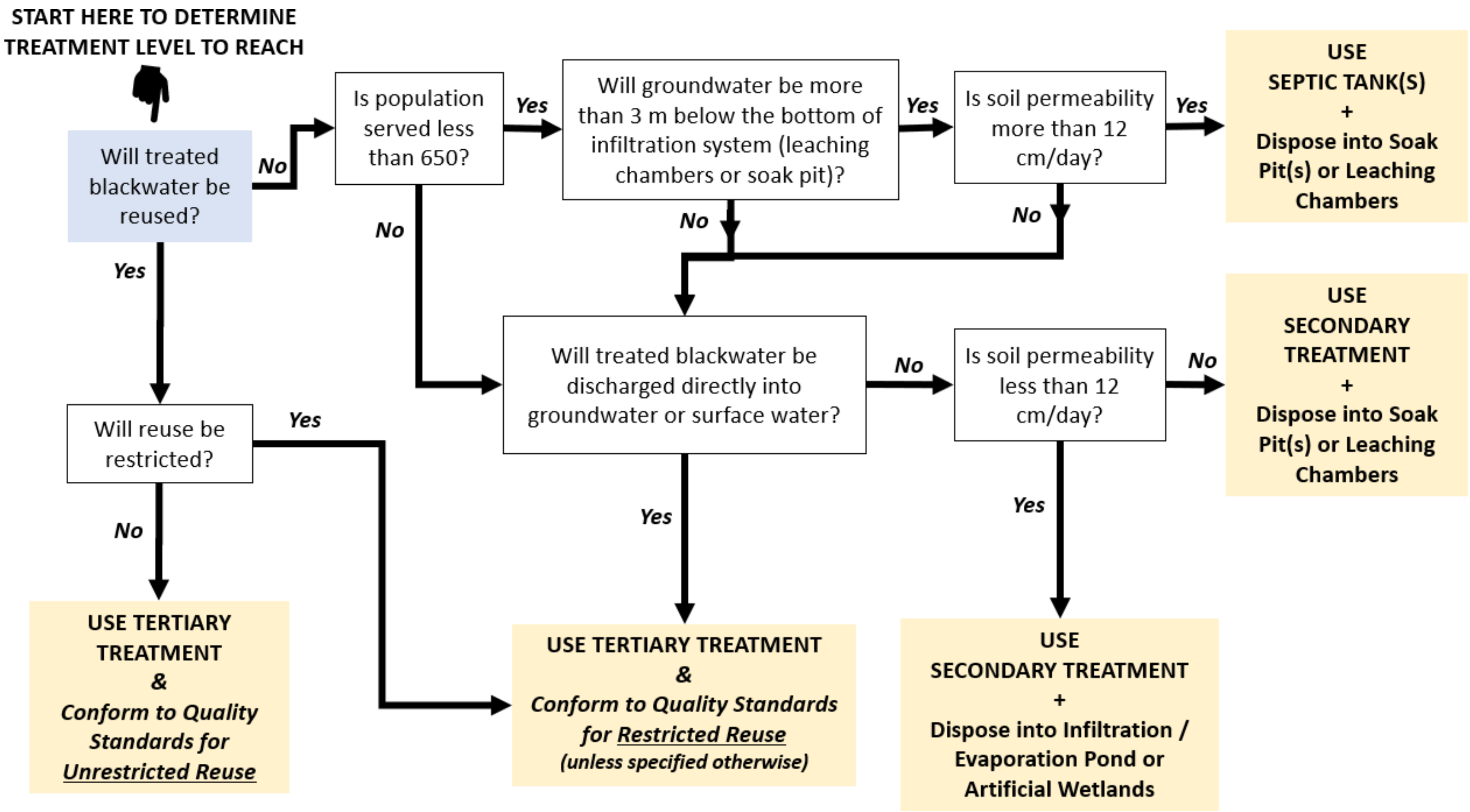
89. If neither of the above reuse/disposal options are considered, then the most appropriate level of treatment before disposal will depend on various factors:

- The total number of users. Septic tank systems, due to the low level of operation and maintenance requirements, should be preferred for loads up to 650 personnel equivalents so long as there is sufficient vertical separation from the groundwater and adequate soil permeability[19]. Beyond that number, secondary treatment will have to be implemented.
- The local groundwater level and soil infiltration capacity. These factors will further determine the most appropriate final disposal option: Soak Pit(s), Leaching Chambers, Infiltration/Evaporation ponds, or Artificial Wetlands.

[18] SOP Environmental Impact Assessment for UN Field Missions (2019.09)

[19] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

Figure 2: Treatment level to reach for any effluent containing blackwater flowchart



**Sub-surface infiltration from soak-pit(s) or leaching chambers is to be considered as groundwater recharge when a 3 meters distance between the bottom of the infiltration system and the groundwater table cannot be respected*

B. DRY SANITATION

90. Dry sanitation relates to toilets that do not use water for flushing. These toilets include portable toilets, composting toilets and pit latrines; and should be considered where water is scarce and not readily available.

91. The toilets are expected to be properly designed, constructed and maintained to allow hygienic use (including the use of non-running water for cultural habits) and avoid the contact with feces. Refer to SSU Database for drawings and details.

92. A bin should be installed along with messaging about not throwing other solid material (such as sanitary napkins, paper towel, wipes, condoms, etc.) in the toilet.

93. A water point with soap needs to be made available in the vicinity, and greywater needs to be either properly disposed of to avoid any area of stagnant water or reused provided they conform with the required quality standards.

The following special additional considerations are given to pit latrines:

94. The construction of pit latrines is possible if the following conditions are met:

- The top of the aquifer is at more than 3m from the bottom of the pit, even during high water season. The pit may be elevated to meet this criterion. Water levels detected in nearby borewells may be used in determining the top of the aquifer.
- No drinking water point is located at less than 30 meters (horizontal distance) of the latrine. This distance may need to be increased if a drinking water point is located downhill and depending on the local soil conditions
- The scale of accommodation is 1 latrine for every 20 persons maximum.
- In situations where the space is limited and pit(s) likely to be emptied for reuse, it is recommended to adopt alternating pit toilet design where one pit is designed for a period of use of two years while a second pit remains unused to ensure die-off of pathogens and safe emptying[20]. Also refer to SSU Database for drawings and details.

95. At site closure, the pit latrine(s) should be backfilled and covered with their location properly reported and documented in the Environmental Close Out Assessment (ECOA) report[21].

The following special considerations are given to portable and composting toilets which may require regular emptying:

96. Use and maintenance of portable and composting toilets need to conform to manufacturer's recommendations. One toilet usually serves up to 20 persons.

97. Toilets designed to convert feces into a reusable product (e.g., compost or fertilizer) may have their product safely managed and used on site.

98. For all other toilets and at site closure, toilet contents should be emptied in a pit (conforming to the same requirements for pit latrines) which should be backfilled and covered with its location properly reported and documented in the Environmental Close Out Assessment (ECOA) report.

[20] Some references: WHO Guidelines for the safe use of Wastewater, Excreta and Greywater, Volume IV (p81) and Sanitation Compendium of Sanitation Systems and Technologies, 2nd revised version, IWA, EAWAG, WSSCC

[21] Refer to the Guidelines for Environmental Clearance and Handover of Mission / Field Entity / Field Entity Sites (2018.28)

C. GREYWATER

99. Greywater is defined as water from sinks, showers, laundry and kitchens. If Greywater is collected separately, it can be disposed using soak pits, infiltration/evaporation ponds, or leaching chambers. Refer to Flowchart 1 and to the next section for details.

100. Oil, fats and grease need to be removed from Greywater from kitchens before disposal:

101. Each kitchen has to be equipped with a grease interceptor to prevent fats, grease and other frying oil residues from entering the sanitary sewer and septic systems [22]. For kitchens with less than 20 users, a grease trap positioned before the connection to the sewer line is a valid option. Refer to SSU Database for drawings and details.

102. Grease interceptors need to be inspected and cleaned on a regular basis, at least once per month. Fat, oil and grease need to be removed and disposed of in an appropriate waste stream (e.g., incineration, landfill, and compost in small amounts) as soon as they reach more than 25 percent of the total depth of the grease interceptor.

103. If Greywater is reused, it will have to conform to the same quality standards as blackwater for the type of reuse considered.

D. OILY WATER

104. Wastewater generated in transport workshops, car washing bays, machinery, engines/generators, fuel farms, fuel storage tanks areas, fuel dispensing areas and used oil storage areas generator, fuel storage and distribution areas have to be channelled through an oil/water separator to reduce the risk of oil pollution to ground and water sources[22]. Refer to Flowchart 1 and to SSU Database for drawings and details.

105. Oil/water separators need to be regularly maintained, and floating oil be disposed of in an appropriate waste stream (similar to used petroleum, oil and lubricants) when exceeding 5 percent of wetted height.

[22] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

C.8.2. Treatment technologies

106. The paragraphs below detail the main characteristics and minimum requirements of wastewater treatment technologies which should be implemented in UN field missions. Refer to Flowchart 1. Signage and additional security measures (e.g., fencing) should be provided as needed to prevent unauthorized access to the sites or facilities used for these technologies. For each technology, further guidance and detailed design may be available in the SSU Database. Technical Assistance can also be requested to UNGSC through the Environmental Technical Assistance Request SOP if needed.

A. LIQUID STREAM

a. Septic tanks

107. Septic tanks partially treat wastewater by separating solids from the liquid and providing limited digestion of organic matter. Settleable solids and partially decomposed organic matter accumulate at the bottom of the tank, and scum and other floatable material rise to the top of the tank's liquid level. Final treatment is provided through microbial action in the soil when the effluent is disposed in a soak pit or leaching chambers, or in a recirculating sand filter when providing tertiary treatment.

108. A septic tank has a two compartment or chamber design, length-to-width ratio between 2:1 to 3:1, flow coming into and out of the short sides of the tank, and liquid water depth between 1.2 and 1.8 meters. The tanks are covered and sealed. It needs to provide a minimum hydraulic retention time of 24 hours[23] and to have a minimum freeboard of 30 mm to allow the accumulation of scum in the tank.

109. When properly designed, septic tanks only need to be inspected once per month and its contents completely pumped out once every 3 to 5 years.

110. At site/mission closure, a handover agreement between the mission and host government/landowner/another UN entity needs to determine if the septic tank(s) are to be handed over for use by host country/landowner/another UN entity, removed, or abandoned in place. In any case, the contents of the tanks are expected to be pumped out and properly disposed. When abandoning in place, remove top of the septic tank, drill holes through tank bottom to prevent the retention of water, and backfill.

b. Secondary treatment

111. Secondary treatment provides full and final stage of wastewater treatment for the type of disposal method/end use selected. Systems providing this level of treatment (i.e., meeting the specified quality standards) are listed below from simple to complex.

i. Oxidation Ponds

112. Detailed analysis and consideration must be given to oxidation ponds before they are constructed and used. Short-term missions should not construct and use these systems. Longer-term missions may consider and construct these systems for their use only after a detailed investigative study and Environmental Impact Assessment is undertaken and support the use of oxidation ponds.

113. At site/mission closure, a handover agreement between the mission and host government/landowner/another UN entity needs to determine if the oxidation pond(s) are to be handed over for use by host country/landowner/another UN entity or abandoned in

[23] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

place. In either case, accumulated sludge in the ponds are expected to be removed and properly disposed. Abandoned ponds have to be properly backfilled.

ii. Aerated Lagoons

114. Aerated lagoons are like oxidation ponds except that they are deeper and have mechanical surface aerators to accelerate the breakdown of organic material. These systems are most appropriate for longer-term missions, and after a detailed investigative study and environmental impact assessment are completed that support their use.

115. At site/mission closure, a handover agreement between the mission and host government/landowner/another UN entity needs to determine if the aerated lagoon(s) are to be handed over for use by host country/landowner/another UN entity or abandoned in place. In either case, accumulated sludge in the lagoons should be removed and properly disposed. Abandoned lagoons have to be properly backfilled.

iii. Extended Aeration Activated Sludge Process

116. When the other two secondary treatment processes above are not appropriate to use, the extended aeration activated sludge process is preferred. This process is a type of activated sludge process that uses larger aeration tanks with longer solids retention times (i.e., sludge is kept in the process longer before removing/wasting). These systems do not require primary treatment, and because of the larger aeration tanks used, provide good equalization during high flow periods. This process is ideal for smaller communities (less than 4,000 cmd) and where less complex operation is preferred.

117. Pre-treatment consists of screening and girt removal. If deemed necessary, an equalization tank may still be used.

118. Full treatment processes may also be undertaken within a minimum of two sequencing batch reactors. Each sequencing batch reactor undergoes the following sequence of treatment: fill, react, settle, decant. The tanks are sized so that one tank is filling while the other tank(s) is cycling through its treatment sequence.

119. These treatment plants are usually constructed with the intent for hand over to host country/landowner/another UN entity when the site closes. The treatment plant should be handed over in perfect working condition along with a stock of spare parts and consumables for one year of standard operation. The handover agreement needs to include a comprehensive training session for host country/landowner/another UN entity operators to ensure proper operation and maintenance of the plant.

c. Tertiary treatment

120. Tertiary treatment provides full and final treatment of the wastewater for the type of disposal method/end use selected. Systems providing this level of treatment (i.e., meeting the specified quality standards) are listed below.

i. Recirculating Sand Filters followed by disinfection

121. Recirculating sand filters consist of septic tank(s), a recirculation tank, and an open sand filter. Wastewater receives partial treatment in a septic tank before flowing into a recirculation tank where it is mixed with wastewater that has passed through the sand filter. This wastewater mixture is pumped and evenly distributed over the sand filter. Treated wastewater is collected in underdrains at the bottom of the filters and is either recycled back to the recirculation tank or discharged for reuse.

122. At site/mission closure, a handover agreement between the mission and host government/landowner/another UN entity needs to determine if the recirculating sand filter(s) are to be handed over for use by host country/landowner/another UN entity or abandoned in place. In either case, accumulated sludge in the septic tanks should be

removed and properly disposed. When abandoning in place, remove top of the septic and recirculation tanks, drill holes through tank bottoms to prevent the retention of water, and backfill.

ii. *Activated sludge process followed by tertiary filtration and disinfection*

123. The plant includes screening, grit removal, flow equalization, aeration and clarification (activated sludge), disinfection, tertiary filtration through sand filters and then activated carbon filters.

124. These treatment plants are usually constructed with the intent for hand over to host country/landowner/another UN entity when the site closes. The treatment plants are expected to be handed over in perfect working condition along with a stock of spare parts and consumables for one year of standard operation. The handover agreement needs to include a comprehensive training session for host country/landowner/another UN entity operators to ensure proper operation and maintenance of the plant.

iii. *Packaged Wastewater Treatment Plants from Systems Contract*

125. Package plants are preferred where rapid deployment is required and are most appropriate for shorter-term missions.

126. For these systems, mission needs to have the following:

- Sufficient capacity and skills to operate and maintain, either done in-house or by a contractor,
- Proper training of operators,
- Permanent availability of critical spare parts on site to be able to repair any breakdown within a two days (48h) notice.

127. Due to the relatively high level of complexity, operating costs and careful maintenance and skilled operators required, handover of packaged wastewater treatment plants from Systems Contracts to host country/landowner is not recommended. Conventional technologies are preferred for long-term missions and where assets may be turned over to the community when the mission is liquidated.

128. In situations where Packaged Wastewater Treatment Plants are removed at camp closure, but functional sanitation facilities left in place, they should be replaced with a functional septic system (septic tank with soak pit or leaching chambers) as a minimum. If no functional sanitation facilities are left in place, the treatment plant(s) should be removed, and the site restored to its original condition. Non-functioning plants will be emptied, cleaned, and disinfected prior to disposal in accordance with the relevant waste management plan.

B. SOLIDS STREAM

a. Screenings and Grit

129. Screenings and grit are removed during pre-treatment at a wastewater treatment plant. These by-products of treatment may be disposed at a landfill or disposed of through an appropriate waste stream (e.g., incineration).

b. Septage

130. Septage is the product removed when septic tanks are pumped out. Septage require additional treatment before being safely disposed. It should be delivered to the wastewater

treatment plant where it is screened before allowing the solids and liquid to separate in a settling tank. The liquid is combined with other incoming wastewater and treated at the plant in a manner that does not shock or overload plant facilities. The solids are disposed with the plant sludge.

131. If a plant is not available, or the available plant does not have the capacity or facilities to receive septage, septage may be treated as described below for “sludge dewatering followed by lime treatment”.

c. Sludge

132. Sludge is the product removed from the settling tanks at activated sludge plants and requires additional treatment before being safely disposed.

i. Sludge dewatering followed by lime treatment

133. Sludge is first dewatered in a sludge dewatering bed or container. Depending on prevailing climatic conditions, shallow evaporation ponds may also be used to dry the sludge. Lime is then blended into dewatered sludge until pH of sludge rises above 11 for several days. Leachate collected at the bottom of the beds or container should be returned to the plant for treatment. The dry sludge may be disposed at a landfill or disposed of through an appropriate waste stream. The sludge may also be reused for agricultural purposes.

ii. Sludge dewatering followed by composting

134. Sludge is first dewatered in a sludge dewatering bed or container. Depending on prevailing climatic conditions, shallow evaporation ponds may also be used to dry the sludge. The dewatered sludge is then mixed with green waste and composted. Leachate collected at the bottom of the beds or container should be returned to the plant for treatment or safely infiltrated into the ground. The dry sludge may be disposed at a landfill or disposed of through an appropriate waste stream. The sludge may also be reused for agricultural purposes.

iii. Aerobic digestion followed by sludge dewatering

135. The sludge is aerated for stabilization, and then dewatered in a sludge drying bed or container. Depending on prevailing climatic conditions, shallow evaporation ponds may also be used to dry the sludge. Leachate collected at the bottom of the beds or container should be returned to the plant for treatment. The dry sludge may be disposed at a landfill or disposed of through an appropriate waste stream.

iv. Reed beds

136. Reed beds provide sludge drying and nutrient removal. The reed beds need to be constructed with tanks configured to collect leachate at the bottom and return it back to the plant for treatment. The tank walls should be minimum of 4 m high. The reeds used should be geographically robust in hazardous conditions with high nutrients and water absorption capacity. The use of exotic invasive plant species is prohibited. Reed beds are environmentally friendly, odor free, and lasts longer with less maintenance when compare to the other sludge treatment and disposal technologies. Reeds usually need to be cut annually. Cut reeds can be burned, composted, or disposed in a landfill.

C.8.3. Quality control

137. The following quality standards have to be reached after treatment[24]:

PARAMETERS	MINIMUM LEVELS FOR DISPOSAL / REUSE				
	Secondary Treatment	Tertiary Treatment		Sludge	
		Disposal or Restricted* Reuse	Unrestricted** Reuse	Disposal	Reuse
BOD5 *5-day Biochemical Oxygen Demand*	• Yearly average ≤ 30 ppm • Quarterly sample ≤ 45 ppm. Important: - BOD5 will be measured at least quarterly. - If needed, for practical reasons, monthly monitoring done using COD/BOD5 ratio is acceptable, provided ratio is determined specifically for each site using the methodology provided in Annex J. - The ratio will have to be checked quarterly and re-adjusted if necessary.			-	-
COD (optional) *Chemical Oxygen Demand*	• Weekly monitoring is preferable, especially for large sites • Monthly monitoring is acceptable for remote sites • Acceptable limit: i) is site specific and ii) is determined from the correlation with BOD5			-	-
TSS *Total Suspended Solids*	• Monthly average ≤ 30 ppm • Weekly sample ≤ 45 ppm Important: - TSS should preferably be measured at least twice per month. - Monthly monitoring is acceptable for remote sites - If needed, for practical reasons, weekly monitoring done using a turbidity/TSS ratio is acceptable provided i) ratio is determined specifically for each site using the methodology provided in Annex J and, ii) checked monthly and re-adjusted if necessary.				
pH	6.0 to 9.0			-	-
Fecal Coliforms	-	Minimum measurement frequency is twice per month and sample ≤ 1,000/100 ml.	Weekly sample ≤ 1/100 ml.	-	-
Free chlorine***	-	-	0,5 to 1 mg/l at the point of use, daily sample	-	-
Turbidity	-	-	Weekly average ≤ 2 NTU. Daily sample ≤ 5 NTU.	-	-
Other					Compost or lime treat before reuse
* Restricted reuse: use for non-potable application and no direct contact with treated effluent (e.g., drip irrigation of plants) ** Unrestricted reuse: use for non-potable application and possibility of direct contact with treated effluent (e.g., toilet flushing, car washing, dust control, spray irrigation) *** Only if chlorination is used for disinfection					

Table 2: Treated wastewater minimum quality standards

[24] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

138. For each parameter, the recommended method of analysis is listed in Annex J.

139. Appropriate record has to be kept of the analysis conducted on file and in a database. Up-to-date records are expected to be available upon request.

140. Once per year as a minimum, mission should have an independent laboratory perform the following analysis on a treated wastewater sample collected by their own means at each major site: BOD5, COD, TSS, pH, Fecal Coliforms, Turbidity and Free chlorine (if applicable). Appropriate records should be kept of the results and any eventual significant difference between the mission's and the independent laboratory results should be investigated and clarified.

141. During commissioning phase, in case of breakdown, or non-compliance with the standards, the analysis frequency needs to be increased until treatment performance (re)reaches the expected level. Disposal or end-use options should be temporarily revised if the quality of treated wastewater significantly deviates from the standards.

142. Integration with the Field Remote Infrastructure Management (FRIM) program or an equivalent remote monitoring system should be used if available. The FRIM program allows remote monitoring and recording of parameters measured automatically in the field.

C.9. WASTEWATER DISPOSAL

143. Key considerations regarding wastewater disposal infrastructure constructed within field mission's camps are described below. In any case, mission should refer to the SSU Database and follow the available design calculations and recommendations.

144. The wastewater disposal system appropriate for the treatment system will be selected using Flowchart 2 considering the site conditions, operation and maintenance complexity and cost. The types of disposal system are listed below:

C.9.1. Soak Pit(s)

145. Soak pits are deep excavations used for subsurface disposal of pre-treated wastewater (e.g., septic tank effluent). Wastewater enters the chamber where it is stored until it seeps out through the chamber wall and infiltrates the sidewall of the excavation. Soak pits may be left empty and lined with porous material to prevent collapse or may be left unlined and filled with coarse media (rocks or gravel).

146. Maintaining sufficient separation between the bottom of the soak pit and the high-water table is a particularly important consideration for protection of groundwater quality when septic tanks are used. Since the dominant infiltration surface of a soak pit is the sidewall, the depth and diameter of the pit is determined from the percolation rate and thickness of each soil layer exposed by the excavation. Use a weighted average of the percolation test results for design.

147. Soak pits should only be used where the following two conditions apply:

- it can be guaranteed that there is a minimum clearance, from the bottom of the soak pit to the highest season level of the water table, of 3 metres, and
- the soil percolation rate is superior to 12 cm/day.

148. Minimum separation distances should be as specified below unless more stringent measures are required following an EIA if applicable. Consideration also needs to be given to neighbouring property uses and separation from them.

Structure	Minimum Separation (horizontal distance)
Well/Drinking water source	• 30 meters if the aquifer is deep and/or confined • 100 meters if the aquifer is shallow and/or unconfined. Additional special attention is recommended if the drinking water source is located downstream of the soak pit(s)
Dwelling/Building foundations	6 meters
River/Stream	30 meters
Camp boundary	10 meters
Other soak pits	30 meters

Table 3: Minimum separation distances from soak pits

C.9.2. Leaching Chambers

149. Leaching chambers are constructed of molded plastic (polypropylene or high-density polyethylene); and are dome shaped with a solid top, an open bottom and louvered

sidewalls. The chambers are typically furnished in 1.32-meter sections in widths of 0.86 meter that are field connected to one another to make each row. A row is finished by installing an end plate/cap on each end of the row. Each row is then connected to one another through interconnecting piping. If chambers with the sizes specified are not locally available, the chambers used should be as large as possible and have dimension as close to the sizes specified.

150. Leaching chambers may also be constructed with mortared stone masonry or reinforced concrete walls, and a reinforced concrete cover.

151. These systems can take traffic loading when the correct model or design is used, and properly installed.

152. Chamber rows may either be installed individually in trenches or in a bed. Row lengths should not exceed 30 meters. Trenches are excavated to the width and depth required. The bottom of each row needs to be level and flat. Scarify the bottom and sidewall surfaces to remove any smearing than may have occurred during excavation. For bed installation, excavate area and level installation area. Scarify surface to remove any smearing that may have occurred during excavation. Place chamber rows 15 cm apart.

153. Unless more stringent measures being defined following an EIA if applicable, the same minimum separation distances as soak pit should be respected as far as is practicable.

C.9.3. Infiltration/Evaporation Pond

154. Infiltration/Evaporation pond(s) should be carefully designed taking into consideration influent flow and evaporation/infiltration rates. Detailed analysis of the environment needs to be undertaken before they are constructed and used to prevent overtopping.

155. Infiltration/Evaporation pond(s) will be in a secured area and fenced to prevent direct contact of pond contents with mission personnel and the general public.

156. When using the ponds to dispose of Greywater, treatment may be needed before disposal to prevent adverse impacts (e.g., odor, mosquito breeding, etc.). The need for treatment and the level of treatment required is determined on a case-by-case basis.

C.9.4. Artificial wetlands

157. Artificial wetlands may be used for discharging secondary treated wastewater in congested locations with low infiltration capacity.

158. The wetlands should be constructed by surrounding the area with earthen mounds/dikes.

159. The reeds/trees used should be geographically robust in hazardous conditions with high nutrients and water absorption capacity.

160. The use of exotic invasive plant species is prohibited.

C.9.5. Surface water discharge point

161. The discharge point into a surface water body needs to be properly constructed to:

- Avoid erosion and allow flow measurement.
- Allow regular sampling to control the quality of the effluent before they reach the natural environment.

C.9.6. Groundwater recharge

162. Any project that reuses treated wastewater for groundwater recharge is subject to an EIA prior to implementation. The EIA may require additional studies and analyses to determine feasibility.

163. The well(s) or area dedicated to groundwater recharge should be:

- Fenced and clearly identified as treated effluent discharge well(s) or area.
- Equipped to monitor: i) the quality of the effluents discharged, ii) the discharge flow and iii) the aquifer's piezometry.

164. The installation of a control piezometer downstream is highly recommended to monitor the impact on groundwater quality and piezometry.

165. The minimum level of treatment required is specified in Flowchart 2. A higher level of treatment may be needed, however, depending on the groundwater aquifer and its use, and as identified in the EIA.

166. At mission closure, the recharge well(s) should be plugged or area should be filled in.

C.9.7. Reuse

167. Wastewater treated for reuse will not be used for drinking.

168. In addition to the requirement stipulated in paragraph 137 regarding the quality of recycled water, Mission is expected to develop and implement a risk-based approach for identifying and controlling potential threats to recycled water quality, considering especially treatment performances and effluent quality monitoring.

169. Storage tanks for treated wastewater:

- If treated wastewater is to be reused on site, the required quality standards based on its end use should be met prior to storage in these tanks.
- It is critical that the tanks are clearly identified as containing recycled wastewater which is not drinkable.
- Treated wastewater should not be stored for more than 7 days. The chlorine level should be controlled every 3 days and readjusted in the storage tank if necessary. The chlorine level needs also to be checked before reuse

170. Piping and piping fixtures need as well to be easily distinguished from other water piping and piping fixtures to prevent cross connections between the two systems. A specific color should be dedicated for piping and piping fixtures used for recycled wastewater. "Purple" is recommended if no pre-existing color is already used by the mission

171. Mission is expected to communicate to personnel on recycled water quality and its application to ensure health and environmental risks are understood. In addition, signage needs to be posted at each point of use to indicate that the water is not suitable for drinking. An example of signage to use is provided in Annex K.

C.10. WASTEWATER RISK MANAGEMENT

172. Missions are expected to dedicate all the necessary resources to ensure proper and safe management of wastewater in the field: clear and comprehensive operation and maintenance procedures, trained and qualified operators, effluent quality control, properly sized equipment, sufficient stock of spare parts and consumables, regular site inspection and close oversight of contractor(s) if outsourcing is in place. Immediate mitigation action has to be undertaken when a problem occurs or is reported.

173. Missions should develop a Wastewater Emergency Contingency Plan that is adopted as and when needed to ensure continuity of wastewater treatment and management of wastewater risks at camps in situation of crisis. Wastewater Emergency Plans need to include stakeholder engagement, water conservation measures, stocking of critical spare parts and consumables, and measures to implement at various levels of potential crises including full lockdown. The Emergency Plan should be revised as necessary to reflect changes and improvements needed based on lessons learned.

174. Within the Performance and Risk Management Framework and the Environmental performances reporting process to Member States, Missions must periodically report on the risk level associated to wastewater management operations in the field. A wastewater risk assessment must be undertaken by answering a series of questions at least once every 6 months at site level and duly reported within the periodic environmental performance reporting process. The principles of the risk assessment methodology are based on the Source - Pathway – Receptor model in which wastewater management is to be assessed all along the sanitation chain, from the source (e.g., ablutions) through final disposal. If a Significant Risk level is reported, Mission shall prepare a Risk Mitigation Plan (RMP) to immediately reduce risk levels and the RMP shall be signed by the SRSG. Further guidance on the risk assessment indicators and risk level scoring are available is the latest MEAP Instruction Manual.

175. The wastewater risk assessment should be conducted preferably by the Environmental Officer with a member of Watsan unit. In certain circumstances, the assessment can be conducted by designated focal points located on site. The result of the assessment needs to be properly documented with record kept. In case of inability to conduct an assessment, technical assistance should be requested to UNGSC/ETSU as per the Environmental Technical Assistance SOP, so that remote support can be provided (e.g., GIS, desktop, etc.).

C.11. WASTEWATER MANAGEMENT PLANNING

176. Missions should prepare a Wastewater Management Plan to support the strategy adopted for wastewater management in the field and adapt the implemented treatment setup(s) to camps' environment, size, phase, operation and maintenance capacity, etc. The plan needs to be updated as needed to support budget planning and investments throughout mission's life until liquidation and handover[25].

C.12. ADDITIONAL MITIGATION MEASURES

177. To further guard against potential negative impacts of water and wastewater activities on the environment, efforts should be made to increase the mission's awareness of aquatic ecosystems and the need to use and manage water in a sustainable and cost-efficient manner and to encourage mission involvement in water resource and wastewater risk

[25] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

management. The Water and Wastewater Specialist is expected to coordinate this activity through collaboration (e.g., with the mission Environment Unit, or similar).

178. Where an Environmental Impact Assessment study has been undertaken, it needs to provide context specific mitigation measures regarding the impact of the Field Mission on water resource(s). This should include a plan/method that will be adopted to ensure that i) water abstraction is sustainable and properly monitored, ii) water use is planned, iii) wastewater management and treated effluent discharge are controlled to ensure a minimum level of wastewater related risk and iv) the environment is given an adequate share of the water to preserve ecosystems. Indeed, Missions are required to recognize the need to reserve water for the environment to minimize the impact of water extraction on wildlife.

C.13. NATIONAL LAWS, REGULATIONS AND INTERNATIONAL TREATIES

179. Peacekeeping missions should respect all local laws and regulations in relation to mitigating the negative impact of water activities (i.e., sourcing, treatment, distribution and storage) and wastewater management (collection, treatment and disposal) on the environment. Where there is lack of relevant national laws and regulations governing these activities, the international obligations under international treaties and international best practice standards, to which the host country is a party[26], will provide the standards of conduct with which the mission need to comply.

[26] Also consider Report of the Special Rapporteur of 24 January 2018 (A/HRC/37/59) which presents framework principles on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment.

D. ROLES AND RESPONSIBILITIES

180. Engineering Section/SSS/LD should set strategic direction, exercise oversight and take guidance decisions; a comprehensive list of responsibilities is in Annex L.

181. UNGSC should be responsible for supporting the implementation of this guidance. UNGSC should additionally provide technical support functions to field missions which includes remote support, on-ground assignments, or a combination of these two. Specific functions are in Annex L.

182. The Head of Mission should take all appropriate measures to ensure the observance of this document. He/she may delegate their authority to the Director/Chief of Mission Support to establish instructions and operating procedures to implement the environmental objectives and obligations.

183. The Director/Chief of Mission Support should ensure that the Mission respects all local laws and regulations in relation to mitigating the negative impact of water activities and operates in compliance with this manual in wastewater management, including conducting periodic sites risks assessment. The DMS/CMS should further be responsible for ensuring Mission compliance with the guidance through:

183.1. allocation of the recommended resources to suit specific field mission water supply and wastewater management needs. This guidance advocates for the hiring of water/wastewater professionals with sound knowledge bases who are capable of:

(i) adopting this manual

(ii) formulating management plans which are specific to the mission/camp local environment

(iii) providing feedback to enable relevant decision-making

(iv) managing continuously wastewater associated risks

(v) maximizing on opportunities for sustainability

A generic structure of the mission Water and Sanitation Unit and corresponding functional requirements is proposed in Annex H; it should be adopted to meet mission-specific needs and challenges.

183.2. ensure that resource planning for mission deployment adopts an integrated and holistic approach to i) optimize water supply with appropriate consideration of water resource sustainability and ii) manage wastewater with all the required attention and in safe manner.

183.3. ensure that wastewater risk assessment is regularly conducted and continuous improvement is supported by the establishment of wastewater management plans

183.4. instituting Administrative Instructions to ensure compliance

183.5. ensuring an SOP for guiding implementation is prepared and promulgated

183.6. monitoring compliance with the Mission SOP on Water and Wastewater Management.

184. The Chief of Engineering and Facilities Management Unit (EFMS)[27] should:

184.1. ensure implementation of the Water & Wastewater Manual through the SOP

184.2. provide expert technical advice on the Water & Wastewater procedures and manual

[27] Or the person who has the delegated authority to serve in this role

184.3. approve the designs of major water supply and wastewater treatment infrastructure projects

184.4. ensure the application of the SOP for EIA for all water and wastewater projects and enforce the implementation of recommended mitigation measures if any

184.5. ensure that bulk water and drinking water are supplied in accordance with this manual

184.6. ensure the minimum water storage requirements are secured

184.7. enforce a Water Conservation Program

184.8. ensure that mission water sources are considered with respect to sound environmental practices

184.9. adopt a Water Safety Plan (WSP) concept to ensure the safeguard of public health

184.10. ensure a camp zero-leakage policy is adopted

184.11. adopt a plan to ensure that the environment is given an adequate share of water of adequate quality

184.12. ensure that treated wastewater meets the expected standards depending on the final disposal or reuse option considered

184.13. ensure that wastewater collection, storage, treatment, and disposal infrastructure are sufficient in capacity, operated and maintained carefully all along the chain.

184.14. ensure oversight on treatment performance and infrastructure operation and maintenance, whether provided through in-house resources or ensured by an external contractor.

184.15. ensure the development, resourcing and implementation of a Wastewater Management Plan where applicable.

184.16. Where COE is used for water or wastewater treatment, ensure that defined processes, procedures, and treatment requirements are met and that all risks, especially in relation to wastewater are adequately managed. Where any concerns arise, these should be immediately mitigated in close coordination with the Chief COE.

185. The Chief Water and Sanitation[28] should:

185.1. develop the Mission SOP and guidelines for the operationalization of this guidance. This SOP will establish more comprehensive mission-specific roles and responsibilities in the context of this guidance (e.g., Facilities Management)

185.2. plan and manage the operation and resources of the Water and Sanitation Unit, including staff

185.3. prepare and manage the water and wastewater budget in a manner to ensure sufficient resources are prioritized to meet the objectives herein

185.4. manage the raising of requisitions, carry out technical evaluations and inspections (for compliance with standard practice and sound risk management) of delivered assets, spare parts, chemicals, reagents and services needed for water and wastewater management

185.5. oversee stock levels of spare parts and chemicals needed for water and wastewater management

185.6. analyse, plan, design and oversee the construction and maintenance of water supply systems including source development, water resource monitoring, fit-for-purpose water treatment, water storage, water distribution, water recycling and water safety

[28] Or the person who has the delegated authority to serve in this role

185.7. analyse, plan, design and oversee the construction and maintenance of wastewater management systems including wastewater collection, storage, conveyance, treatment and disposal

185.8. undertake the implementation of any recommended mitigation measures regarding the impact of water and sanitation related activities on the environment

185.9. evaluate, review and revise project documents including designs, scopes of work, general & particular specifications and contracts for water supply and wastewater infrastructure projects

185.10. define and manage the performance of contractors providing water and wastewater management services

185.11. ensure water and wastewater quality tests are carried out as prescribed in this manual

185.12. adopt and enforce an adequate monitoring system to ensure sustainable effectiveness of the water and wastewater treatment processes and ensure that records are properly kept

185.13. manage routine inspection and improvement of the performance of water and wastewater treatment plants as recommended by the equipment manufacturer

185.14. ensure the implementation of routine, periodic and comprehensive inspection of water storage and distribution facilities as well as wastewater facilities including collection, storage, conveyance, treatment and disposal infrastructures

185.15. provide expert guidance and manage participation in COE and ORI inspections to ascertain the performance of contingent owned water and wastewater treatment plants and other related facilities

185.16. develop and enforce a water conservation and safety plan including water source pollution prevention and control measures

185.17. develop and update the mission's water Emergency Plan

185.18. develop, implement and update the Mission's Wastewater Management Plan

185.19. liaise with government functionaries on all matters related to water and wastewater management to UN operations

186. The Chief of the Environment Unit[29] should:

186.1. objectively review the Mission's water & wastewater management practices, and especially:

i. The processes documented in the SOP for Water and Wastewater management

ii. The requirements of the risk and performance management framework in order to evaluate the efficacy of the risk management procedures in place

186.2. ensure that the Environment Unit assesses wastewater risk compliance as part of the regular inspections, including the validation of any wastewater risk assessment at each mission site at least once every six months, prior to final mission approval of such data and submission to DOS for the issuance of the mission's annual Environmental Management Scorecard

186.3. make recommendations on how to improve internal controls and governance processes, in consultation with the Chief Engineer and Chief Water and Sanitation

186.4. ensure that the mission is complying with relevant laws and statutes

[29] Or the person who has the delegated authority to serve in this role

186.5. contribute to ensure the proper application of the SOP on Environmental Impact Assessments for water and wastewater related projects

186.6. conduct an awareness campaign on water conservation and wastewater management, disseminated at site-level, to help motivate behavioural change and improved performance

186.7. support the overall implementation of this manual

187. The Chief Supply Chain should exercise his/her capacity to provide specific guidance and policy on acquisitions, procurement, warehousing, asset and inventory management, transportation, and freight planning, expediting movement and tracking to support the implementation of this manual. The Chief Supply Chain should:

187.1. ensure water and wastewater management is effectively integrated within the supply chain processes of the mission

187.2. ensure that the supply chain budget supports effective and cost-efficient water and wastewater supply chain services across all mission components and provide advice to any reprioritization of supply chain resources during the budget period, especially in line with wastewater risk management

187.3. maintain active communication with UN headquarters and the Global Service Centre to ensure that the Demand and Integrated Business Planning processes are consistent with the mission's environmental action plan and water/wastewater management plan, as well as to support the mission in meeting the requirements of this manual

188. The Chief of Service Delivery30 should ensure the overall management of the technical and logistical support services to all Mission components through planning, coordinating and delivering integrated technical and logistical services including management of staff, assets and budgetary resources. The Chief of Service Delivery should:

188.1. contribute to planning for and resourcing operational requirements; ensure that the demands for water and wastewater goods and services are planned and resourced, forecasted, accurate, and submitted in a timely manner to allow for processing through the supply chain; and ensure successful implementation of related activities

188.2. ensure efficiency and effectiveness of support services for water and wastewater management, and serves as the principal liaison with the Regional Service Centre (Global Service Centre) and Headquarters as appropriate

188.3. ensure that water and wastewater related support services satisfy UN rules and regulations, and take account of this manual

188.4. advise senior management on water and wastewater services management, structures and staffing levels ensuring that they are adequate at all times to meet the requirements of missions' needs

[30] Or the person who has the delegated authority to serve in this role

E. TERMS AND DEFINITIONS

189. Water Supply: For purposes of this document, water supply is deemed to cover all elements of water sourcing and/or production, purification and processing, storage and distribution.

190. Wastewater Management: Wastewater management comprises all elements related to wastewater from its point of generation to final disposal and covers collection, storage, transport, treatment, disposal and reuse, both for liquid and solid streams.

191. Water/Wastewater Specialist: The term Water/Wastewater Specialist in this guidance implies a qualified person with sufficient knowledge and sound experience in fields related to water and wastewater engineering; these fields include, but are not limited to, civil/hydraulic/environmental/sanitation/chemical engineering, hydrogeology, hydrology, water quality, treatment or technical specializations. The role and professional bias/strength of the Water/Wastewater Specialist should be chosen/determined to suit the particular field challenge in the water and wastewater management cycle; it may also vary with the mission phase.

F. REFERENCES

192. Normative or superior references:

A. WHO Guidelines for Drinking Water Quality

193. Related procedures or guidelines:

B. Contingent Owned Equipment (COE) Manual (A/75/121), 2020

C. UN Military Engineering Unit CET Search and Detect Manual (2020.03)

D. SOP on Environmental Impact Assessment for UN Field Missions dated of May 2019

E. Guidelines for Environmental Clearance and Handover of Mission / Field Entity / Field Entity Sites (2018.28)

F. Waste Management Policy for UN Field Missions (2018.14)

G. Environmental Technical Assistance Request SOP (GSC/SOP/165.00), dated of October 2017

H. Mission Start-up Field Guide dated August 2012

I. Environmental Policy for UN Field Missions (2009.6)

J. Water Policy and Strategy of UNEP dated 2008

K. Guidelines on Water Supply for UN Field Missions dated June 2007

L. Engineering Support Manual dated March 1998

G. MONITORING AND COMPLIANCE

194. This manual should be monitored for compliance and implementation, at least annually, by the relevant Director/Chief Mission Support.

195. The D/CMS in each Field Mission should monitor compliance with this manual; especially taking into consideration mission-specific environmental sensitivities (i.e., a risk-based

assessment and response), and the need for corresponding, tailored mitigation and sustainable measures to be adopted. A precautionary approach should be adopted in the decision-making process. Where there is risk and/or diminishing likelihood of achieving compliance that may result in environmental, human health or safety impacts (actual or potential) it is the responsibility of the D/CMS to escalate concerns to the Director UNGSC, for the attention of the Chief Environmental Technical Support Unit.

196. The consequences of non-compliance with the compulsory aspects of this manual may result in risks to safety, the health and well-being of field personnel, environmental degradation, damaging public relations and perception. Where warranted, this might result in a nullification of the Score reported to Member States in the RBB Framework, to ensure the immediate implementation of appropriate mitigation measures.

H. CONTACT

197. The Director, GSC is the primary contact for this manual.

I. HISTORY

198. This is the first version of this manual. This document supersedes all references to the Draft Water Guidance for UN Field Missions.

Approved by:	Approved by:	Approved by:
Rosemary A. DiCarlo Under-Secretary-General for Political and Peacebuilding Affairs	Atul Khare Under-Secretary-General for Operational Support	Jean-Pierre Lacroix Under-Secretary-General for Peace Operations
Date: 14 January 2022	Date: 17/12/2021	Date: 13 January 2022

ANNEXURES

ANNEX A : THE FIELD MISSION WATER SUPPLY CONCEPT

Purpose of the Mission Water Supply Concept

1. The purpose of the FMWSC is to provide an information base from which to plan, develop, manage, monitor and evaluate water supply options and to encourage integrated water system management [31] into mission start-up/establishment, and eventually long-term operations. The initiation of the FMWSC during the TAM[32] should allow for optimized water supply options to be considered alongside force protection, strategic and tactical issues and logistics in the determination of suitable camp locations, deployment numbers and overall mission planning.

Technical Assessment Mission (TAM)

2. The assignment of the Water Specialist to the TAM should be the responsibility of Engineering Section/LSD/DOS; who should ensure that the water engineer, with the most suitable skills to successfully accomplish the specific task, is assigned – it should be the responsibility of this Water Specialist to provide concrete guidance on how mission start-up takes into consideration water supply requirements. Experience in similar environments and knowledge of peacekeeping practicalities is expected to be brought to bear on all plans, which should be realistic, pragmatic and consist, wherever possible, of tried and tested solutions.

3. Resource planning for mission deployment should adopt an integrated and holistic approach to optimize all resources, especially water supply, which is essential for life support. The adoption of a meaningful approach relies on the quality of data available to direct and support decision-making. The preliminary FMWSC, initiated during the TAM, lays the foundation for immediate and future development decisions and henceforth should;

   i. assess possibilities for immediate, reliable, continuous bulk water supplies of sufficient quantity and quality to meet Initial Operating Capability (IOC)[33] requirements
   ii. provide baseline data on water source characteristics to aid the decision-making process during camp and overall mission planning and to minimize the impacts by the base camps on local environments and communities as per the SOP on Environmental Impact Assessment (EIA)
   iii. raise awareness of water resource issues and concerns
   iv. assess threats, trends and emerging issues with respect to which future action may be needed
   v. distinguish between the initial temporary/short-term solutions for water supply and what is required for long-term, sustainable scenarios to be developed (e.g., rainwater harvesting, wastewater recycling).

4. The water demands for sustaining a camp could have a significant impact on the availability of local water resources. Therefore, the FMWSC needs to assess how using the local available water supplies affects the indigenous wildlife population and local human population. In case of water sensitive context (e.g., high water stress level, high

[31] Integrated Water System Management: A process which promotes the coordinated development and management of water and related resources in an equitable manner without compromising the sustainability of local ecosystems. It involves the management framework (i.e., policies, stakeholder participation, management plans, and incorporates scientific, technological, environmental, and social considerations).
[32] Refer to the Mission Start-up Field Guide (rev.2012) for further details on the TAM's objectives, concepts and composition.
[33] The Mission Start-up Field Guide (2010) states that, "The aim of every manager and the mission as a whole is to reach a stage of initial operating capability (IOC)". IOC refers to the point at which a mission has attained a sufficient level of resources and capability to begin limited mandate implementation, significantly expand its presence within the mission area and support its operational elements in the field.

groundwater table, vicinity of drinking water resources/collection points for the communities, etc.), the TAM will recommend within the framework of the SOP on EIA a full Environmental Impact Assessment on water resources, in order to establish appropriate measures to monitor and mitigate the impact to the extent possible[34].

5. Baseline data concerning water source characteristics should be rigorously collected to be able to plan for a sustainable water supply system. The baseline survey should comprise both data collection from State Water Agencies and other institutions active in the water supply sector as well as the physical inspection of any existing infrastructure. The preliminary FMWSC aims to give detailed discussions covering the following strategic points as a minimum:

- what governmental/institutional arrangement is in place for the supply of water; including their policies and any permit requirements?
- what are the possible water sources and/or suppliers?
- in what quantities and of what quality are they available; including how vulnerable/secure are they?
- a description of the local water-sourcing practices, including mapping;
- which sources can be recommended for use by the mission (with ranking and justification of the identified alternatives)?
- what would need to be done to access the recommended sources (remedial works, procurement, well drilling, etc.)?
- what would be the recommendations for treatment in each scenario and on what basis?
- the local general market conditions and its capability to support the mission operations (e.g., is there a local laboratory facility, are there skilled locals water specialists, etc.);
- the critical environmental issues as they relate to water supply in the short (IOC) and long-term (FOC);
- how the above findings affect/may affect the deployment plan?
- what resources are needed in terms of equipment (e.g., trucks, plant, etc.) and personnel (e.g., hydrogeologist, laboratory technician, etc.) to guide sourcing decisions, budgeting and recruitment?
- the key tasks and priorities for the mission Advance Team;
- the critical issues that the mission will need to consider for long term sustainability;
- how to supply the mission's water requirements, while simultaneously protecting critical water resources to limit environmental impact and minimize their effect on long-term livelihoods in conflicted areas?

6. The preliminary FMWSC should provide a comprehensive analysis of water supply options as well as the consequences, risks, threats and opportunities associated with each. This needs to be included in the TAM report to guide further decision-making as the Advance Team is deployed and actual mission start-up commences.

7. Critical activities and responsibilities are outlined below in the form a "Water Baseline Survey Checklist", developed as further guidance towards achieving these objectives:

i. Pre-deployment

- Identification/understanding what water supply characteristics, in terms of type and quality, are required
- Determination/estimation of water needs (i.e., how much will be required)
- Desk study of the local conditions and, to the extent possible, UN Agencies operating locally
- Liaison with GIS and consultations with counterparts facing similar water supply challenges to promote knowledge transfer

[34] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

ii. Within the mission – engagement with all relevant parties to investigate and determine the following which should be included in the TAM report:

- What governmental/institutional arrangement is in place for the supply of water; including their policies and any permit requirements?
- What are the possible water sources and/or suppliers?
- In what quantities and of what quality are they available; including how vulnerable/secure they are?
- A description of the local practices for water sourcing, including a mapping.
- Which sources can be recommended for use by the mission (with ranking and justification of the identified alternatives)?
- What needs to be done to access the recommended sources (remedial works, procurement, well drilling, energy supply for water extraction and conveyance to treatment facilities, etc.)?
- What would be the recommendations for treatment in each scenario and on what basis?
- The local general market conditions and its capability to support the mission operations (e.g., is there a local laboratory facility, are there skilled locals, etc.?)
- The critical environmental issues as they relate to water supply in the short- and long-term, and a recommendation as to whether an EIA has to be undertaken.
- How the above findings affect the deployment plan?
- What resources are needed in terms of equipment and personnel (to guide sourcing decisions, budgeting and recruitment)?
- The key tasks and priorities for the mission advance team
- The critical issues that the mission will need to consider for long term sustainability
- How to supply the mission's water requirements, while protecting critical water resources to limit environmental impact and minimize their effect on long-term livelihoods in conflicted areas

8. The possibility of utilizing the host nation's facilities has to be considered and a thorough assessment of the existing infrastructure and capacities, including operation and maintenance, needs to be combined with an assessment of the willingness of the State Agencies to engage.

9. Where local municipal supplies are possible, it is the responsibility of the Water Specialist to perform a preliminary water system analysis to fully understand the capacity and rates that the system can provide sustainably. It is of paramount importance to not exceed these capabilities and to not put any strain on water supplies for the local population.

10. The Water Specialist should also liaise with counterparts in the Supply Section to provide inputs in relation to the mission's plans for drinking water supplies (emergency and rations).

11. There should be clear transition and knowledge transfer during the mission start-up process, from the TAM to the AT and eventually to the WatSan unit of the Engineering Section.

Advance Team (AT)

12. In comparison to the TAM which is deployed for short duration (typically 2 weeks), the AT may be deployed on Temporary Duty (TDY) for up to three months. During this period, the assigned Water Specialist will progress with the development of the FMWSC; taking into consideration the recommendations put forward by the TAM.

13. The appointment of the Water Specialist to the AT should take into consideration the recommendations of the TAM and aim to match the identified challenges in the field with the most suitably skilled and experienced personnel. ES/LSD/DOS should provide inputs and guidance during this process and should support the mission senior managers, both for the AT and towards the establishment of the mission Water and Sanitation Unit within Engineering Section, or its equivalent.

14. The Water Specialist assigned to the AT should thoroughly review the TAM report to get an understanding of the:

   i. identified short- and long-term needs of the mission
   ii. recommended tasks
   iii. mission locations under consideration and the deployment plan
   iv. security issues
   v. environmental issues
   vi. host country points of contact.

15. The immediate task should then be to interrogate and verify the recommendations of the preliminary FMWSC through supplementary investigation and consultation. Findings during this period need to be documented indicating:

   - agreements with the initial outcomes of the preliminary FMWSC and steps that should follow towards short- and long-term development
   - disagreements with the initial findings of the preliminary FMWSC and why, as well as alternative courses of action for the short- and long-term
   - an in-depth discussion on findings not covered in the preliminary FMWSC and how they may affect initial and future mission plans.

16. Where the Host Nation's water supply infrastructure is able to support UN deployment, discussions should be held to establish written agreement. The mission should ensure that the water tapping points are metered using FRIM or an equivalent remote monitoring system wherever available, that monitoring procedures are in place and that downstream recipients are not adversely affected.

17. An additional output of the AT should be the development of a Water Conservation Programme (WCP) which includes ways of conservation, reuse and recycling to give water conservation the highest priority. The significance of performing this exercise at this stage is to facilitate the planning and design of water conservation efforts for seamless integration into the rest of mission planning and future operations. Water, as an essential resource, should be examined and appraised from source through to the resulting waste generated and all elements given due consideration.

18. The Water Conservation Programme should determine engineering practices based on the plumbing, fixtures and/or water supply operating procedures that can be applied through procurement, construction, installation, commissioning, treatment and eventual day-to-day operation to use water more effectively and reduce the operational costs. It is expected to include recommendations issued in an Environmental Impact Assessment, if undertaken, in order to monitor and eventually mitigate the impact of Field Mission on water resources. Options for water conservation and how they can be implemented are provided as guidance (Annex I). It is the responsibility of the D/CMS during IOC to ensure that sustainable management of water resources is effectively integrated into mission planning and to support the programme as far as practicable.

19. At the conclusion of the AT assignment it is envisaged that the Water & Sanitation Unit would have been established with the initial staff deployed. As part of formal handover procedures, the revised FMWSC and the Water Conservation Programme should be included in the complete package to be handed over to the mission engineering section.

20. The WatSan Unit will then develop a mission-specific Standard Operating Procedures (SOP) to provide guidance and monitor conformance.

ANNEX B: WATER SOURCES

- Surface water sources such as lakes, rivers and streams – perennial rivers and lakes to be considered for long-term water supply
- Groundwater sources such as natural springs, shallow wells and boreholes
- The atmosphere by use of atmospheric water generators
- Rainwater Harvesting – missions should endeavour to capture as much rain water as is practicable. Rainwater will be used to supplement the main sources of water in the mission
- Treated wastewater, provided compliance with paragraphs 137 and 167 to 171. Recycled water, as well as harvested rainwater, can be used for non-potable use such as dust control, fire suppression, landscaping, gardening, toilet flushing, car washing, etc.

The following factors should be considered in selecting a water source for development:

1. water quantity – water availability from the source versus water demand
2. sustainability – the ability of the water source(s) to supply the required quantity for as long as required without interruption and without negative impacts on the environment and on the local communities using the same water source. Seasonality also has a differing impact on resources and should be given consideration.
3. water quality – freshwater resources may contain undesirable elements, either naturally or because they have been exposed to some kind of contamination and may require one form of treatment or another. Source water quality will be determined in order to properly assess the need for treatment. Preference should be given in the following order:
    i. sources requiring minimum treatment
    ii. sources requiring uniform treatment (i.e., sources with a consistent quality problem) so long as the water is contaminated by easily treatable pollutants
    iii. sources with a fluctuating quality should only be considered if the above two parameters cannot be met
4. cost – this includes capital investment (e.g., well drilling), as well as life-cycle costs, treatment, pumping, purchased water supplies, distribution (e.g. trucking) and storage, as well as monitoring and eventual impact mitigation measures implementation.

ANNEX C: POLLUTION PREVENTION MEASURES

Site establishment fall under the scope of the SOP on Environmental Impact Assessment. Hence site establishment is subject to an Environmental Baseline Assessment and where environmental issues are identified, an Environmental Impact Assessment should be completed. Such assessments will provide context-specific monitoring and mitigation actions, in order to minimize the risk of pollution and the impact on water resources, among others.

Nevertheless, below is a non-exhaustive list of standard pollution prevention measures, which apply in any context regardless of Mission's phase:

General facilities, building

1. Establishing settlements at a suitable location away from water sources.
2. Applying green infrastructure in the built environment to prevent or reduce the impact of the development (i.e., camps) on water sources.
3. Preserving and/or restoring wetlands along water sources.

Daily operations

4. Preventing oil and fuel spills by using containers suitable for the oil stored, providing separation and secondary containment to catch any oil spills (concrete bunds), implementing operating procedures to prevent spills and adopting counter measures to clean up and mitigate the effects of any spills.

Solid waste management

5. Positioning solid waste dump sites at a safe distance from water sources based on the hydrogeological conditions and aquifer characteristics in the area under consideration – the minimum recommended distance should be determined as per EIA SOP in sensitive context.
6. Lining solid waste dumps located in areas with a high groundwater tables with plastic sheet to contain the leachate and put in place efficient leachate treatment and disposal system.

Rainwater management

7. Treating polluted surface water runoff prior to discharge to receiving waters.
8. Applying a low impact development approach/sustainable stormwater practices to manage stormwater as close to its source as possible (e.g., by preserving and/or creating natural landscaping, minimizing imperviousness by using permeable pavements, among others).

Wastewater discharge control and proper sanitation:

9. Compliance with the wastewater related guidance provided in this document will ensure proper pollution prevention of water resource due to wastewater management.

ANNEX D: COE RESPONSIBILITIES RELATING TO WATER PURIFICATION AND WASTEWATER MANAGEMENT

1. For Water purification, COE should meet the treatment levels set out in Annex F, Table 2 (see paragraph 33).

2. For Wastewater treatment, COE will have to conform to the wastewater treatments levels set out in the paragraph 137 of this manual and meet minimum risk requirements[35].

3. Contingents are expected to ensure that properly trained/qualified personnel/technicians are included in each rotation to operate and maintain their equipment.

4. COE should be operated and maintained in line with the recommendations of the plant manufacturer.

5. Personnel responsible for operating water purification equipment will ensure that
    - the drinking water standards set forth in paragraph 37 are adhered to
    - water quality testing meets the requirements defined in paragraph 42
    - all consumables, spares and associated supplies are available
    - monitoring and controls are in place and data is archived and retrievable.

6. Personnel responsible for operating wastewater treatment equipment will ensure that:
    - The treated wastewater quality standards set forth in paragraph 137 are conformed with
    - all consumables, spares and associated supplies are available
    - monitoring and controls are in place and data is archived and retrievable
    - regular wastewater risk assessments are undertaken, and minimum risks requirements are met

[35] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

ANNEX E: MINIMUM STANDARDS FOR WATER POTABILITY IN THE FIELD

Constituent	Source Water	Short-term Consumption	Long-term Consumption
Microbiological			
Coliform	10^4 CFU/ml	1 CFU/100ml	1 CFU/100ml
Virus	10^2 PFU/ml	0 PFU/1000ml	0 PFU/1000ml
Spores/Cysts	10^4 CFU/ml	0 CFU/1000ml	0 CFU/1000ml
Physical			
pH	5 – 9.2	5 – 9.2	5 – 9.2
Temperature	4 – 35ºC	4 – 35ºC	15 – 22ºC
Turbidity	50 NTU	5 NTU	1 NTU
Total Dissolved	1000mg/l	1000mg/l	1000mg/l
Solids[2]Color	75 Color Units	50 Color Units	15 Color Units
Chemical (mg/l)			
Arsenic	20	0.3	0.05
Cyanide	200	6	0.5
Mustard	2	0.2	0.05
Nerve Agent	10	0.02	0.005
Glycollate	1	0.07	0.007
Mycotoxin	0.1	0.026	0.0087
Chloride	600	600	600
Sulphate	300	300	300
Magnesium	100	100	100
Nitrate	100	50	50
Cadmium	20	0.05	0.01
Copper	20	2	0.125

Annex E, Table 1 : Minimum Standards for Water Potability in the Field (Source: Quadripartite Standardization Agreement (QSTAG) 245[36])

Notes:

1. It is recommended that water intended for human consumption includes the following analysis as a minimum:
   a. Bacteriological: E. Coli, Total Coliforms, Total plate count
   b. Physico-chemical: Nitrates, Nitrite, Ammonia, Chloride, pH, Color, Conductivity, Total Hardness, Bicarbonate, Sulphate, Sodium, Potassium, Calcium, Magnesium, Fluoride, Iron, Manganese, Copper, Lead, Zinc
2. The conversion factor depends on the chemical composition of the TDS and can very between 0.54 – 0.96. A value of 0.67 is commonly used as an approximation if the actual factor is not known [(TDS)ppm = Conductivity µS/cm x 0.67].

CFU – Colony Forming Units
PFU – Plaque Forming Units

[36] The armies of the United States, United Kingdom, Canada and Australia have agreed, when operating on land, to adopt minimum requirements as specified in the Details of Agreement for potability of drinking water to be issued to troops in combat zones or in any other strict emergency situation.

ANNEX F: CRITICAL ON-SITE WATER PARAMETER TESTING GUIDELINES-DAILY/MONTHLY

Parameter	WHO Guidelines	Unit of Measurement
Turbidity	1	NTU
Free Chlorine	0.2 – 0.5	mg/l
pH	6.5 – 8.5	
Total Dissolved Solids	<1000	mg/l

Annex F, Table 1: Critical On-site Water Parameter Testing Guidelines

Parameter	WHO Guidelines	Unit of Measurement
Total Coliforms	0	CFU/100ml
Faecal Coliforms	0	CFU/100ml
Turbidity	1	NTU
Free Chlorine	0.1 – 0.2	mg/l
pH	6.5 – 8.5	
Total Dissolved Solids	<1000	mg/l

Annex F, Table 2: Critical Laboratory Water Parameter Testing Guidelines

ANNEX G: DRINKING WATER QUALITY GUIDELINES

PARAMETER	UNIT	Recommended levels	Recommended testing frequency
PHYSICAL/AESTHETIC			
Aluminum	mg/l	0.2	Annually
Chloride	mg/l	250	Annually
Color	TCU	15	Annually
Copper	mg/l	2	Annually
Hardness	mg/l	500	Annually
Iron	mg/l	0.3	Annually
Odor	OTN	-	Annually
pH	No	6.5 – 8.5	Weekly/daily
Sodium	mg/l	200	Annually
Sulphate	mg/l	500	Annually
Taste	-	Inoffensive	Weekly/daily
Temperature	°C	-	Weekly/daily
Total Dissolved Solids	mg/l	1000	Monthly
Total Suspended Solids	mg/l	-	Weekly/daily
Turbidity	NTU	1	Weekly/daily
Zinc	mg/l	5.0	Annually
MICROBIOLOGICAL			
Total Coliforms	#/100ml	Absent	Monthly/Situation rise
Faecal Coliforms	#/100ml	Absent	Monthly/Situation rise
INORGANIC			
Arsenic	mg/l	0.01	Annually
Cyanide	mg/l	0.5	Annually
Cadmium	mg/l	0.003	Annually
Calcium	mg/l	200	Annually
Chromium	mg/l	0.05	Annually
Fluoride	mg/l	1.5	Annually
Lead	mg/l	0.01	Annually
Magnesium	mg/l	-	Annually
Mercury	mg/l	0.006	Annually
Nitrate	mg/l	50	Annually
Silver	mg/l	0.05	Annually
Selenium	mg/l	0.04	Annually
ORGANIC			
Benzene	mg/l	0.01	Annually
RADIOACTIVITY			
Gross Alpha	Bq/l	0.5	Annually
Gross Beta	Bq/l	1.0	Annually
FREE CHLORINE (when chlorine disinfection is adopted)			
Free chlorine	mg/l	0.2 - 1	Weekly/daily

Annex G, Table 1: Drinking Water Quality Guidelines (Source: World Health Organization, Guidelines for drinking-water quality, 4th edition, 2017)

ANNEX H: WATER & SANITATION UNIT FUNCTIONS AND CORRESPONDING SKILLS

The descriptions below relate to roles and responsibilities without reference to Grade. Missions should determine, based on the field needs and the responsibilities outlined below, which of the functional areas are needed. Further guidance is provided at the bottom of table below.

Key Functional Areas	Related Professions/Skills	Fundamental/Primary Responsibilities
Water Sourcing[i]	Hydrogeologist (ground water supplies) Hydrologist (surface water supplies) Geophysicist	▪ Interpret technical data and information from maps, historical documentation, flow and quality models ▪ Design and carry out investigations, including measurements and sampling ▪ Design and commission boreholes, measure groundwater/surface water ▪ Manage projects and contracts ▪ Monitor the impact of abstraction on the water resource sustainability ▪ Predict trends and impacts ▪ Resource management and protection ▪ Technical report writing, provide technical guidance
Water / Wastewater Treatment & Quality Control[ii]	Plant Operators Laboratory Technicians	▪ Run and service/maintain equipment ▪ Ensure and optimize process operations ▪ Guarantee quality of water and wastewater and perform routine laboratory tests ▪ Control operating expenses ▪ Keep records (e.g., meter readings, laboratory data, operational reports) ▪ Recommend technical & operational improvements ▪ Manage projects and contracts ▪ Ensure sampling, testing, measuring, recording and analysis of results ▪ Maintain and operate standard laboratory equipment ▪ Ensure the laboratory is well stocked and resourced
Networks (Storage & Distribution)[iii]	Plumbers Electromechanical Technicians	▪ Install, inspect, test and maintain pipe systems and fixtures ▪ Install and maintain pumps, meters, controls, etc. ▪ Determine suitable material and equipment types and amounts ▪ Troubleshoot and repair ▪ Replace worn parts
Sanitation[iv]	Civil Engineer Sanitation Engineer Environmental Engineer	▪ Designs and directs construction and operation of wastewater works and drainage systems ▪ Directs installation, commission, operation and maintenance of wastewater treatment facilities ▪ Advises on suitable treatment and disposal methods ▪ Manage projects and contracts ▪ Ensure spare parts and chemicals renewal and proper stock management ▪ Supervise contractor(s) for any water/wastewater management outsourced activity Carries out field risk assessments, ensures compliance with best practice and international standards ▪ Develop technical guidance material

Annex H, Table 1: Water & Sanitation Unit Functions and Corresponding Skills

[i] Sourcing is especially critical where a Field Mission obtains, or needs to identify and obtain, its own water supplies as opposed to being able to use government/municipal supplies or outsourcing to a water supply contractor. Missions in these situations predominantly rely on well drilling and surface water sources and need complete field water strategy, development and execution. The identifying, acquiring/establishment and use of these sources should be done in a sustainable manner. Missions are required to adhere to the guidance provided in section C.3 and the skills provided here are recommended.

[ii] Treatment of raw, bulk and drinking water and of wastewater is a critical mission requirement. The aim is to establish and operate based on fit-for-purpose water and wastewater quality. In the case of potable water treatment, the filtration and reverse osmosis equipment provided require skilled and trained operators. Monitoring and control of potential contaminants is a critical element of the treatment process; this is a core function of mission operations, required to ensure personnel health and safety. The size and capacity of the laboratory establishment should depend on mission-specific needs; otherwise all water and wastewater treatment equipment come with portable laboratory equipment for critical parameter testing in the field.

[iii] This an on-going and essential function and should feature in all field missions, either within the Water and Sanitation Unit/Engineering Section itself or as part of Facilities Management depending on size and accommodation arrangements.

[iv] Sanitation is a critical aspect that affects public health and safety – in all cases where municipal facilities are unavailable, this function is mandatory, and wastewater related risks managed closely and reported.

ANNEX I: WATER CONSERVATION PROGRAMME

The Water Conservation Programme (WCP) is a strategy or combination of strategies for reducing the consumption of water, reducing the loss or waste of water, improving or maintaining the efficiency in the use of water, or increasing recycling and reuse of water. It contains best management practice measures intended to meet the targets and goals identified to achieve water conservation.

The Water Conservation Programme is expected to consider;

1. Water use characteristics for military and civilians to identify water conservation opportunities.
2. Specific targets and quantification of water savings and goals for water loss reduction.
3. Alternative water resources use opportunities following the context including rainwater and treated wastewater.
4. A schedule for implementing the plan to achieve targets and goals.
5. A method for tracking the implementation and effectiveness of the plan.
6. A metering system to measure and account for the amounts of water derived from the source(s) of supply.
7. A program for meter testing, repair and periodic replacement.
8. Measures to determine and control water losses (i.e., a programme for leak detection including periodic visual inspections along distribution lines, periodic audit on the water system to compare water produced versus water consumed, etc.)
9. Regular awareness programmes and information-sharing regarding water conservation. This should include, among other strategies, providing water conservation information through training (e.g., during induction) and monitoring by nominated focal points placed in charge of this activity.
10. A water allotment structure (water scaling) which does not encourage the excessive use of water.
11. A means of implementation and enforcement evidenced by adoption of the plan; including:
    a. an administrative instruction from the Director/Chief of Mission Support indicating the mission's adoption of the WCP
    b. a description of the implementation mechanism of the plan
    c. A broadcast of the WCP to all civilian and military personnel.

Possible ways to conserve water include:

i. During source selection:

- Using harvested rainwater or recycled wastewater for non-potable use(s) such as such as dust control, fire suppression, landscaping, agriculture, toilet flushing, car washing, etc.

ii. During water treatment process:

- Optimizing filter backwashing – backwashing of sand and membrane filters in the water treatment modules uses potable water. During water shortages, rather than cutting back on or limiting the filter wash rate or duration, there may be opportunities to carefully adjust backwash pressures in such a way as to assure that neither the water nor the filter media is lost. In such cases, the manufacturer's instructions should be used as guidance.
- Filter wash water recycling – recycling backwash water can be achieved by collecting it, allowing for sedimentation and using the supernatant, which is then mixed (effectively diluted) with raw water at the head (raw water intake) of the plant. No more than 10% by

volume of the mixture should be backwash water at any given time however, due to the higher concentration of contaminants in the backwash.

iii. At distribution level:

- Installing meters to manage closely consumption and identify leakages

- Conducting regular inspections to repair eventual leakages

- Installing/retrofitting with low water consuming equipment: push taps, aerators on tap and showers, dual or low flush toilets, etc. Refer to the required standards in the below table.

- Converting any and all toilets into low flush toilets using simple displacement – e.g., use a 1.5l plastic bottle, remove any labels on the outside; fill it partially with gravel or sand and add water if more weight is needed (if only filled with water the bottle will move around in the cistern and interfere with the moving parts); carefully place this bottle in the cistern and test it.

Equipment	Requirement
Faucet (Basin Taps & Mixers)	• Maximum flow rate ≤1.50 Liter/min at 45 psi/ 3 bar pressure • Timing Faucet
Faucet- Sink Taps & Mixers (Kitchen)	• Maximum flow rate of the product is ≤5 Liters/min at 45 psi/ 3 bar pressure
Shower Taps, Mixers or Showerheads, Handled (telephonic) Showers	• Maximum flow rate of the product is ≤5 Liters/min at 45 psi/ 3 bar pressure • Timing Faucet
Dual Flush Flushing Cisterns- Full flush	• ≤4.5 Liters Per Flush
Dual Flush Flushing Cisterns- Half flush	• ≤2.5 Liters Per Flush
Urinals	• ≤1.9 Liter Per Flush • Timing Faucet
Aerators/ Flow Regulators	• ≤5 Liters/min at 45 psi/ 3 bar pressure for kitchen sink taps and mixers and for handled (telephonic) showers • ≤1.5 Liter/min at 45 psi/ 3 bar pressure for basin taps and mixers, hand bidet washers

Annex I, Table 1: Water fittings minimum performances standards[37]

Do not apply to recycled water points of use

[37] Compliance obligation currently included in the updated Environmental Policy (expected to be promulgated in 2021)

ANNEX J: RECOMMENDED METHODS OF ANALYSIS

The recommended method(s) of analysis for water quality parameter are indicated in the table below.

PARAMETER	METHOD OF ANALYSIS	SAMPLING AND STORAGE
BOD5	Standard Method 5210 B (5-Day BOD Test)	- Collect samples in borosilicate glass bottles - Refrigerate without freezing sample at <6°C between collection and analysis - Begin analysis within 24 hours of collection
COD	Standard Method 5220 C (Closed Reflux, Titrimetric Method) or 5220 D (Closed Reflux, Colorimetric Method)	- Collect samples in preferably glass bottles - Analyze immediately after sampling - Blend or homogenize all samples before analysis
TSS	Standard Method 2540 D (Total Suspended Solids Dried at 103-105oC)	- Collect samples in borosilicate glass bottles - Analyze samples within 48 hours - Refrigerate without freezing sample at <6°C between collection and analysis - Before analysis, bring sample to room temperature
pH	Standard Method 4500-H+ B (Electrometric Method)	- Analyze immediately after sampling
Fecal Coliforms	Standard Method 9221 B (Standard Total Coliform Fermentation Technique) or 9223 B (Enzyme Substrate Test)	- Collect samples in borosilicate glass bottles - Refrigerate without freezing sample at <6°C between collection and analysis - begin analysis within 24 hours of collection
Free Chlorine	Standard Method 4500-Cl G (DPD Colorimetric Method)	- Analyze immediately after sampling - Avoid agitation and excessive light
Turbidity	Standard Method 2130 B (Nephelometric Method)	- Analyze immediately after sampling - Gently agitate sample before analysis

Annex J, Table 1: Recommended Methods of Analysis (Source: Standard Methods for the Examination of Water and Wastewater, 23rd edition, 2017)

ANNEX K: RECYCLED WATER POINT OF DISTRIBUTION SIGNAGE

ANNEX L: ROLES AND RESPONSIBILITIES

In accordance with paragraph 180, Engineering Section/LSD/DOS is responsible for:

1. oversight of the adoption and implementation of the Water and Wastewater Manual in field missions
2. integrating all stakeholders in the planning and decision-making processes at critical mission stages especially at mission start-up and liquidation, at points of significant change and in emergency situations for the sustainable management of water resources and wastewater treatment in accordance with this guidance
3. assignation of the Water Specialist to the TAM
4. review of all expert panel and audit reports regarding management of water supply and wastewater treatment to field missions
5. identifying guidance requirements to support the implementation of the Water and Wastewater Manual through on-going dialogue with field missions and designating staff resources for their production
6. the establishment and management of System Contracts in support of the Water and Wastewater Manual
7. developing and supporting programme training in conjunction with UNGSC and relevant training partners

In accordance with paragraph 181, UNGSC will provide remote and on-ground support;

i. Remote support covers such responsibilities as listed below:

8. liaising with field missions to collect on-going data relating to the implementation of the Water and Wastewater Manual; including but not limited to records, documents, feedback, ratings, tests, observations and/or evidence, and conducting wastewater risk assessments
9. supporting the evaluation of the Water and Wastewater Manual through a formative approach
10. maintaining, initiating the review and periodically updating the Water and Wastewater Manual
11. supporting field missions in the development of Statements of Requirements, technical specifications, designs and engineering plans
12. interfacing with partners in UNGSC to provide comprehensive logistical support to field missions
13. providing support in the development of technical specifications for System Contracts, including the technical evaluation of vendor submissions
14. maintaining global online engineering databases in support of field missions
15. general business process engineering expertise in line with directions from UNHQ, or as requested by field missions
16. other engineering related functions/special projects as may be deemed applicable by LD/UNHQ in response to certain priorities and/or support needs to meet compliance with this guidance
17. training, which is deemed to involve:
    a. implementation, in collaboration with UNHQ, of the guidance materials, certification and training programmes developed at HQ, or requested by missions
    b. briefing of potential Troop Contributing Countries (TCCs) on water and wastewater requirements in the field.

ii. On-ground assignments include:

18. participation in field visits – project and risk assessments, start-up (TAM/AT) and liquidation support and involvement in mission support concepts development and implementation;
19. participation in pre-deployment visits (PDV) for TCC engineering equipment;
20. provision of inputs into, and implementation of, ad hoc engineering components in field missions to meet specific requirements, in emergencies and routinely

ANNEX M: ACRONYMS

AT: Advance Team

BMP: Best Management Practices

BOD: Biochemical Oxygen Demand

CFU: Colony Forming Units

COD: Chemical Oxygen Demand

COE: Contingent Owned Equipment

cPVC: Chlorinated Polyvinyl Chloride

CMS: Chief Mission Support

DOS: Department of Operational Support

DMS: Director of Mission Support

DPO: Department of Peace Operations

DPPA: Department of Political and Peacebuilding Affairs

EIA: Environmental Impact Assessment

ES: Engineering Section

ETSU: Environmental Technical Support Unit

EFMS: Engineering and Facilities Management Section

FMWSC: Field Mission Water Supply Concept

FOC: Final Operating Capability

FRIM: Field Remote Infrastructure Monitoring

FRP: Fiber-reinforced Plastic

GIS: Geographical Information System

HDPE: High Density Polyethylene

IOC: Initial Operating Capability

IOM: International Organization for Migration

LD: Logistics Division

LSD: Logistic Support Division

MEAP: Mission-wide Environmental Action Plan

MoU: Memorandum of Understanding

ORI: Operational Readiness Inspection

PCC: Police Contributing Country

PDV: Pre-deployment Visit

PPE: Personal Protective Equipment

QA: Quality Assurance

RBB: Results Based Budget

RMP: Risk Mitigation Plan

SoFA: Status of Forces Agreement

SoMA: Status of Mission Agreement

SOP: Standard Operating Procedures

SPM: Special Political Mission

SRSG: Special Representative of the Secretary General

SSU: Sourcing Support Unit

TAM: Technical Assessment Mission

TCC: Troop Contributing Country

TDY: Temporary Duty

TSS: Total Suspended Solids

UNGSC: United Nations Global Service Centre

UNHQ: United Nations Head Quarters

UNICEF: United Nations International Children's Emergency Fund

UNOE: UN Owned Equipment

uPVC: Unplasticized Polyvinyl Chloride

UV: Ultraviolet

WCP: Water Conservation Programme

WHO: World Health Organization

WSP: Water Safety Plan