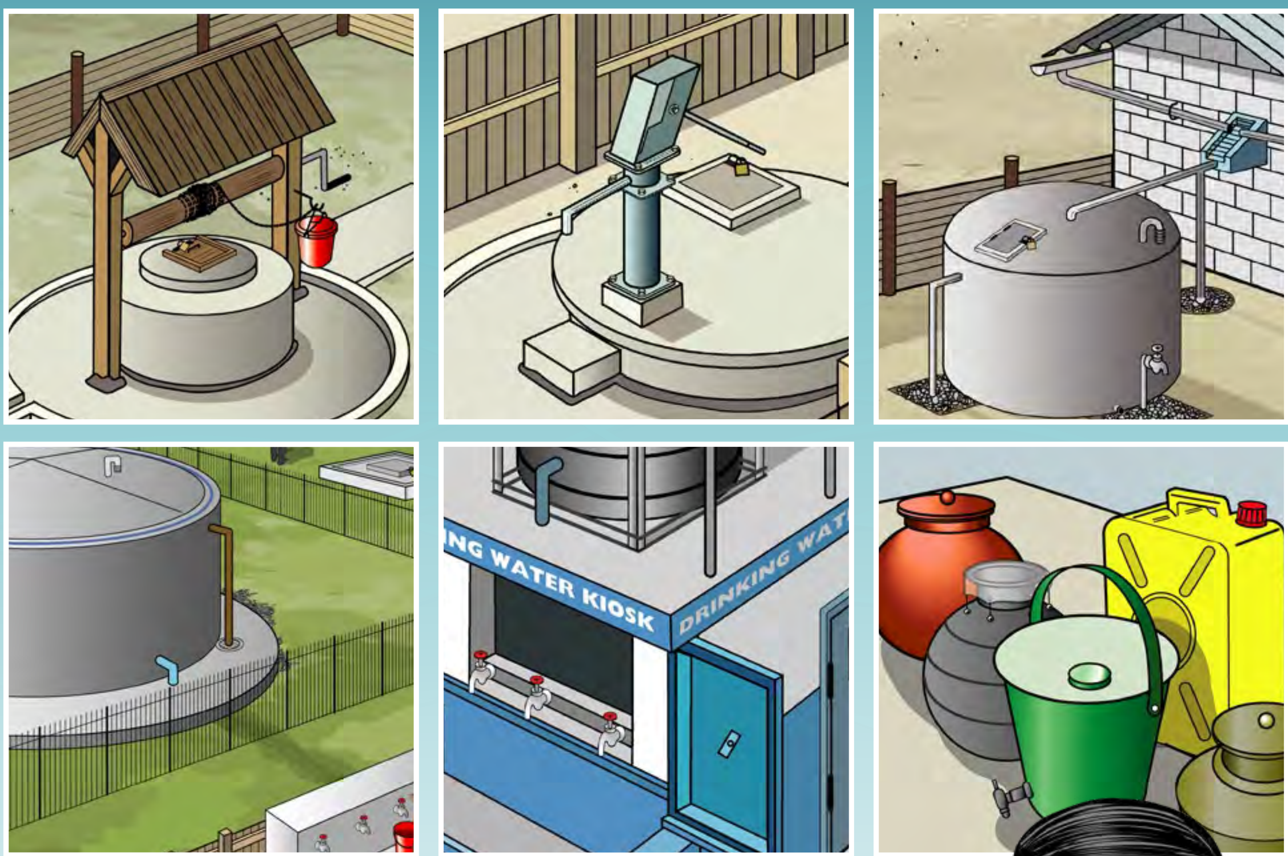
Sanitary inspection packages

A supporting tool for the *Guidelines for drinking-water quality: small water supplies*



World Health Organization

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Sanitary inspection packages - a supporting tool for the Guidelines for drinking-water quality: small water supplies

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Introduction

Improving the safe management and performance of small water supplies represents a neglected but important opportunity to make significant contributions to public health and well-being, address inequalities and improve livelihoods.

The World Health Organization (WHO) has developed the 2024 *Guidelines for drinking-water quality: small water supplies* (or *GDWQ: small water supplies*)[1] to address the needs and opportunities associated with small supplies, and to facilitate progress towards safe and sustainable drinking-water services for all. The *GDWQ: small water supplies* provide recommendations and guidance for decision-makers at national and subnational levels who have responsibilities for developing and implementing drinking-water quality regulatory frameworks and associated programmes. It presents proven good practices, including proactive risk management. As highlighted in the *GDWQ: small water supplies*, sanitary inspections play an important role in supporting proactive risk management.

This associated publication, *Sanitary inspection packages - a supporting tool for the Guidelines for drinking-water quality: small water supplies* (or *Sanitary inspection packages*), provides practical tools to support sanitary inspections and associated management activities, including by health authorities, surveillance agencies and water suppliers. Use of these resources aids the practical implementation of sanitary inspections, in line with the guidance in WHO's *GDWQ: small water supplies*.

What is a sanitary inspection?

A sanitary inspection is a rapid, on-site evaluation, traditionally using a checklist, to help identify and support the management of priority risk factors that may lead to contamination of a water supply.

Sanitary inspections are a simple yet powerful tool that can be applied in many settings, especially for small drinking-water supplies. Sanitary inspection forms support the identification of common risk factors – these can include the physical structure of the water supply, how the water supply is operated and maintained, and external environmental factors that could compromise the safety of the water supply.

Once risk factors have been identified through sanitary inspection, corrective actions and ongoing safe management and monitoring can then be undertaken to help progressively manage these risks.

For what purposes can sanitary inspections be applied and by whom?

Sanitary inspections are a versatile way to support the management of drinking-water quality risks in water supplies. Table A illustrates common examples of their application.

[1] Guidelines for drinking-water quality: small water supplies. Geneva: World Health Organization; 2024.

Table A. **Common examples of the application of sanitary inspections**

Purpose	Examples of application	Typically applied by	Considerations
Drinking-water quality surveillance	Part of ongoing drinking-water supply oversight and assessment of risk management practice	Surveillance agency (or designate)	Outcomes can support progressive improvement for individual water supplies, and be applied at national and subnational levels to inform policies and programming.[a]
Risk management of drinking-water supplies	Applied to support water safety planning	Water suppliers	Sanitary inspections can support the implementation of water safety plan (WSP) activities, including: • identification of hazards to inform the risk assessment process; and • ongoing monitoring of the water supply. If WSP implementation is not yet considered feasible, sanitary inspections (when combined with corrective actions and ongoing management and monitoring) can be used by water suppliers as an interim risk management approach while WSP capacity is developed.[b]
	Basic risk management tool as an alternative to water safety planning	Households	When combined with corrective actions and ongoing management and monitoring, sanitary inspections can provide a simple alternative to WSPs for household-managed supplies.[b]

[a] For further information, see Chapter 5 of GDWQ: small water supplies (WHO, 2024).

[b] For further information, see Chapter 4 of GDWQ: small water supplies (WHO, 2024).

A note on sanitary inspections and water quality testing

Sanitary inspections and water quality testing are complementary activities. A sanitary inspection can identify the presence of risk factors that may lead to contamination of the drinking-water supply, and water quality testing can indicate the extent to which contamination is occurring at that point in time.

The results of the two activities can be jointly analysed to assess the overall safety of a drinking-water supply.[2]

Where water quality testing cannot be performed, sanitary inspection can still provide valuable information that can support safe water-supply management.

What is included in each sanitary inspection package?

Sanitary inspections can be undertaken using the sanitary inspection packages presented in this publication. The complete list of packages provided is presented in Figure A.

[2] For guidance, see Chapter 5 of GDWQ: small water supplies (WHO, 2024).

SOURCE → **DISTRIBUTION/STORAGE** → **USER**

SOURCE

1. *Dug well with a hand pump*
2. *Dug well with a windlass*
3. *Spring*
4. *Tubewell with a hand pump*
5. *Borehole with a motorized pump*
6. *Rainwater collection and storage*
7. *Surface water source and intake*

DISTRIBUTION/STORAGE

8. *Piped distribution: storage tank*
9. *Piped distribution: network*
10. *Piped distribution: tapstand*
11. *Filling station and water cart*
12. *Kiosk*

USER

13. *Household practices*

Figure A. Sanitary inspection packages within this publication

Each sanitary inspection package includes:

1. **Sanitary inspection form** – a checklist of equally-weighted yes/no questions and supporting illustrations to help identify common risk factors and prompt corrective action. The form also contains a general information section to capture key water supply information (including water quality testing data where obtained) that may provide context for completion of the sanitary inspection, aid risk assessment, and help to develop or maintain water supply inventories.
2. **Technical fact sheet** – provides an overview of the water supply technology/scenario and technical information to support sanitary inspection form completion. This includes illustrations showing the water supply in a "sanitary condition", which can be used to help identify risk factors when compared against the sanitary inspection form illustration (i.e. the "unsanitary condition").
3. **Management advice sheet** – provides general guidance to support the ongoing safe management of the water supply through basic operations, maintenance and monitoring. Also includes simple problem-solving advice for corrective actions to consider for each risk factor included in the sanitary inspection form.

Portable document format (PDF) and editable versions of the sanitary inspection packages can be downloaded and adapted as needed from https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/water-safety-and-quality/water-safety-planning/sanitary-inspection-packages.

For information on the methodology used to develop the sanitary inspection packages, see Annex 1.

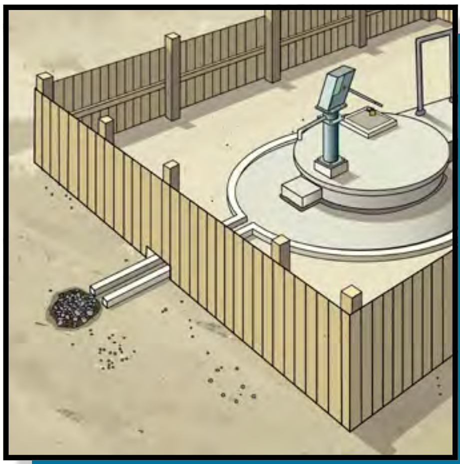
The packages are updates of the sanitary inspection forms presented in the *Guidelines for drinking-water quality. Volume 3: surveillance and control of community supplies.*[3] For a summary of the key changes to the new sanitary inspection packages, see Annex 2.

What should be considered in applying the sanitary inspection packages?

Sanitary inspections can be conducted using the packages in the format provided in this publication. However, because small water supplies vary widely, some aspects of the packages may not be applicable in all contexts. For example, there may be local variations in water supply technology (e.g. hand pump design), or locally specific risk factors may not be included in the packages provided. Similarly, certain risk factors presented in the packages may not be relevant in some contexts. Where capacity and resources permit, authorities should adapt the sanitary inspection packages to the local context as needed.[4] This is particularly important in the case of household use, where the sanitary inspection materials should be simplified to suit local capacity (e.g. using a picture-card approach).

Further, authorities should consider the training needed to apply the sanitary inspection packages. The user of the packages – whether water supplier (or householder) or surveillance staff – must have sufficient knowledge to ensure consistent and accurate results. Authorities should therefore consider developing capacity-building programmes, which can include training packages tailored to the local context, where capacity and resources permit.

3 Guidelines for drinking-water quality. Volume 3: surveillance and control of community supplies. 2nd edition. Geneva: World Health Organization; 1997.
4 For further information, see Annex 4 of GDWQ: small water supplies (WHO, 2024).



1

Sanitary inspection package

Dug well with a hand pump

Dug well with a hand pump

A. GENERAL INFORMATION

A.1. Dug well information

Dug well location (e.g. village, town, community, parish, district, province, state)							
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)							
Year of construction of dug well	**Depth of dug well** (including units)		**Approximate number of households using this water source** Circle one of the options below				
			1–10	11–50	51–100	101–500	>500
Circle the options below			If **Yes**, describe (e.g. what happens, how often, for how long)				
Is the dug well affected by flooding?	Unsure	No	Yes				
Is the dug well affected by drought?	Unsure	No	Yes				

A.2. System functionality

Circle **Yes** or **No** to indicate if water is currently available from the dug well. If **No**, describe why (e.g. broken pump, low water level) and then go to Section B. In Section C, record the corrective actions needed for the dug well to provide water, and record the details of any alternative water source(s) currently being used.

Is water currently available from the dug well?		If **No**, describe why (then go to Section B)
Yes	No	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.5)	Yes										
Parameter tested		*E. coli*[a]		*or* Thermotolerant (faecal) coliforms[a]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

❑ **No treatment applied.**
❑ **Treatment applied at the well.** Describe (e.g. chlorine dose, frequency of dosing, how it is applied).[b]
❑ **Treatment applied downstream of the well.** Describe (e.g. the type of household water treatment used).

[a] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[b] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For general information on chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

General notes

- This form is intended for use on a single dug well with a hand pump. Where there are multiple dug wells to be inspected, additional forms will be needed. Dug wells may be inspected on a rotational basis where there are too many to cover during each inspection.
- If other water sources are in use (e.g. spring, borehole), or if users collect and store water in the home, carry out additional sanitary inspections using the corresponding sanitary inspection packages.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the dug well. ***Note*** – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the dug well being inspected.
3. Tick the **No** box if the question does apply to the dug well being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

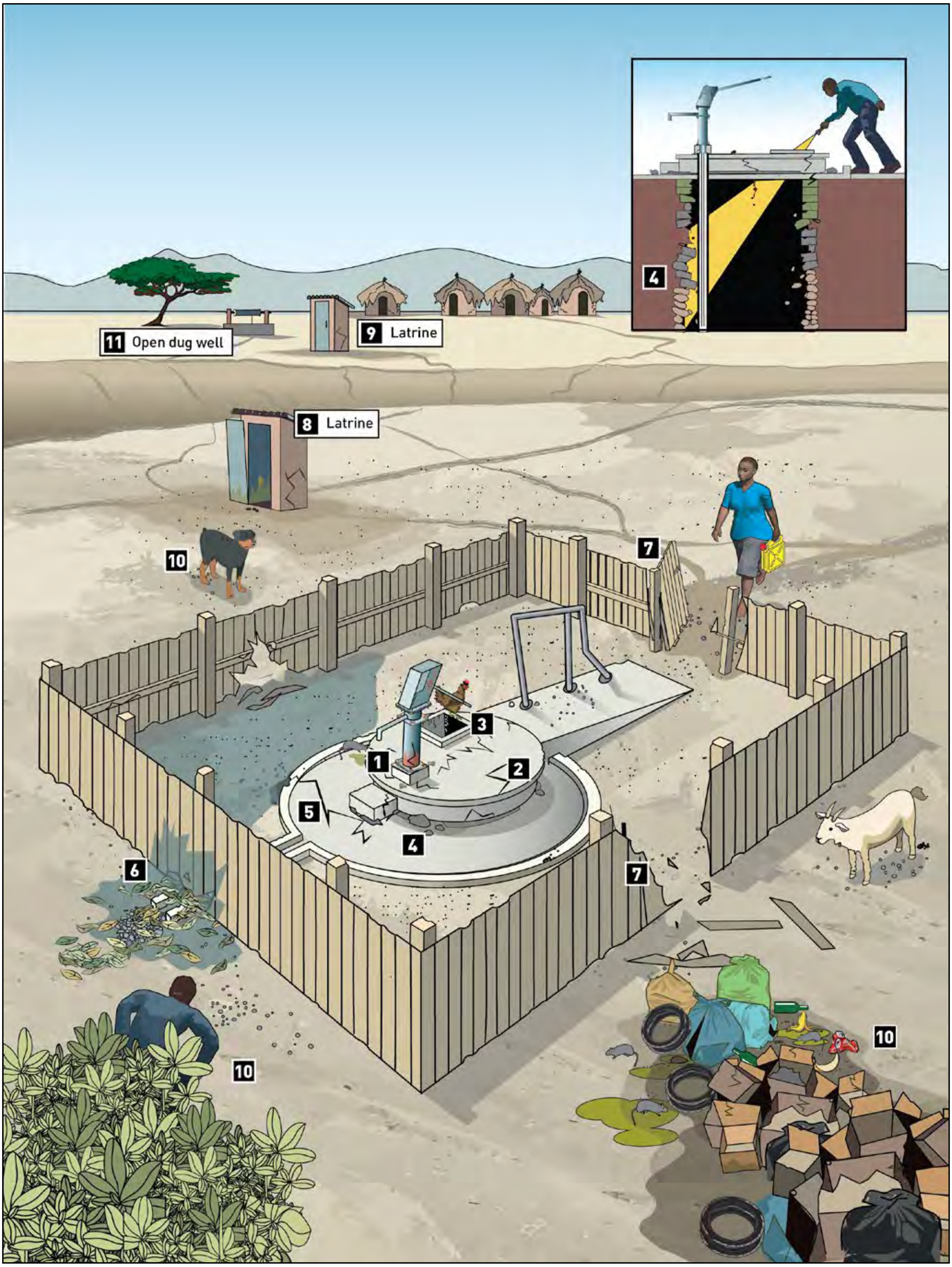


Figure 1. Typical risk factors associated with a dug well with a hand pump

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Is the hand pump in poor condition or loose at the point of attachment to the cover slab?** Contaminants could enter the water if the hand pump is damaged or severely corroded, or if the spout is dirty. Contaminated surface water could also enter the well, particularly after rain, if the hand pump is loosely attached to the cover slab (i.e. if there is a gap between the hand pump and the cover slab).	❑	❑	❑	
2	**Is the cover slab absent or in poor condition?** Contaminants could enter the well if there is no cover slab present. This could also happen if the cover slab is damaged (e.g. has deep cracks or gaps), which could allow surface water to enter the well.	❑	❑	❑	
3	**If there is an inspection hatch, is the lid missing or in poor condition?** Contaminants could enter the well (e.g. entry of contaminated surface water following rain, entry of animals) if the inspection hatch lid is missing (or open, unlocked). This could also happen if the lid is damaged (e.g. cracked, severely corroded, does not fit tightly when closed).	❑	❑	❑	
4	**Is the well wall damaged?** Contaminants could enter the well if there are deep cracks or gaps in either the aboveground headwall, or the belowground well wall.	❑	❑	❑	
5	**Is the apron around the well absent or in poor condition?** Contaminants could enter the well, particularly after rain, if there is no apron present. This could also happen if the apron is damaged (e.g. gaps, deep cracks). Erosion under the apron may also allow contaminated surface water to enter the well.	❑	❑	❑	
6	**Is drainage inadequate, which could allow water to accumulate in the well area?** Stagnant water could contaminate the well if there is no drainage channel, or if the channel is damaged (e.g. deep cracks) or blocked (e.g. from leaves, sediment). This could also happen if there is no downward slope for water to drain away from the well area to a working drain or soakaway. This is especially likely after rain. *Note* – the presence of pooled water and/or erosion under the apron may indicate poor drainage.	❑	❑	❑	

Sanitary inspection questions		NA	No	Yes	If Yes, what corrective action is needed?
7	**Is the fence or barrier around the well missing or inadequate so that animals could enter the well area?** Animals could contaminate or damage the well area if the fence or barrier around the well is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	
8	**Is there sanitation infrastructure within 15 metres of the well?**[c] Sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer pipes) close to the well may affect water quality. For example, waste could seep into the groundwater or overflow and be washed into the well, particularly after rain. Visually check structures in this area, and ask community members, to see if the structures are sanitation related.	❑	❑	❑	
9	**Is there sanitation infrastructure on higher ground within 30 metres of the well?**[c] Contaminated groundwater and surface water may flow downhill from sanitation infrastructure towards the well. This could result in harmful microorganisms and other contaminants entering the well, particularly after rain.	❑	❑	❑	
10	**Can other sources of pollution be seen within 15 metres of the well (e.g. open defecation, animals, drinking troughs for livestock, rubbish, commercial activity, fuel storage)?**[c] The presence of animals or faeces on the ground close to the well poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could be washed into the well during rain or seep into the groundwater.	❑	❑	❑	
11	**Is there any unprotected entry point to the aquifer within 100 metres of the well?**[c] An unprotected entry point to the aquifer (e.g. uncapped borehole, open dug well) could allow contaminants to enter the groundwater and contaminate the well.	❑	❑	❑	
	Total number of Yes responses				

[c] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

C. ADDITIONAL DETAILS

Include any additional risk factors,[d] recommendations, observations or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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[d] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ________________________

Organization: ________________________

Designation/title of inspector: ________________________

Signature: ________________ Date: ________

Name of water supply representative: ________________________

Contact number (if available): ________________________

Signature (if available): ________________ Date: ________

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Website: https://www.who.int/health-topics/water-sanitation-and-hygiene-wash

World Health Organization

Dug well with a hand pump

This technical fact sheet provides background information on a dug well with a hand pump, which supports the sanitary inspection of this water source.[a]

A dug well consists of an excavated hole in the ground, with a water-lifting device (e.g. a hand pump, windlass) that is used to bring groundwater to the surface.

Groundwater is considered to be better quality than surface water in many places. However, appropriate treatment/disinfection are required for groundwater sources that are vulnerable to contamination.

Improved dug wells are lined, covered and fitted with a secure water-lifting device (e.g. a hand pump) to provide safe drinking-water. **Unimproved dug wells** are open or uncovered wells. These are more likely to become contaminated, and should be improved where possible.

Dug wells can be excavated by hand or with a machine. The diameter of a dug well is often more than 1 metre. This means that dug wells can typically be accessed by a person for inspection, operations and maintenance or improvement works (e.g. repairing the well wall, removing sediment, deepening the well).

Dug wells should have adequate capacity (i.e. have an appropriate depth below the water table and width) to meet the needs of users at all times of the year. Limited capacity could result in users seeking alternative drinking-water sources that could be less safe.

The water collection area should be built so it is accessible for all users.[b]

Figure 1 shows a common type of dug well with a hand pump. A section view of the belowground elements of the dug well is shown in Figure 2. These figures show a typical design. Other designs can also provide safe drinking-water.

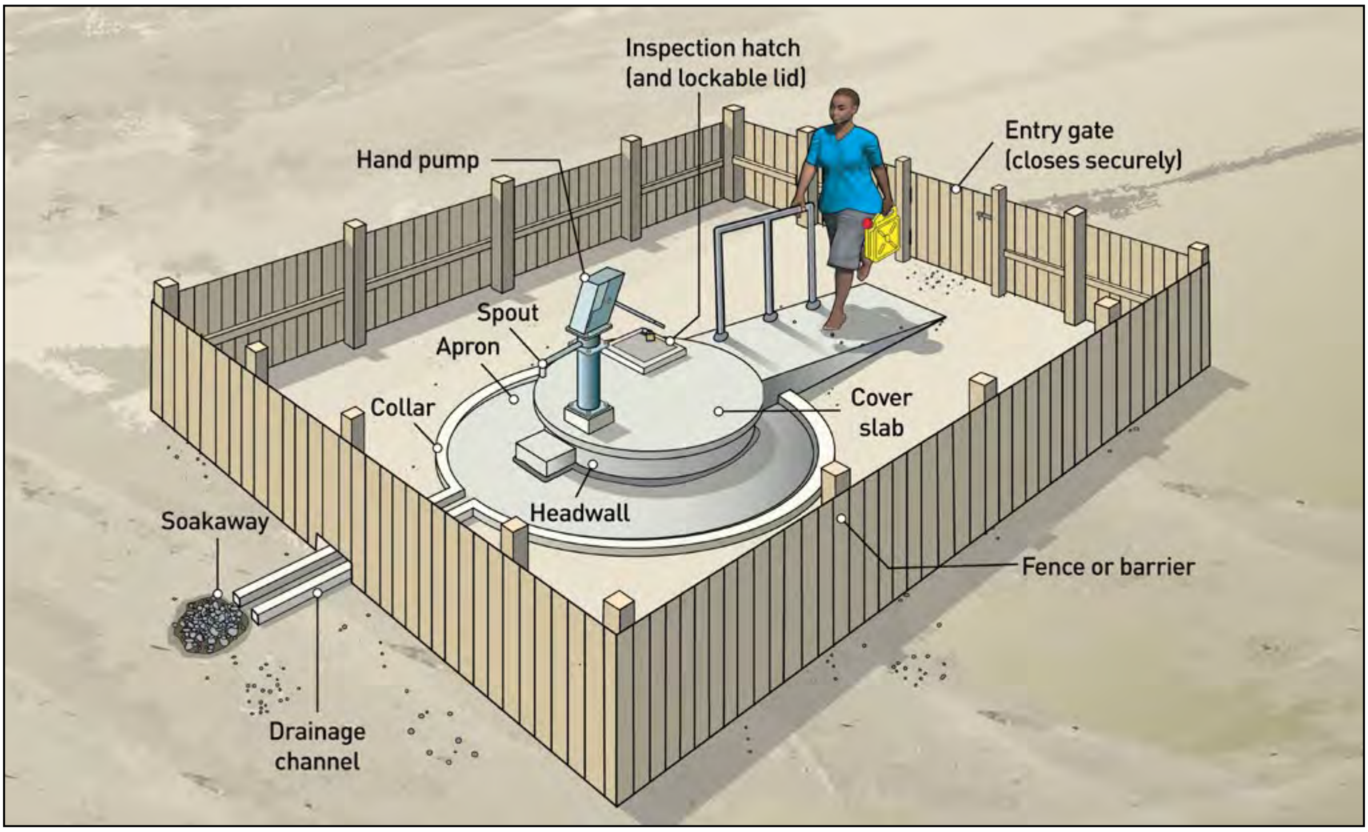

Figure 1. A common dug well with a hand pump in a sanitary condition

[a] This fact sheet is not intended to serve as a guide to construction. For detailed guidance on the design and construction of a dug well, refer to Hand-dug shallow wells: series of manuals on drinking water supply, Vol. 5 (Collins, 2000).

[b] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones & Reed, 2005).

Typical risk factors associated with a dug well with a hand pump are presented in the corresponding *Sanitary inspection form.*

A dug well with a hand pump typically includes the following main components.

- **Hand pump:** Draws groundwater from the well through a pipe (called a **rising main**) to the point of collection (the **spout**) above the surface. The hand pump should be securely fitted to the cover slab (i.e. tightly fitting with no gaps) to prevent contaminants from entering the well.
- **Cover slab:** A raised stone, brick or concrete cover built over the well. This prevents contaminants from entering the well. The cover slab also provides a standing area for users when collecting water.
- **Inspection hatch:** Allows access to the dug well for inspection, operations and maintenance, or improvement works. The inspection hatch should have a lid that is tightly fitting and lockable to stop contaminants from entering the well, and to stop unauthorized access by people.
- **Well wall:** The wall (or lining) between the well and the surrounding ground, which gives structural support that prevents the well from collapsing (Figure 2). The well wall is often constructed using reinforced concrete rings, blocks or bricks. At least the top 3 metres of the well should be lined with an impermeable barrier (e.g. bricks and mortar) to stop surface water from draining into the well. Below this, the well wall should be permeable to allow groundwater to enter the well.
- **Headwall:** The part of the well wall aboveground that supports the cover slab. The headwall should have a water-tight seal with the cover slab and apron to stop surface water from entering the well.
- **Apron:** A reinforced stone, brick or concrete floor built around the headwall to drain water away from the well. To ensure adequate protection, the apron should be at least 1 metre wide all around the headwall, sloping down from the well towards a collar.
- **Collar:** The raised edge of the apron that captures water and directs it to a drainage channel.
- **Drainage channel:** Directs water away from the well to a drainage area or soakaway, where the water can drain into the ground. The drainage channel should slope down from the well. This prevents water ponding and stagnating around the well area, which could contaminate the well. Drainage water may be used to provide water for livestock or other activities, provided that these activities occur at a safe distance downhill from the well.[c]
- **Soakaway:** A hole in the ground filled with coarse material (e.g. gravel, stones, rocks), or that has a permeable wall, that allows water to drain back into the ground. The soakaway should be located at a safe distance downhill from the well.[c]
- **Fence or barrier:** A physical barrier to prevent animals from contaminating the well area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked. Where practical, the fence or barrier should ideally be constructed at least 15 metres from the well (general guidance only).[c]

Additional considerations

Before the dug well is constructed, sources of naturally occurring contaminants (e.g. arsenic, fluoride) and contamination from human activities (e.g. agriculture, industry) should be investigated to determine their impact on groundwater quality. Latrines and other sanitation facilities should be identified before choosing a site for the well.

After a new dug well is constructed, it should be cleaned, flushed and disinfected (e.g. with chlorine), and flushed again, to disinfect the components before the water is used. Ideally, water quality testing should be conducted before the dug well is commissioned to confirm the water is safe for consumption. Periodic disinfection and testing may also be required (e.g. after flooding, after maintenance).[d]

When selecting components for the hand pump, the corrosion potential of the groundwater should be considered. If the groundwater has low pH, high salinity and high chloride, corrosion-resistant materials are required.

When constructing new dug wells or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme, including for lead-free or low-lead materials).

c For guidance on determining appropriate minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

d See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating hand-dug wells (WHO & WEDC, 2013).

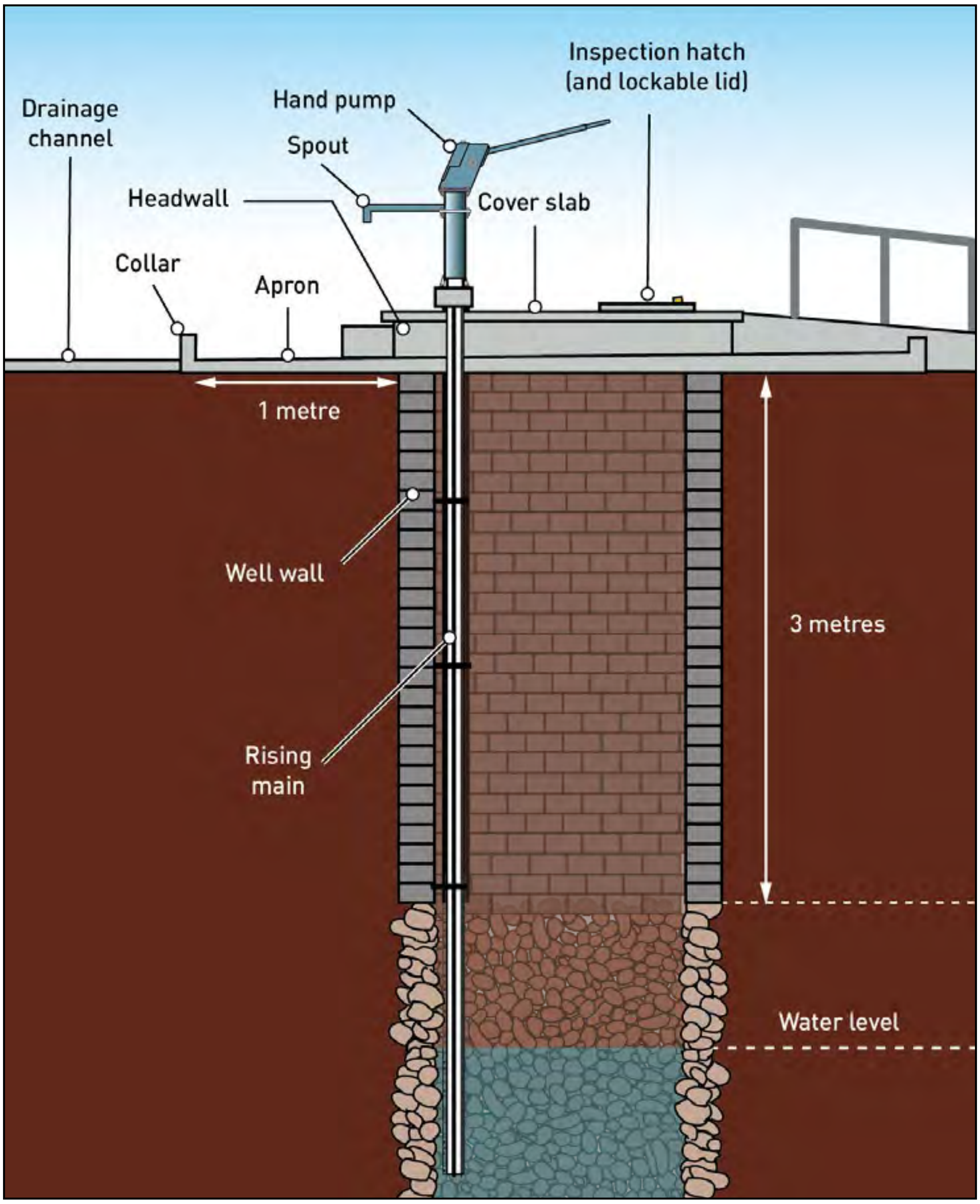

Figure 2. A common dug well with a hand pump in a sanitary condition (section view)

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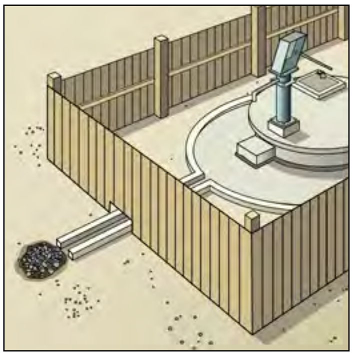
Dug well with a hand pump

This management advice sheet provides guidance for the safe management of a dug well with a hand pump, which supports the sanitary inspection of this water source.



Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the dug well and hand pump in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained owner, user or caretaker/operator (e.g. simple maintenance tasks such as cleaning the well area). Larger repairs and maintenance tasks (e.g. repairing the well wall, pump maintenance) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the dug well and hand pump should be inspected routinely to help prevent contaminants entering the well. Any damage or faults should be repaired immediately (e.g. deep cracks in the cover slab, broken fence, soil erosion around the apron). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. removing the pump for maintenance, repairing the well wall). These should be followed by trained individuals so the work is carried out safely and the well is not contaminated during the work.

Consultation with the relevant authorities may be required to ensure that sanitation infrastructure (e.g. latrine pits, septic tanks, sewers, soakage fields) is not built near the well unless hydrogeological studies show that it is safe to do so. Consideration should also be given to catchment activities that extract groundwater (e.g. for irrigation, mining, power) to ensure an adequate quantity of drinking-water to meet the needs of users.

Activities other than the collection of drinking-water (e.g. laundry, washing, bathing) should not be permitted at the dug well area. These should be carried out at a safe distance downhill from the well.

Adequate treatment/disinfection are required before consuming the drinking-water if the dug well is vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the dug well facility, including the spout. Remove any polluting materials (e.g. faeces, rubbish). • Check that the hand pump is working.[a] Perform pump maintenance as needed, repair or replace damaged parts, then clean and disinfect (e.g. with chlorine) the hand pump. • If present, check that the inspection hatch lid is in place and in good condition, and is closed and locked securely. Repair or replace damaged parts, and lock as needed. • Check that the drainage channel is clear and in good condition (i.e. no deep cracks, gaps). Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed.

Table 1. ...continued

Frequency	Activity
Annually	• Perform a detailed inspection of the well structure (including the well wall) for signs of damage or failure. Repair as needed.[b]
As the need arises[c]	• Drain the well, remove debris or sediment and clean the internal walls (e.g. using a brush and clean water), and then disinfect the well (e.g. with chlorine).[d] • Rehabilitate the well (e.g. repair the well wall, deepen the well).[b] • Replace any eroded earth around the dug well, and fill any depressions in the ground where water ponds. • Monitor water yield and use to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] A broader assessment of hand pump functionality and condition can be performed during the sanitary inspection. For basic guidance on functionality checks, preventive maintenance and repair for common hand pump types, refer to the pump-specific guidance manuals at https://www.rural-water-supply.net/en/resources/, or the relevant manufacturer's guide.

[b] For guidance on construction aspects, refer to Hand-dug shallow wells: series of manuals on drinking-water supply, Vol. 5 (Collins, 2000).

[c] See Table 2 for potential problems that could trigger these activities.

[d] See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating hand-dug wells (WHO & WEDC, 2013). This activity is required following a contamination event (e.g. flooding, *E. coli* detection). *Note* – in water scarce areas, consult with local health authorities before draining the well to make sure that the risk to water quality justifies the loss of water. If the well is drained, alternative water supply arrangements may be needed to ensure that users have sufficient water quantity to meet domestic needs.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when entering the well for inspection or maintenance. Safety risks such as well collapse and asphyxiation should be appropriately managed. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form*. Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a dug well with a hand pump, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The hand pump is in poor condition or loose at the point of attachment to the cover slab, which could allow contaminants to enter the water.	• Repair any damaged or severely corroded components of the hand pump. Clean and disinfect the hand pump once finished (e.g. with chlorine). • Fix the hand pump unit so that it is secure and tightly fitted to the cover slap with no gaps. • If the hand pump spout is dirty, clean and disinfect it (e.g. with chlorine). • Communicate the importance of routine cleaning/maintenance of the hand pump.
2	The cover slab is absent, or it is in poor condition, which could allow contaminants to enter the well.	• If the cover slab is absent, rehabilitate the well to include a raised, sealed cover slab. • If the cover slab is in poor condition, repair any damage, deep cracks or gaps, to ensure that the well is adequately sealed. • Clean and disinfect (e.g. with chlorine) the well once finished.[d]
3	If there is an inspection hatch, the inspection hatch lid is missing (or open, unlocked), or it is in poor condition (e.g. deep cracks, severely corroded, does not fit tightly when closed), which could allow contaminants to enter the well (e.g. via surface water, entry of animals).	• If the inspection hatch lid is missing, or it is in poor condition, provide a temporary seal (e.g. impermeable plastic sheeting) over the inspection hatch to minimize the entry of contaminants. Repair or replace the hatch and/or lid as soon as possible. • If the inspection hatch lid is open or unlocked, communicate the importance of closing and locking the lid securely when it is not in use (e.g. through awareness raising, signage).
4	The walls of the well – either above the ground (i.e. the headwall) or below the ground (i.e. well wall), are damaged (e.g. deep cracks, gaps), which could allow contaminants to enter the well.	• Repair the headwall to ensure that the well is adequately sealed (e.g. repair mortar and brickwork). • For the belowground well wall, seek skilled help as needed to repair and seal the well wall. Pay special attention to the health and safety risks to workers when entering the well, and the potential to contaminate the well during the work. • Clean and disinfect the well once finished.[d]
5	The apron around the well is absent, or it is in poor condition (e.g. with gaps, deep cracks, shows signs of erosion under the apron), which could allow contaminants to enter the well (e.g. from contaminated surface water).	• If the apron is absent, construct an apron at least 1 metre around the headwall, ensuring that it slopes downward to a defined collar. • If the apron is damaged or has deep cracks, repair it to ensure that it is adequately sealed. • If the area around or under the apron shows signs of erosion, replace any eroded earth to ensure that it is adequately sealed. (Where the erosion is caused by poor drainage, see row 6.)
6	The drainage is inadequate (e.g. absent, damaged or blocked drainage channel or soakaway, insufficient drainage slope), which could result in stagnant water contaminating the well.	• If a drainage channel or soakaway is absent, dig a temporary channel to divert water away from the well area. Construct a permanent drainage system as soon as possible. • If a drainage channel or soakaway is not working, consider whether maintenance is needed (e.g. repairing, cleaning), or if deepening, widening or extending is required.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
7	The fence or barrier around the well is missing or inadequate, which could allow animals to contaminate or damage the well area.	• If absent, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the well area is damaged and/or does not close securely, repair or replace it.
8	There is sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer line) within 15 metres of the well that could contaminate the well (e.g. from overflow, seepage).[e]	• Involve local authorities to assess the significance of the risk from the sanitation infrastructure. • Consider what immediate actions should be taken to minimize the risk to public health. • Consult with local authorities to consider appropriate steps to relocate or eliminate the source of pollution.
9	There is sanitation infrastructure on higher ground within 30 metres of the well that could contaminate the well.[e]	

10	There are other sources of pollution (e.g. open defecation, animals, drinking trough for livestock, rubbish, commercial activity, fuel storage) within 15 metres of the well that could contaminate the well.[e]	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the dug well area in a clean condition.
		• Consult with local authorities and users to consider:
		  ○ appropriate actions to relocate or eliminate the source of pollution
		  ○ other actions to minimize the issue from occurring again (e.g. awareness raising, signage, enforcement measures).

11	There is an unprotected point of entry to the aquifer (e.g. open or uncapped well or borehole) within 100 metres of the well that could provide a direct pathway for contaminants to enter the groundwater and contaminate the well.[e]	• Consult with local authorities to:
		  ○ assess the significance of the risk from the unprotected point of entry to the aquifer
		  ○ cover the point of entry in the immediate term
		  ○ consider what actions are appropriate to permanently seal, decommission or relocate the point of entry.

[e] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table and the volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

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World Health Organization

2

Sanitary inspection package

Dug well with a windlass

Dug well with a windlass

A. GENERAL INFORMATION

A.1. Dug well information

Dug well location (e.g. village, town, community, parish, district, province, state)							
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)							
Year of construction of dug well	**Depth of dug well** (including units)		**Approximate number of households using this water source** Circle one of the options below				
			1–10	11–50	51–100	101–500	>500
Circle the options below			If **Yes**, describe (e.g. what happens, how often, for how long)				
Is the dug well affected by flooding?	Unsure	No	Yes				
Is the dug well affected by drought?	Unsure	No	Yes				

A.2. System functionality

Circle **Yes** or **No** to indicate if water is currently available from the dug well. If **No**, describe why (e.g. broken windlass, low water level) and then go to Section B. In Section C, record the corrective actions needed for the dug well to provide water, and record the details of any alternative water source(s) currently being used.

Is water currently available from the dug well?		If **No**, describe why (then go to Section B)
Yes	No	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.5)	Yes										
Parameter tested		*E. coli*[a]		*or* Thermotolerant (faecal) coliforms[a]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

❑ **No treatment applied.**

❑ **Treatment applied at the well.** Describe (e.g. chlorine dose, frequency of dosing, how it is applied).[b]

❑ **Treatment applied downstream of the well.** Describe (e.g. household water treatment).

[a] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[b] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For general information on chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

General notes

- This form is intended for use on a single dug well with a windlass. Where there are multiple dug wells to be inspected, additional forms will be needed. Dug wells may be inspected on a rotational basis where there are too many to cover during each inspection.
- If other water sources are in use (e.g. spring, borehole), or if users collect and store water in the home, carry out additional sanitary inspections using the corresponding sanitary inspection packages.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the dug well. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the dug well being inspected.
3. Tick the **No** box if the question does apply to the dug well being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

Figure 1. Typical risk factors associated with a dug well with a windlass

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Is the bucket and chain (or rope) dirty?** Contaminants could enter the water if the bucket and chain (or rope) are dirty. This could also happen if they are stored in a way that they could become dirty when not in use (e.g. in a wet area, on the ground).	❑	❑	❑	
2	**Do individuals use their own buckets for drawing water from the well?** Contaminants could enter the well if individuals use their own buckets that are dirty, or have been used for purposes other than drinking-water collection (e.g. storing milk, chemicals, fuel, oil).	❑	❑	❑	
3	**Is the well inadequately covered to prevent the entry of contaminants?** Contaminants could enter the well, particularly after rain, if there is no well cover in place. This could also happen if the cover or access hatch is in poor condition (e.g. damaged, deep cracks, severely corroded, does not tightly fit when closed).	❑	❑	❑	
4	**Is the well wall damaged?** Contaminants could enter the well if there are deep cracks or gaps in either the aboveground headwall, or the belowground well wall.	❑	❑	❑	
5	**Is the apron around the well absent or in poor condition?** Contaminants could enter the well, particularly after rain, if there is no apron. This could also happen if the apron is damaged (e.g. gaps, deep cracks). Erosion under the apron could also allow contaminated surface water to enter the well.	❑	❑	❑	
6	**Is drainage inadequate, which could allow water to accumulate in the well area?** Stagnant water could contaminate the well if there is no drainage system in place. This could also happen if the drainage system is damaged (e.g. deep cracks) or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water and/or erosion under the apron may indicate poor drainage.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
7	**Is the fence or barrier around the well missing or inadequate so that animals could enter the well area?** Animals could contaminate or damage the well area if the fence or barrier around the well is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	
8	**Is there sanitation infrastructure within 15 metres of the well?**[c] Sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer pipes) close to the well may affect water quality. For example, waste could seep into the groundwater or overflow and be washed into the well, particularly after rain. Visually check structures in this area, and ask community members, to see if the structures are sanitation related.	❑	❑	❑	
9	**Is there sanitation infrastructure on higher ground within 30 metres of the well?**[c] Contaminated groundwater and surface water may flow downhill from sanitation infrastructure towards the well. This could result in harmful microorganisms and other contaminants entering the well, particularly after rain.	❑	❑	❑	
10	**Can other sources of pollution be seen within 15 metres of the well (e.g. open defecation, animals, drinking troughs for livestock, rubbish, commercial activity, fuel storage)?**[c] The presence of animals or faeces on the ground close to the well poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could be washed into the well during rain or seep into the groundwater.	❑	❑	❑	
11	**Is there any unprotected entry point to the aquifer within 100 metres of the well?**[c] An unprotected entry point to the aquifer (e.g. uncapped borehole, open dug well) could allow contaminants to enter the groundwater and contaminate the well.	❑	❑	❑	
	Total number of Yes responses				

[c] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

C. ADDITIONAL DETAILS

Include any additional risk factors,[d] recommendations, observations or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

[d] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ______________________

Organization: ______________________

Designation/title of inspector: ______________________

Signature: ______________________ Date: __________

Name of water supply representative: ______________________

Contact number (if available): ______________________

Signature (if available): ______________________ Date: __________

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World Health Organization

Dug well with a windlass

This technical fact sheet provides background information on a dug well with a windlass, which supports the sanitary inspection of this drinking-water source.[a]

A dug well consists of an excavated hole in the ground with a water-lifting device (e.g. hand pump, windlass) that is used to bring groundwater to the surface.

Groundwater is considered to be better quality than surface water in many places. However, appropriate treatment/disinfection are required for groundwater sources that are vulnerable to contamination.

Improved dug wells are lined, covered and fitted with a secure water-lifting device to provide safe drinking-water. **Unimproved dug wells** are open or uncovered wells. These are more likely to become contaminated, and should be improved where possible.

Dug wells can be excavated by hand or with a machine. The diameter of a dug well is often more than 1 metre. This means that dug wells can typically be accessed by a person for inspection, operations and maintenance or improvement works (e.g. repairing the well wall, removing sediment, deepening the well).

Dug wells should have adequate capacity (i.e. have an appropriate depth below the water table and width) to meet the needs of users at all times of the year. Limited capacity could result in users seeking alternative drinking-water sources that could be less safe.

The water collection area should be built so it is accessible for all users.[b]

Figure 1 shows a common type of dug well with a windlass. A section view of the belowground elements of the well is shown in Figure 2. These figures show a typical design. Other designs can also provide safe drinking-water.

Typical risk factors associated with a dug well with a windlass are presented in the corresponding *Sanitary inspection form.*

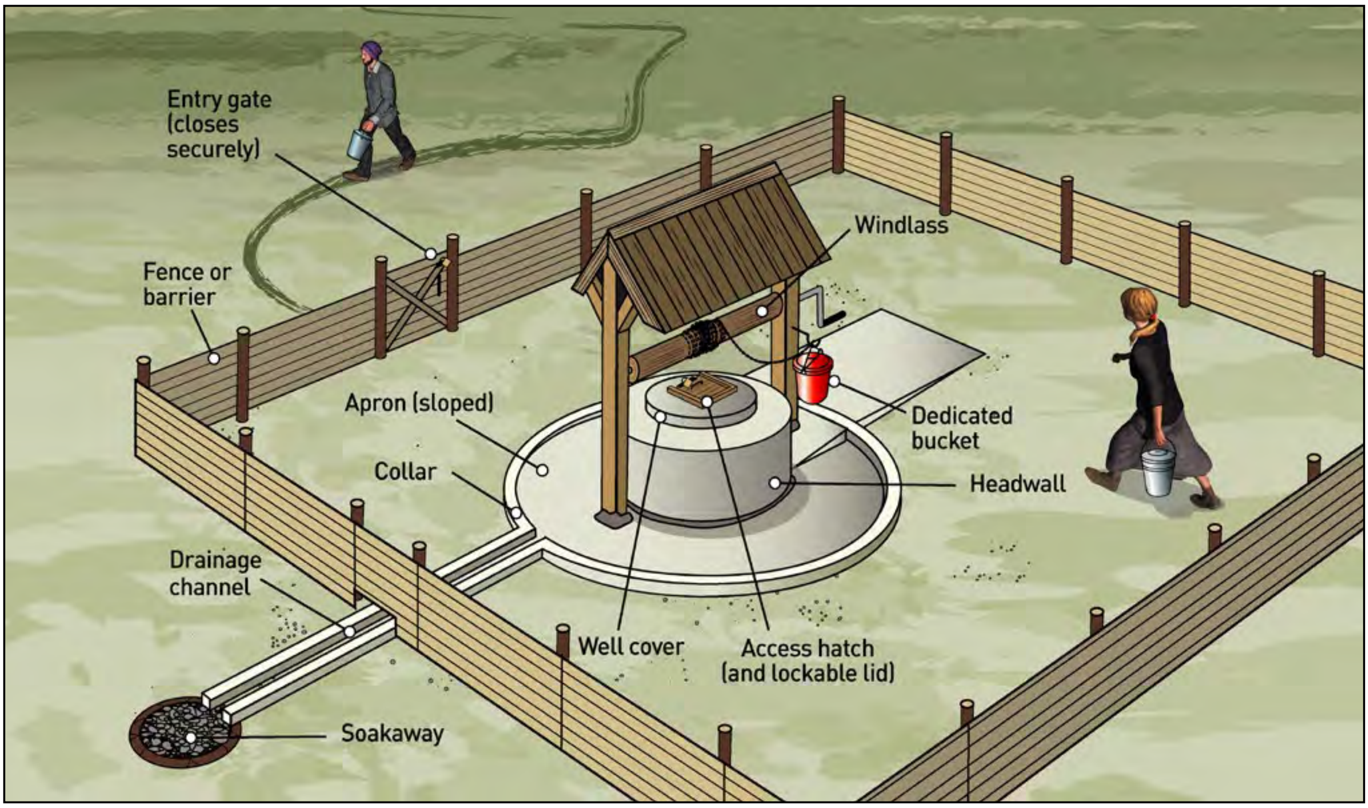

Figure 1. A common dug well with a windlass in a sanitary condition

[a] This fact sheet is not intended to serve as a guide to construction. For detailed guidance on the design and construction of a dug well, refer to Hand-dug shallow wells: series of manuals on drinking water supply, Vol. 5 (Collins, 2000).

[b] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones & Reed, 2005).

A dug well with a windlass typically includes the following main components.

- **Windlass:** Draws groundwater from the well and delivers it to the surface. A windlass is typically a fixed structure positioned above the well that collects water by manually rotating a windlass handle to lower/lift a bucket.
- **Bucket:** Allows users to collect water from the well. The bucket should be fixed to the windlass (e.g. by a chain or rope), and used only for the collection of drinking-water from the well. When not in use, the bucket should be kept in a sanitary storage area with a tightly fitting lid that closes securely (e.g. a clean, dry storage area that is raised off the ground).
- **Well wall:** The wall (or lining) between the well and the surrounding ground, which gives structural support that prevents the well from collapsing. The well wall is often constructed using reinforced concrete rings, bricks or concrete blocks. At least the top 3 metres of the well should be lined with an impermeable barrier (e.g. bricks and mortar) to stop surface water from draining into the well. Below this, the well wall should be permeable to allow groundwater to enter the well.
- **Headwall:** The part of the well wall aboveground that supports the cover slab. The headwall should have a water-tight seal with the cover slab and apron to stop surface water from entering the well.
- **Well cover:** A tightly fitting cover that is fixed in place over the headwall to prevent contaminants entering the well. The well cover is typically made from metal, plastic or wood. It should only be removed to allow inspection and operations and maintenance activities.
- **Access hatch:** Allows access to the well to collect water. The inspection hatch should have a lid that is tightly fitting and lockable to stop contaminants from entering the well, and to stop unauthorized access by people.
- **Apron:** A reinforced stone, brick or concrete floor built around the headwall to drain water away from the well. To ensure adequate protection, the apron should be at least 1 metre wide all around the headwall. The apron should slope down from the well towards a collar for adequate drainage. The apron also provides a standing area for users when collecting water.
- **Collar:** The raised edge of the apron that captures water and directs it to a drainage channel.
- **Drainage channel:** Directs water away from the well to a drainage area or soakaway, where the water can drain into the ground. The drainage channel should slope down from the well. This prevents water ponding and stagnating, which could contaminate the well. Drainage water may be used to provide water for livestock or other activities, provided that these activities occur at a safe distance downhill from the well.[c]
- **Soakaway:** A hole in the ground filled with coarse material (e.g. gravel, stones, rocks), or that has a permeable wall, that allows water to drain back into the ground. It should be located at a safe distance downhill from the well.[c]
- **Fence or barrier:** A physical barrier to prevent animals from contaminating the well area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked. Where practical, the fence or barrier should ideally be constructed at least 15 metres from the well (general guidance only).[c]

Additional considerations

Before the dug well is constructed, sources of naturally occurring contaminants (e.g. arsenic, fluoride) and contamination from human activities (e.g. agriculture, industry) should be investigated to determine their impact on groundwater quality. Latrines and other sanitation facilities should be identified before choosing a site for the well.

After a new dug well is constructed, it should be cleaned, flushed and disinfected (e.g. with chlorine), and flushed again, to disinfect the components before the water is used.[d] Ideally, water quality testing should be conducted before the dug well is commissioned to confirm the water is safe for consumption. Periodic disinfection and testing may also be required (e.g. after flooding, after well maintenance).

The corrosion potential of the groundwater should be considered when selecting components for the windlass. If the groundwater has low pH, high salinity and high chloride, corrosion-resistant materials are required.

When constructing new dug wells or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme).

[c] For guidance on determining appropriate minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

[d] See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating hand-dug wells (WHO & WEDC, 2013).

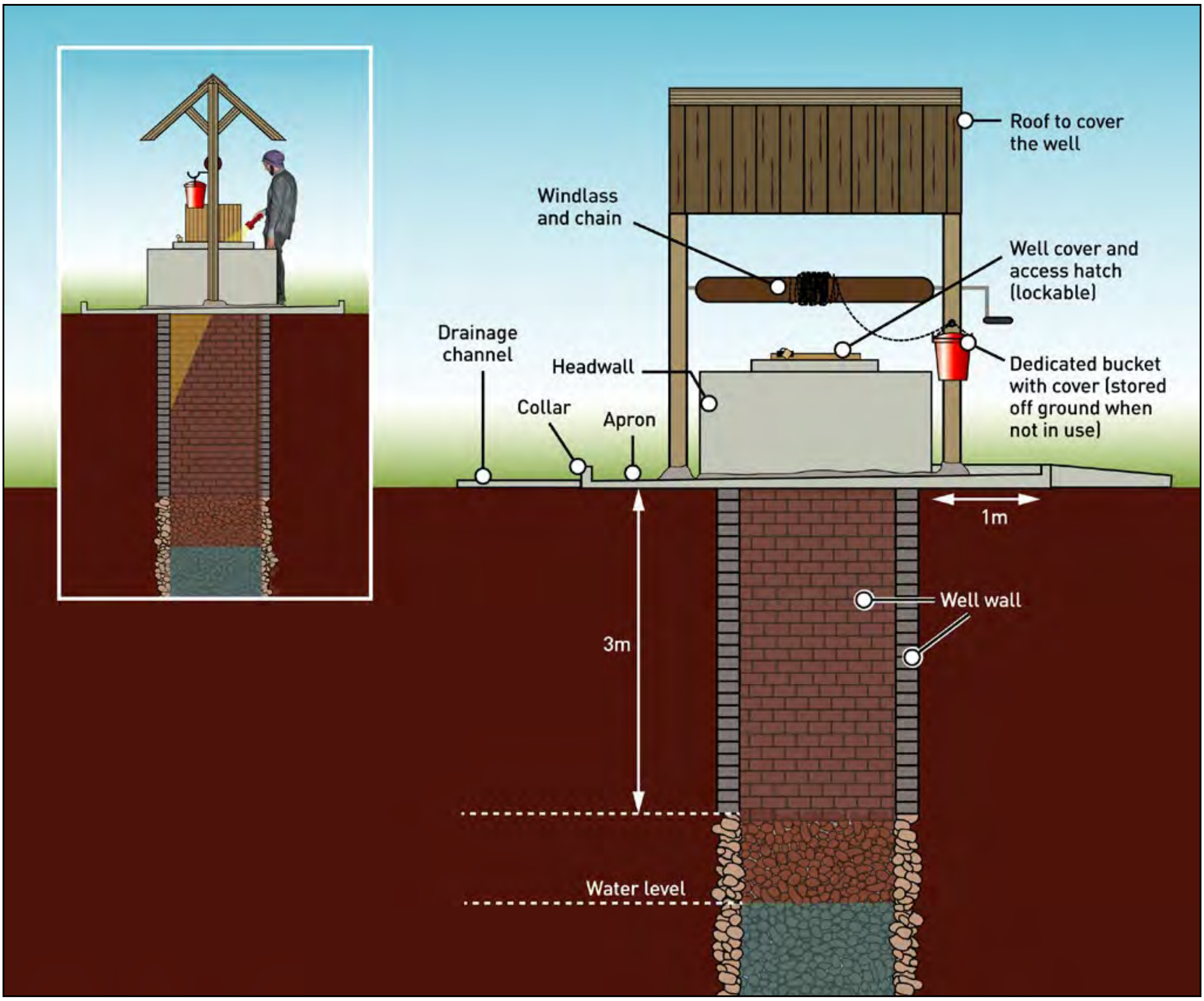

Figure 2. A common dug well with a windlass in a sanitary condition (section views)

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Dug well with a windlass

This management advice sheet provides guidance for the safe management of a dug well with a windlass, which supports the sanitary inspection of this drinking-water source.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the dug well and windlass in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained owner, user or caretaker/operator (e.g. simple maintenance tasks such as cleaning the well area). Larger repairs and maintenance tasks (e.g. repairing the well wall, windlass maintenance) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the dug well and windlass should be inspected routinely to help prevent contaminants entering the well. Any damage or faults should be repaired immediately (e.g. deep cracks in the headwall, broken fence, soil erosion around the apron). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. entering the well to inspect the well wall). These should be followed by trained individuals so the work is carried out safely and the well is not contaminated during the work.

Consultation with the relevant authorities may be required to ensure that sanitation infrastructure (e.g. latrine pits, septic tanks, sewers, soakage fields) is not built near the well unless hydrogeological studies show that it is safe to do so. Consideration should also be given to catchment activities that extract groundwater (e.g. for irrigation, mining, power) to ensure an adequate quantity of drinking-water to meet the needs of users.

Activities other than the collection of drinking-water (e.g. laundry, washing, bathing) should not be permitted at the dug well area. These should be carried out at a safe distance downhill from the well.

Adequate treatment/disinfection are required before consuming the drinking-water if the dug well is vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the dug well facility. Remove any polluting materials (e.g. faeces, rubbish). • Check and clean the bucket and chain (or rope). Store in a sanitary manner (e.g. in a clean/dry area, off the ground). • Check that the windlass is working. Repair or replace damaged parts as needed. • Check that the well cover and access hatch lid are in place and in good condition, and can be closed and latched shut/locked securely. Repair or replace damaged parts, or lock as needed. • Check that the drainage channel is clear and in good condition. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed.

Table 1. ...continued

Frequency	Activity
Annually	• Perform a detailed inspection of the well structure (including the well wall) for signs of damage or failure. Repair as needed.[a]
As the need arises[b]	• Drain the well (e.g. pump out as much water as possible), remove debris or sediment and clean the internal walls (e.g. using a brush and clean water), and then disinfect the well (e.g. with chlorine).[c] • Rehabilitate the well (e.g. repair the well wall, deepen the well).[a] • Replace any eroded earth around the dug well, and fill any depressions in the ground where water ponds. • Monitor water yield and use to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] For guidance on construction aspects, refer to Hand-dug shallow wells: series of manuals on drinking-water supply, Vol. 5 (Collins, 2000).

[b] See Table 2 for potential problems that could trigger these activities.

[c] For guidance on safely cleaning and disinfecting dug wells, see Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating hand-dug wells (WHO & WEDC, 2013). This activity is required following a contamination event (e.g. flooding, *E. coli* detection). *Note* – in water scarce areas, consult with local health authorities before draining the well to make sure that the risk to water quality justifies the loss of water. If the well is drained, alternative water supply arrangements may be needed to ensure that users have sufficient water quantity to meet domestic needs.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when entering the well for inspection or maintenance. Safety risks such as well collapse and asphyxiation should be appropriately managed. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form*. Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a dug well with a windlass, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The bucket and chain (or rope) are dirty or stored in a way they could become contaminated (e.g. in a wet area, on the ground).	• If the bucket and chain (or rope) are dirty, clean and disinfect them (e.g. with chlorine). • If there is no dedicated sanitary storage place for the bucket and chain (or rope), install a storage space for them (e.g. a hook or shelf raised off the ground). • Communicate the importance of routine cleaning/maintenance, and returning the bucket and chain (or rope) to the dedicated storage location after each use. Consider installing information signs at the well to remind users of the risk.
2	Individuals use their own buckets for drawing water from the well, which could allow contaminants to enter the well.	• Ensure there is a bucket present that is dedicated for drawing drinking-water from the well. • Communicate the importance of using only the dedicated bucket for drawing water from the well. Consider installing information signs at the well to remind users of the risk.
3	The well is inadequately covered, which could allow contaminants to enter the well (e.g. via surface water, entry of animals).	• If the well cover or access hatch lid is absent or damaged (e.g. deep cracks, severely corroded, does not fit tightly when closed), provide a temporary cover (e.g. impermeable plastic sheeting) to minimize the entry of contaminants. Install or repair the cover and/or lid as soon as possible.
4	The walls of the well – either above the ground (i.e. the headwall) or below the ground (i.e. well wall), are damaged (e.g. deep cracks, or gaps), which could allow contaminants to enter the well.	• Repair the headwall to ensure that the well is adequately sealed (e.g. repair mortar and brickwork). • For the belowground well wall, seek skilled help as needed to repair and seal the well wall. Pay special attention to the health and safety risks to workers when entering the well, and the potential to contaminate the well during the work. • Clean and disinfect (e.g. with chlorine) the well once finished.[c]
5	The apron around the well is absent or in poor condition (e.g. with gaps, deep cracks; signs of erosion under the apron), which could allow contaminants to enter the well (e.g. from contaminated surface water).	• If the apron is absent, construct an apron at least 1 metre around the headwall, ensuring that it slopes downward to a defined collar. • If the apron is damaged or has deep cracks, repair it to ensure that it is adequately sealed. • If the area around or under the apron shows signs of erosion, replace any eroded earth to ensure that it is adequately sealed. (Where the erosion is caused by poor drainage, see row 6.)
6	The drainage is inadequate (e.g. absent, damaged or blocked drainage channel or soakaway), which could result in stagnant water contaminating the well.	• If a drainage channel or soakaway is absent, dig a temporary channel to divert water away from the well site. Construct a permanent solution as soon as possible. • If a drainage channel or soakaway is not working, consider whether maintenance is needed (e.g. repairing, cleaning), or if deepening, widening or extending is required.

Table 2. ...continued

<table>
<tr><th>Question</th><th>Problem identified</th><th>Corrective actions to consider</th></tr>
<tr><td>7</td><td>The fence or barrier around the well is absent or inadequate, which could allow animals to contaminate or damage the well area.</td><td>• If absent, construct a robust fence or barrier with a lockable gate that closes securely.
• If a fence or barrier is present but inadequate to prevent access, repair or replace it.
• If the entry point (e.g. gate) to the well area is damaged and/or does not close securely, repair or replace it.</td></tr>
<tr><td>8</td><td>There is sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer line) within 15 metres of the well that could contaminate the well (e.g. from overflow, seepage).[d]</td><td rowspan="2">• Involve local authorities to assess the significance of the risk from the sanitation infrastructure.
• Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise the household to treat the water before consumption).
• Consult with local authorities to consider appropriate steps to relocate or eliminate the source of pollution.</td></tr>
<tr><td>9</td><td>There is sanitation infrastructure on higher ground within 30 metres of the well that could contaminate the well.[d]</td></tr>
<tr><td>10</td><td>There are other sources of pollution (e.g. open defecation, animals, drinking trough for livestock, rubbish, commercial activity, fuel storage) within 15 metres of the well that could contaminate the well.[d]</td><td>• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the dug well area in a clean condition.
• Consult with local authorities and users to consider:
  ◦ appropriate actions to relocate or eliminate the source of pollution
  ◦ other actions to minimize the issue from occurring again (e.g. signage, enforcement measures).</td></tr>
<tr><td>11</td><td>There is an unprotected point of entry to the aquifer (e.g. open or uncapped well or borehole) within 100 metres of the well that could provide a direct pathway for contaminants to enter the groundwater and contaminate the well.[d]</td><td>• Consult with local authorities to:
  ◦ assess the significance of the risk from the unprotected point of entry to the aquifer
  ◦ cover the point of entry in the immediate term
  ◦ consider what actions are appropriate to permanently seal, decommission or relocate the point of entry.</td></tr>
</table>

[d] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table and the volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

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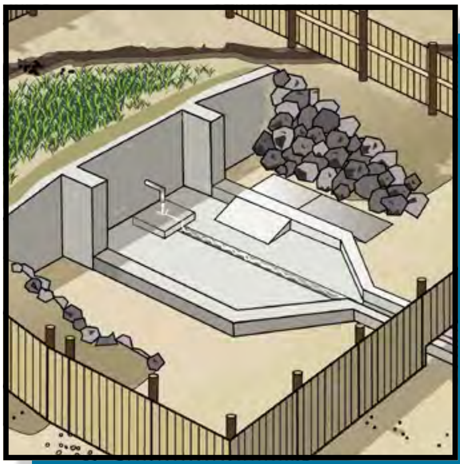

3

Sanitary inspection package

Spring

Spring

A. GENERAL INFORMATION

A.1. Spring information

Spring location (e.g. village, town, community, parish, district, province, state)								
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)								
Year of construction of spring				**Approximate number of households using this water source** Circle one of the options below				
				1–10	11–50	51–100	101–500	>500
Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)				
Is the spring affected by flooding?	Unsure	No	Yes					
Is the spring affected by drought?	Unsure	No	Yes					

A.2. System functionality

Circle **Yes** or **No** to indicate if water is currently available from the spring. If **No**, describe why (e.g. faulty or missing component, low water level) and then go to Section B. In Section C, record the corrective actions needed for the spring to provide water, and record the details of any alternative water source(s) currently being used.

Is water currently available from the spring?		If **No**, describe why (then go to Section B)
Yes	No	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.5)	Yes										
Parameter tested		*E. coli*[a]		*or* Thermotolerant (faecal) coliforms[a]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

- ❑ **No treatment applied.**
- ❑ **Treatment applied at the spring.** Describe (e.g. chlorine dose, frequency of dosing, how it is applied).[b]
- ❑ **Treatment applied downstream of the spring.** Describe (e.g. water treatment plant, household water treatment).

[a] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[b] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For general information on chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

General notes

- This form is intended for use on a single spring source. Where there are multiple springs to be inspected, additional forms will be needed. Springs may be inspected on a rotational basis where there are too many to cover during each inspection.
- If other water sources are in use (e.g. dug well, borehole), or if users collect and store water in the home, carry out additional sanitary inspections using the corresponding sanitary inspection packages.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the spring. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the spring being inspected.
3. Tick the **No** box if the question does apply to the spring being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

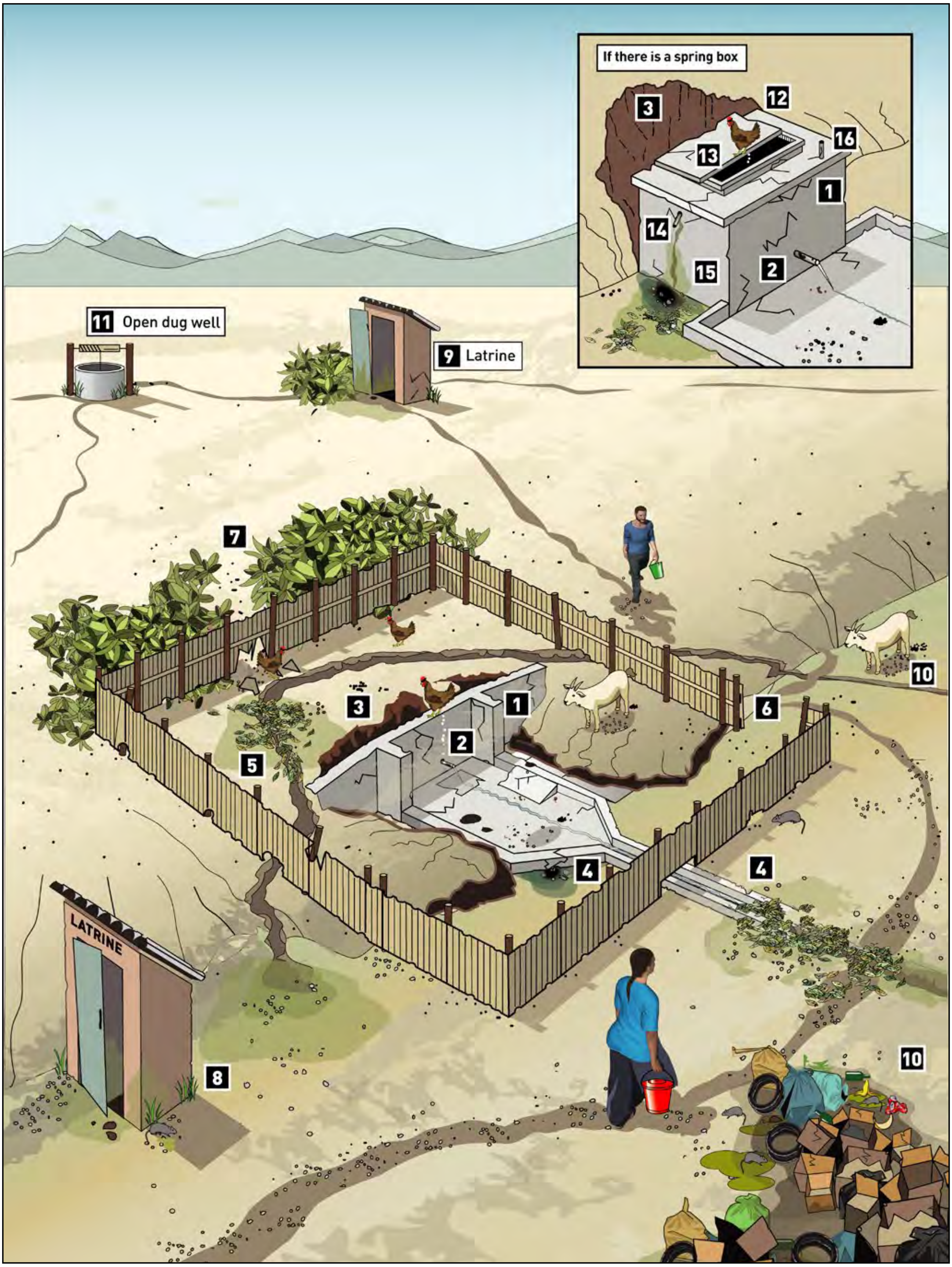

Figure 1. Typical risk factors associated with a spring. Main picture shows a protective spring wall. The inset picture (top right) shows an alternative design with a spring box.

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Does the spring lack a functioning protective structure?** Contaminants could enter the spring if there is no protective structure in place (e.g. a masonry or concrete wall, or a spring box). This could also happen if there is a protective structure in place, but it is damaged (e.g. deep cracks, gaps, leaking).	❑	❑	❑	
2	**Is the outlet pipe missing or in poor condition?** Contaminants could enter the water during collection if there is no outlet pipe in place. This could also happen if the outlet pipe is poorly maintained (e.g. damaged, severely corroded, leaking, dirty).	❑	❑	❑	
3	**Is the backfill area behind the protective structure eroded?** Contaminants could enter the spring if the backfill area shows signs of erosion (e.g. from surface water run-off).	❑	❑	❑	
4	**Is drainage inadequate, which could allow water to accumulate in the spring area?** Stagnant water could contaminate the spring if there is no drainage system in place. This could also happen if the drainage system is damaged (e.g. deep cracks) or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water and/or erosion under the apron may indicate poor drainage.	❑	❑	❑	
5	**Is a stormwater diversion ditch *above* the spring absent or blocked?** Surface water could contaminate the spring if there is no diversion ditch in place, or if it is blocked. Excessive run-off could also damage the spring components. *Note* – the presence of erosion around the spring may indicate inadequate diversion of surface water.	❑	❑	❑	
6	**Is the fence or barrier *around* the spring missing or inadequate so that animals could enter the spring area?** Animals could contaminate or damage the spring area if the fence or barrier around the spring is missing. This could also happen if the fencing or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
7	**Is the fence or barrier *uphill* of the spring absent or inadequate?**[c] Animals could contaminate the spring area if there is no fence or barrier uphill of the spring, or if the fence or barrier is broken or poorly built (e.g. has large gaps).	❑	❑	❑	
8	**Is there sanitation infrastructure within 15 metres of the spring?**[d] Sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer pipes) close to the spring may affect water quality. For example, waste could seep into the groundwater or overflow and be washed into the spring area, particularly after rain. Visually check structures in this area, and ask community members, to see if the structures are sanitation related.	❑	❑	❑	
9	**Is there sanitation infrastructure on higher ground within 30 metres of the spring?**[d] Contaminated groundwater and surface water may flow downhill from sanitation infrastructure towards the spring. This could result in harmful microorganisms and other contaminants entering the spring, particularly after rain.	❑	❑	❑	
10	**Can other sources of pollution be seen within 15 metres of the spring (e.g. open defecation, animals, drinking troughs for livestock, rubbish, commercial activity, fuel storage)?**[d] The presence of animals or faeces on the ground close to the spring poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could seep into the groundwater and contaminate the spring.	❑	❑	❑	
11	**Is there any unprotected entry point to the aquifer within 100 metres of the spring?**[d] An unprotected entry point to the aquifer (e.g. uncapped borehole, open dug well) could allow contaminants to enter the groundwater and contaminate the spring.	❑	❑	❑	

[c] An adequate fence or barrier means that the uphill area is closed-off to where the groundwater is at least 2 metres deep or 30 metres away from the spring (general guidance only – refer to note d).

[d] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

Sanitary inspection questions		NA	No	Yes	If Yes, what corrective action is needed?
Where there is a spring box[e]					
12	**Are there any signs of contaminants inside the spring box?** The presence of animals or faeces inside the spring box is a serious risk to the safety of the drinking-water, and indicates that harmful microorganisms are present. Sediments may also contain harmful microorganisms and other contaminants (such as metals) that can affect the safety or acceptability of the water.	❑	❑	❑	
13	**Is the inspection hatch lid missing or in poor condition?** Contaminants could enter the spring box (e.g. from the entry of contaminated water following rain, entry of animals) if the inspection hatch lid is missing (or open, unlocked). This could also happen if the lid is damaged (e.g. deep cracks, severely corroded, does not fit tightly when closed).	❑	❑	❑	
14	**Does the overflow pipe lack adequate protection from vermin?** Contaminants could enter the spring box (e.g. from insects, rodents, birds), if the overflow pipe is not covered with a vermin-proof screen (e.g. mesh, gauze).	❑	❑	❑	
15	**Is the overflow pipe poorly designed so that overflow water falls from a height on to the ground?** The spring box structure may be undermined and damaged if water from the overflow pipe erodes the ground beneath the spring box. This could affect water quality, or result in water loss.	❑	❑	❑	
16	**Are the air vents poorly designed so that contaminants could enter the spring box?** Contaminants could enter the spring box if the air vents are facing upwards, or are not covered with a vermin-proof screen.	❑	❑	❑	
				Total number of Yes responses	

[e] Where there is a protective wall in place instead of a spring box, record this information in Section C and tick the **NA** (not applicable) box for questions 12-16.

C. ADDITIONAL DETAILS

Include any additional risk factors,[f] recommendations, observations (e.g. spring box construction material, spring box volume) or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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f These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ___

Organization: ___

Designation/title of inspector: ___

Signature: ___ Date: ___

Name of water supply representative: ___

Contact number (if available): ___

Signature (if available): ___ Date: ___

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World Health Organization

Spring

This technical fact sheet provides background information on a spring, which supports the sanitary inspection of this drinking-water source.[a]

A spring is formed when groundwater is naturally forced up to the surface. For example, where solid rock or clay layers block the underground flow of groundwater.

Groundwater is considered to be better quality than surface water in many places. However, appropriate treatment/disinfection are required for groundwater sources that are vulnerable to contamination.

A spring source consists of a protective structure, such as a wall or spring box, with an outlet positioned below the lowest natural water level. Different types of spring systems exist, ranging from basic springs where water is collected by users directly at the source, to springs that feed larger storage tanks which may be connected to piped distribution networks.

Spring sources should have adequate capacity to meet the needs of users at all times of the year. Limited capacity could result in users seeking alternative drinking-water sources that could be less safe.

The water collection area should be built so it is accessible for all users.[b]

Figure 1 shows a common type of spring source consisting of a protective wall and outlet pipe. Alternatively, a spring box may be in place instead of a protective wall, as shown in Figure 2. These figures show typical designs. Other designs can also provide safe drinking-water.

Typical risk factors associated with a spring source are presented in the corresponding *Sanitary inspection form.*

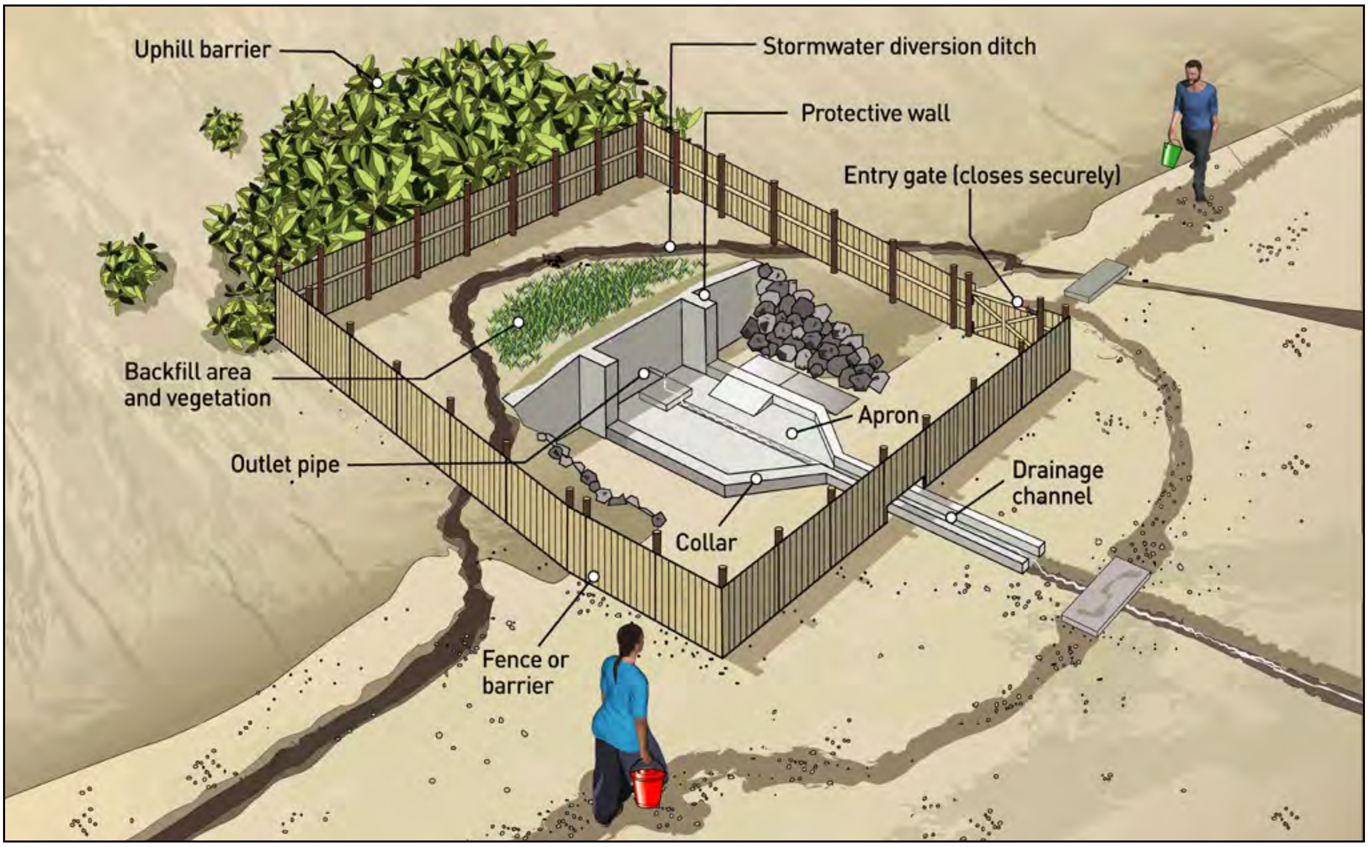

Figure 1. A common spring source with a protective wall in a sanitary condition

[a] This fact sheet is not intended to serve as a guide to construction. For more detailed guidance on the design and construction of a spring, refer to Spring catchment: series of manuals on drinking water supply, Vol. 4 (Meuli and Wehrle, 2001).

[b] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones & Reed, 2005).

A spring supply typically includes the following main components.

General spring components

- **Protective wall or spring box:** Directs spring water to an outlet as it leaves the ground. Typically constructed from concrete or masonry, this structure protects the water from contamination until it is collected by the user.
- **Outlet pipe:** A pipe (e.g. metal or plastic) that delivers water from the spring to the user. *Note* – the outlet pipe should be raised off the ground to minimize the risk of contamination during water collection.
- **Apron:** A reinforced stone, brick or concrete floor to drain water away from the spring area. The apron should slope down from the spring towards a collar for adequate drainage. The apron also provides a standing area for users when collecting water.
- **Collar:** The raised edge of the apron that captures water and directs it to a drainage channel.
- **Backfill area:** The area immediately behind the spring structure that protects the spring water as it flows to the surface. To stop erosion, the backfill area should be planted with light vegetation (e.g. grass). The roots from heavier vegetation (e.g. trees, larger bushes) could undermine and damage the spring structure or pipework.
- **Drainage channel:** Directs water away from the spring (e.g. to join a larger waterway or drain into the ground). The drainage channel should slope down from the spring. This prevents water ponding and stagnating, which could contaminate the spring. Drainage water may also be used to provide water for livestock or other activities, provided that these activities occur at a safe distance downhill from the spring.[c]
- **Stormwater diversion ditch:** Diverts uphill surface water away from the spring structure. The diversion ditch should have sufficient capacity (i.e. depth, width) to manage the most likely volumes of stormwater flow.
- **Fence or barrier:** A physical barrier to stop animals from contaminating the spring area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked. Where practical, the fence or barrier should ideally be constructed at least 15 metres from the spring (general guidance only).[c]

  A fence or barrier should also be present uphill of the spring to where the groundwater is at least 2 metres deep or 30 metres away from the spring (general guidance only).[c]

Spring box components

- **Inspection hatch:** Allows access to the spring box for inspection, operations and maintenance, or improvement works. The inspection hatch should have a lid (or cover) that is tightly fitting and lockable to stop contaminants from entering the spring box, and to stop unauthorized access by people.
- **Overflow pipe:** Directs excess water from the spring box to a drainage channel. This stops the spring box overflowing in an uncontrolled way, which could contaminate the spring or damage components. The overflow pipe should be facing downwards and have a vermin-proof screen (e.g. gauze or mesh) to stop contaminants entering the spring box. Water from the overflow pipe should not erode the ground beneath the pipe, as this could undermine and damage the spring box, which could lead to contamination or water loss.
- **Air vent:** Allows ventilation in the spring box. The air vent should be facing downwards and have a vermin-proof screen to stop contaminants entering the spring box.

Additional considerations

Before the spring is constructed, sources of naturally occurring contaminants (e.g. arsenic, fluoride) and contamination from human activities (e.g. agriculture, industry) should be investigated to determine their impact on groundwater quality. Latrines and other sanitation facilities should be identified before choosing a site for the spring.

After a new spring box is constructed, it should be cleaned, flushed and disinfected (e.g. with chlorine) and flushed again, to disinfect the components before the water is used. Ideally, water quality testing should be conducted before the spring is commissioned to confirm the water is safe for consumption. Periodic disinfection and testing may also be required (e.g. after flooding, after maintenance).

When constructing new springs or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme).

[c] For guidance on determining appropriate minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

[d] Guidance for disinfecting a spring box may be adapted from Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013).

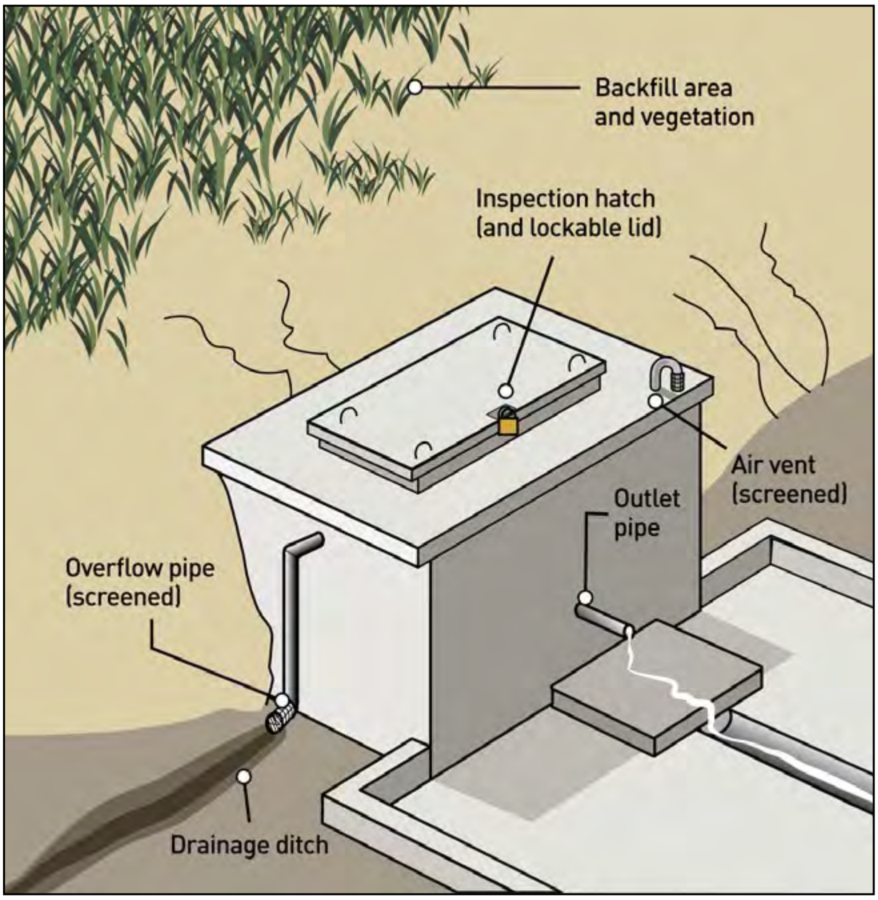

Figure 2. A common spring source with a spring box in a sanitary condition

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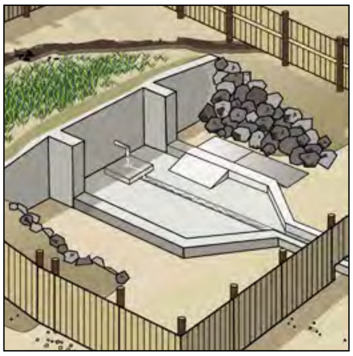
Spring

This management advice sheet provides guidance for the safe management of a spring, which supports the sanitary inspection of this drinking-water source.



Guidance for typical operations and maintenance (O&M) activities is provided in Table 1 including suggested frequencies for each activity. These activities are important for keeping the spring in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained owner, user or caretaker/operator (e.g. simple maintenance tasks such as cleaning the spring area). Larger repairs and maintenance tasks (e.g. repairing the spring box structure) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the spring should be inspected routinely to help prevent contaminants entering the spring. Any damage or faults should be repaired immediately (e.g. deep cracks in the spring box wall, broken fence, soil erosion behind the spring box). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. inspecting the spring box). These should be followed by trained individuals so the work is carried out safely and the spring is not contaminated during the work.

Consultation with the relevant authorities may be needed to ensure that sanitation infrastructure (e.g. latrine pits, septic tanks, sewers, soakage fields) is not built near the spring unless hydrogeological studies show that it is safe to do so. Consideration should also be given to catchment activities that extract groundwater (e.g. for irrigation, mining, power) to ensure an adequate quantity of drinking-water to meet the needs of users.

Activities other than collection of drinking-water (e.g. laundry, washing, bathing) should not be permitted at the spring area. These should be carried out at a safe distance downhill from the spring.

Adequate treatment/disinfection are required before consuming the drinking-water if the spring is vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the spring facility, including the outlet pipe. Remove any polluting materials (e.g. faeces, rubbish). • Check that the outlet pipe is in good working condition. Repair or replace damaged parts as needed, then clean and disinfect it (e.g. with chlorine). • Where present, check that the spring box inspection hatch lid (or cover) is in place and in good condition, and is closed and locked securely. Repair or replace damaged parts, and lock as needed. • Check that the inside of the spring box is clean (e.g. free from animals, faeces, sediment build-up). Drain as needed, then clean and disinfect it (e.g. with chlorine).[a] • Check that the drainage channels are clear and in good condition. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed.

Table 1. ...continued

Frequency	Activity
Weekly to monthly	• Where present, check that the spring box air vent and overflow pipe are in good condition. Ensure that protective vermin-proof screens are securely fitted and in good condition. Repair or replace damaged parts. • Check that the stormwater diversion ditch is clear and in good condition. Remove debris or repair as needed.
Annually	• Perform detailed inspection of the protective wall or spring box and the backfill area for signs of damage or failure. Repair as needed.[b]
As the need arises[c]	• If present, drain the spring box, remove debris or sediment and clean the internal walls (e.g. using a brush and clean water), and then disinfect the spring box (e.g. with chlorine).[a] • Rehabilitate the spring box or protective wall (e.g. repair the walls).[b] • Replace any eroded earth around the spring structure, and fill any depressions in the ground where water ponds. • Monitor water yield and use to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] Guidance for disinfecting a spring box may be adapted from Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013). This activity is required following a contamination event (e.g. after flooding, presence of animals in the spring box). *Note* – in water scarce areas, consult with local health authorities before draining the spring box to make sure that the risk to water quality justifies the loss of water. If the spring box is drained, alternative water supply arrangements may be needed to ensure that users have sufficient water quantity to meet domestic needs.

[b] For guidance on construction aspects, refer to Spring catchment: series of manuals on drinking water supply, Vol. 4 (Meuli and Wehrle, 2001).

[c] See Table 2 for potential problems that could trigger these activities.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when entering a spring box for inspection or maintenance. Safety risks such as asphyxiation and structure collapse should be appropriately managed. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form*. Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a spring source, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The spring lacks a functioning protective structure (e.g. a protective wall or spring box in good working condition), which could allow contaminants to enter the spring.	• If there is no protective structure in place, seek the relevant skilled help to construct a wall or spring box. • If the protective structure is in poor condition (e.g. damaged, deep cracks, gaps, leaking), repair the structure as needed (e.g. repair mortar or brickwork). • Consider what immediate actions should be taken to minimize the risk to health in the interim (e.g. advise users to treat the water before consumption or use an alternative safe water source).
2	The outlet pipe is absent, or it is in poor condition, which could allow contaminants to enter the water during collection.	• If the outlet pipe is absent, rehabilitate the spring structure to include an outlet pipe. • If the outlet pipe is in poor condition, repair or replace the outlet pipe, then clean and disinfect it (e.g. with chlorine). • If the outlet pipe is dirty, clean and disinfect it. • Communicate the importance of routine cleaning/maintenance of the outlet pipe.
3	The backfill area is eroded (e.g. due to surface water run-off and the absence of vegetation), which could allow contaminants to enter the spring.	• Rehabilitate the backfill area with suitable filler material (e.g. earth) and plant light vegetation (e.g. grass, small bushes) to protect against erosion. • Ensure adequate drainage is in place to prevent erosion of the backfill area (see row 5).
4	The drainage is inadequate (e.g. absent, damaged or blocked drainage channel), which could result in stagnant water contaminating the spring.	• If a drainage channel or soakaway is absent, dig a temporary channel to divert water away from the spring site. Construct a permanent solution as soon as possible. • If a drainage channel or soakaway is not working, consider whether maintenance is needed (e.g. repairing, cleaning), or if deepening, widening or extending is required.
5	The stormwater diversion ditch uphill of the spring is absent or inadequate, which could allow surface water run-off to contaminate the spring or damage its components.[d]	• If a stormwater diversion ditch is absent, dig a temporary uphill ditch to divert surface water away from the spring area. Construct a permanent solution as soon as possible. • If an uphill diversion ditch is present but it is not working, consider whether maintenance is required (e.g. repair, cleaning), or if deepening, widening or extending is required.
6	The fence or barrier around the spring is absent or inadequate, which could allow animals to contaminate or damage the spring area.	• If absent, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the spring area is damaged and/or does not close securely, repair or replace it.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
7	The fencing or barrier uphill[d] of the spring is absent or inadequate, which could allow contaminants to enter the spring (e.g. from animal faeces, open defecation, agricultural practices).	• If absent, construct a robust fence or barrier an appropriate distance uphill of the spring. • If an uphill fence or barrier is present but inadequate to prevent access, repair or replace it. • If an uphill fence or barrier is present but it is an insufficient distance from the spring, extend the fence or barrier further uphill from the spring.
8	There is sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer line) within 15 metres of the spring that could contaminate the spring (e.g. from overflow, seepage).[e]	• Involve local authorities to assess the significance of the risk from the sanitation infrastructure. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. issue household water treatment advisory). • Consult with local authorities to consider appropriate steps to relocate or eliminate the source of pollution.
9	There is sanitation infrastructure on higher ground within 30 metres of the spring that could contaminate the spring.[e]	
10	There are other sources of pollution (e.g. open defecation, animals, drinking trough for livestock, rubbish, commercial activity, fuel storage) within 15 metres of the spring that could contaminate the spring.[e]	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the spring area in a clean condition. • Consult with local authorities and users to consider: ◦ appropriate actions to relocate or eliminate the source of pollution ◦ other actions to minimize the issue from occurring again (e.g. signage, enforcement measures).
11	There is an unprotected point of entry to the aquifer (e.g. open or uncapped well or borehole) within 100 metres of the spring that could provide a direct pathway for contaminants to enter the groundwater and contaminate the spring.[e]	• Consult with local authorities to: ◦ assess the significance of the risk from the unprotected point of entry to the aquifer ◦ cover the point of entry in the immediate term ◦ consider what actions are appropriate to permanently seal, decommission or relocate the point of entry.
Where there is a spring box		
12	There are signs of contaminants (e.g. animals, faeces, sediment build-up) in the spring box, which could present a serious risk to water quality.	• Remove the contaminants immediately if possible. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to treat the water before consumption). • Drain, clean and disinfect the spring box (e.g. with chlorine).[a] • Consider appropriate measures to minimize the risk of contaminants entering the spring box from this source in the future (e.g. locking the inspection hatch, securing the fence or barrier).

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
13	The inspection hatch lid is missing (or open, unlocked), or it is in poor condition (e.g. deep cracks, severely corroded, does not fit tightly when closed), which could allow contaminants to enter the spring box.	• If the inspection hatch lid is missing or in poor condition, provide a temporary cover (e.g. impermeable plastic sheeting) over the inspection hatch to minimize the entry of contaminants. Repair or replace the hatch and/or lid as soon as possible. • If the inspection hatch lid is open or unlocked, communicate the importance of closing and locking the lid securely when not in use (e.g. through awareness raising, signage).
14	The overflow pipe is inadequately protected (e.g. with a mesh or gauze), which could allow vermin (e.g. insects, rodents, birds) to enter the spring box and contaminate the water.	• If the overflow pipe is unprotected, cover the pipe with a vermin-proof screen (e.g. gauze or mesh). • If the overflow pipe screen is damaged (e.g. ripped, broken) or has wide gaps, replace with a functioning vermin-proof screen.
15	The overflow pipe is poorly designed and allows overflow water to fall from a height and erode the ground beneath the spring box, which could damage the spring box and affect water quality, or result in water loss.	• Modify or extend the overflow pipe so that it does not erode the ground beneath it, and directs the overflow water away from the spring area (e.g. via a drainage channel).
16	The air vents are poorly designed (e.g. facing upwards) or unprotected (e.g. no vermin-proof screen), which could allow contaminants to enter the spring box.	• If the air vents are facing upwards, modify the vents so they face downwards. • If the air vents are unprotected, cover the vents with a vermin-proof screen. • If the air vent screens are damaged or have wide gaps, replace with functioning vermin-proof screens.

[d] As a general guide, a fence or barrier should also be present uphill of the spring to where the groundwater is at least 2 metres deep or 30 metres away from the spring (refer to note e).

[e] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and the volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

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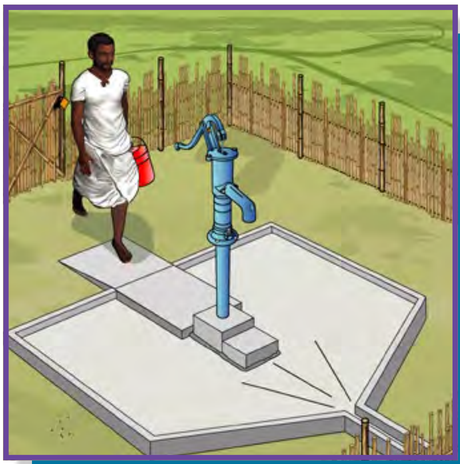

4

Sanitary inspection package

Tubewell with a hand pump

Tubewell with a hand pump

A. GENERAL INFORMATION

A.1. Tubewell information

Tubewell location (e.g. village, town, community, parish, district, province, state)

Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)	

Year of construction of tubewell	**Depth of tubewell** (including units)	**Approximate number of households using this water source** Circle one of the options below				
		1–10	11–50	51–100	101–500	>500

Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)
Is the tubewell affected by flooding?	Unsure	No	Yes	
Is the tubewell affected by drought?	Unsure	No	Yes	

A.2. System functionality

Circle **Yes** or **No** to indicate if water is currently available from the tubewell. If **No**, describe why (e.g. broken pump, low water level) and then go to Section B. In Section C, record the corrective actions needed for the tubewell to provide water, and record the details of any alternative water source(s) currently being used.

Is water currently available from the tubewell?		If **No**, describe why (then go to Section B)
Yes	No	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**	**Sample identification code**	**Other information**
No (go to A.5)	Yes			

Parameter tested	*E. coli*[a] *or* Thermotolerant (faecal) coliforms[a]				Additional parameter		Additional parameter		Additional parameter	
Results and units	Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

❑ **No treatment applied.**

❑ **Treatment applied at the tubewell.** Describe (e.g. chlorine dose, frequency of dosing, how it is applied).[b]

❑ **Treatment applied downstream of the tubewell.** Describe (e.g. household water treatment).

[a] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[b] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For general information on chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

General notes

- This form is intended for use on a single tubewell with a hand pump. Where there are multiple tubewells to be inspected, additional forms will be needed. Tubewells may be inspected on a rotational basis where there are too many to cover during each inspection.
- If other water sources are in use (spring, borehole), or if users collect and store water in the home, carry out additional sanitary inspections using the corresponding sanitary inspection packages.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the tubewell. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the tubewell being inspected.
3. Tick the **No** box if the question does apply to the tubewell being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

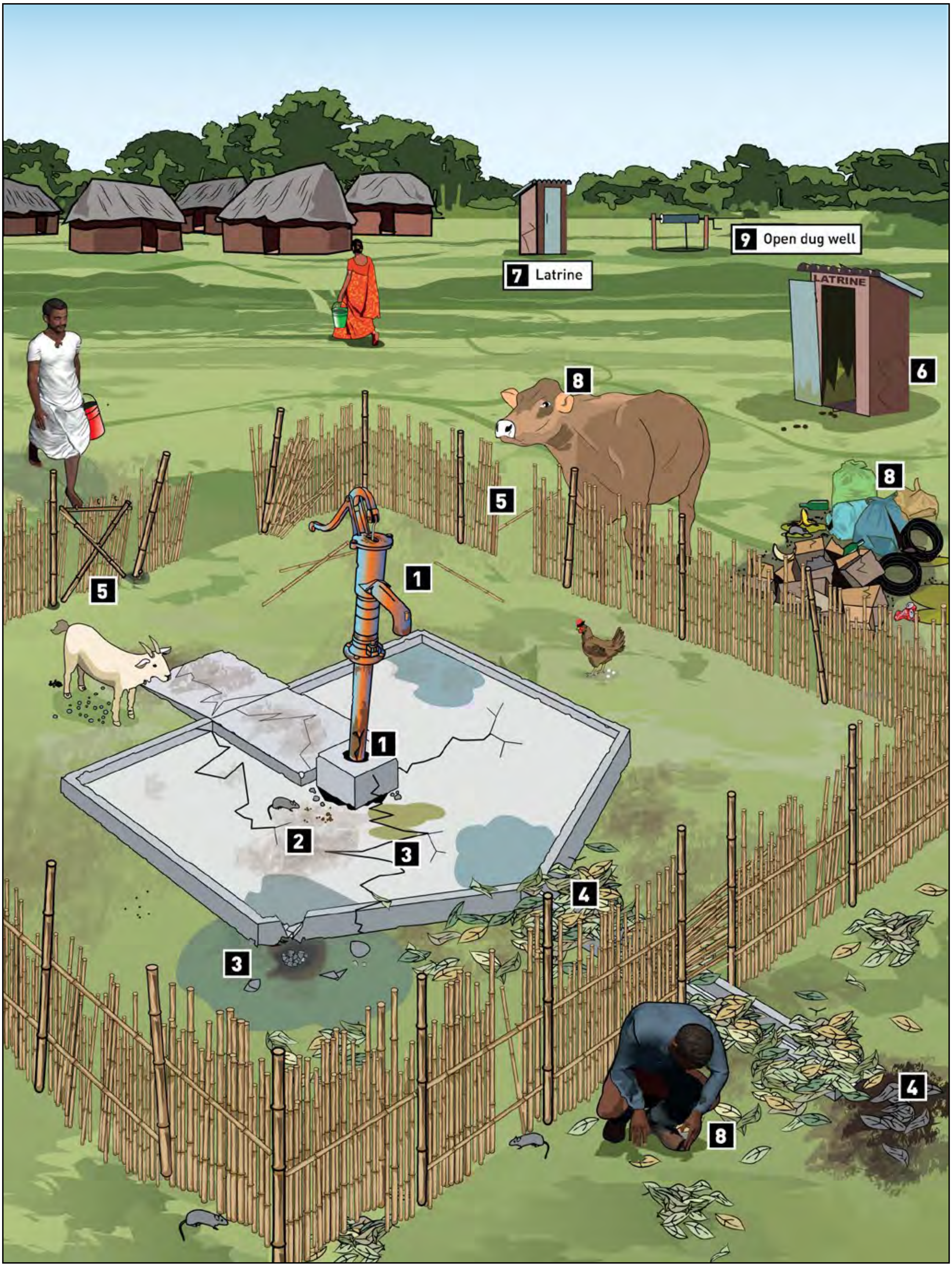

Figure 1. Typical risk factors associated with a tubewell with a hand pump

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Is the pump in poor condition or loose at the point of attachment to the mounting block?** Contaminants could enter the water if the hand pump is damaged or severely corroded, or if the spout is dirty. Contaminated surface water could also enter the tubewell, particularly after rain, if the hand pump is loosely attached to the mounting block (i.e. if there is a gap between the hand pump and the mounting block).	❑	❑	❑	
2	**Is the area directly around the tubewell seal dirty?**[c] Contaminants could enter the tubewell, particularly after rain, if the area immediately around the tubewell seal shows signs of pollution (e.g. animals, faeces).	❑	❑	❑	
3	**Is the apron around the tubewell absent or in poor condition?** Contaminants could enter the tubewell, particularly after rain, if there is no apron. This could also happen if the apron is damaged (e.g. gaps, deep cracks). Erosion under the apron could also allow contaminated surface water to enter the tubewell.	❑	❑	❑	
4	**Is drainage inadequate, which could allow water to accumulate in the tubewell area?** Stagnant water could contaminate the tubewell if there is no drainage system in place. This could also happen if the drainage system is damaged (e.g. deep cracks) or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water and/or erosion under the apron may indicate poor drainage.	❑	❑	❑	
5	**Is the fence or barrier around the tubewell missing or inadequate so that animals could enter the tubewell area?** Animals could contaminate or damage the tubewell area if the fence or barrier around the tubewell is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
6	**Is there sanitation infrastructure within 15 metres of the tubewell?**[d] Sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer pipes) close to the tubewell may affect water quality. For example, waste could seep into the groundwater or overflow and be washed into the tubewell, particularly after rain. Visually check structures in this area, and ask community members, to see if the structures are sanitation related.	❑	❑	❑	
7	**Is there sanitation infrastructure on higher ground within 30 metres of the tubewell?**[d] Contaminated groundwater and surface water may flow downhill from sanitation infrastructure towards the tubewell. This could cause harmful microorganisms and other contaminants to enter the tubewell, particularly after rain.	❑	❑	❑	
8	**Can other sources of pollution be seen within 15 metres of the tubewell (e.g. open defecation, animals, drinking troughs for livestock, rubbish, commercial activity, fuel storage)?**[d] The presence of animals or faeces on the ground close to the tubewell poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could be washed into the tubewell during rain or seep into the groundwater.	❑	❑	❑	
9	**Is there any unprotected entry point to the aquifer within 100 metres of the tubewell?**[d] An unprotected entry point to the aquifer (e.g. uncapped borehole, open dug well) could allow contaminants to enter the groundwater and contaminate the tubewell.	❑	❑	❑	
	Total number of Yes responses				

[c] The seal protects the tubewell from contamination, filling the underground area between the tubewell casing and the surrounding earth. Refer to the *Technical fact sheet* for further information.

[d] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

C. ADDITIONAL DETAILS

Include any additional risk factors,[e] recommendations, observations or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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[e] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ___

Organization: ___

Designation/title of inspector: ___

Signature: ___ Date: ___

Name of water supply representative: ___

Contact number (if available): ___

Signature (if available): ___ Date: ___

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Tubewell with a hand pump

This technical fact sheet provides background information on a tubewell with a hand pump, which supports the sanitary inspection of this drinking-water source.[a]

A tubewell consists of a drilled hole in the ground, with a water-lifting device (e.g. a hand pump) that is used to bring groundwater to the surface.

Groundwater is considered to be better quality than surface water in many places. However, appropriate treatment/disinfection are required for groundwater sources that are vulnerable to contamination.

Tubewells can be constructed by hand (e.g. using a manual auger) or by machinery (e.g. percussion drilling). The tubewell should be lined with a casing and have a screen, and be fitted with a secure water-lifting device (e.g. a hand pump in the case of shallower tubewells).[b]

Tubewells are generally 0.1–0.25 metres in diameter. For this reason, tubewells cannot be physically accessed by a person for inspection, operations and maintenance (e.g. sediment removal) or improvement works. These activities must be carried out from ground level once the hand pump has been removed.

Tubewells should have adequate capacity (i.e. have an appropriate depth below the water table and width) to meet the needs of users at all times of the year. Limited capacity could result in users seeking alternative drinking-water sources that could be less safe.

The water collection area should be built so it is accessible all users.[c]

Figure 1 shows a common type of tubewell with a hand pump. A section view of the belowground elements of the tubewell is shown in Figure 2. These figures show a typical design. Other designs can also provide safe drinking-water (e.g. using a motorized pump).

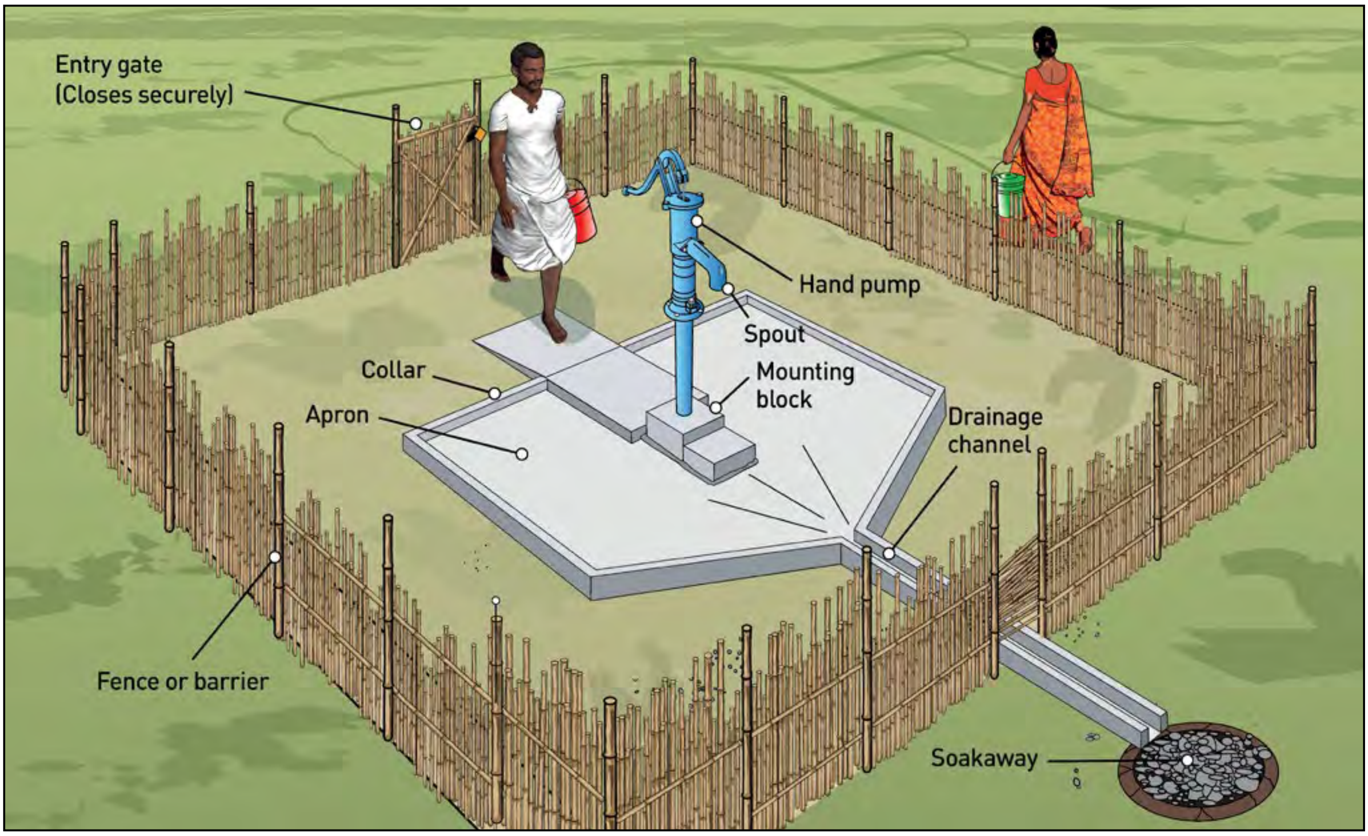

Figure 1. A common tubewell with a hand pump in a sanitary condition

[a] This fact sheet is not intended to serve as a guide to construction. For detailed guidance on the design and construction of a tubewell, refer to Hand-dug shallow wells: series of manuals on drinking water supply, Vol. 5 (Collins, 2000).

[b] Hand pumps (levered type) may be suitable for water abstraction depths of up to approximately 45 metres. Deeper than 45 metres, geared hand pumps or motorized pumps are likely required.

[c] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones & Reed, 2005).

Typical risk factors associated with a tubewell with a hand pump are presented in the corresponding *Sanitary inspection form.*

A tubewell with a hand pump typically includes the following main components.

- **Hand pump:** Draws groundwater from the tubewell through a pipe (called a **rising main**) to the point of collection (the **spout**) above the surface. The hand pump should be securely fitted to the casing and mounting block (i.e. tightly fitting with no gaps) to prevent contaminants from entering the tubewell.[d]
- **Mounting block:** A raised stone, brick or concrete cover built over the tubewell to support the casing and rising main. The mounting block also provides a point of attachment for the hand pump.
- **Seal:** Provides structural protection for the upper part of the tubewell, and protects the tubewell from contamination. The seal is typically constructed using a mixture of cement, bentonite (clay) and sand. The seal should fill the gap between the casing and surrounding ground, and should not allow water to pass through it. For adequate protection, the seal should extend to a depth of at least 3 metres.
- **Casing:** Provides structural support for the walls of the tubewell and protects the rising main. The casing should have sufficient strength to resist collapse, and is typically made from water-resistant materials such as metals, plastic or fibreglass. Where practical, the casing should ideally extend to at least 0.5 metres above the ground to protect from surface water contamination.
- **Screen:** Provides structural support for the tubewell and allows water to enter the casing (acting also as a barrier to prevent larger particles from entering the rising main). The screen material should be resistant to corrosion and have sufficient strength to resist collapse.
- **Apron:** A reinforced stone, brick or concrete floor built around the tubewell to drain water away from the tubewell area. To ensure adequate protection, the apron should be at least 1 metre wide all around the mounting block. The apron should slope down from the tubewell towards a collar for adequate drainage. The apron also provides a standing area for users when collecting water.
- **Collar:** The raised edge of the apron that captures water and directs it to a drainage channel.
- **Drainage channel:** Directs water away from the tubewell to a drainage area or soakaway, where the water can drain into the ground. The drainage channel should slope down from the tubewell. This prevents water ponding and stagnating, which could contaminate the tubewell. Drainage water may be used to provide water for livestock or other activities, provided that these activities occur at a safe distance downhill from the tubewell.
- **Soakaway:** A hole in the ground filled with coarse material (e.g. gravel, stones, rocks), or that has a permeable wall, that allows water to drain back into the ground. The soakaway should be located at a safe distance downhill from the tubewell.[e]
- **Fence or barrier:** A physical barrier to prevent animals from contaminating the tubewell area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked. Where practical, the fence or barrier should ideally be constructed at least 15 metres from the tubewell (general guidance only).[e]

Additional considerations

Before the tubewell is constructed, sources of naturally occurring contaminants (e.g. arsenic, fluoride) and contamination from human activities (e.g. agriculture, industry) should be investigated to determine their impact on groundwater quality. Latrines and other sanitation facilities should be identified before choosing a site for the tubewell.

After a new tubewell is constructed, it should be cleaned, flushed and disinfected (e.g. with chlorine), and flushed again, to disinfect the components before the water is used.[f] Ideally, water quality testing should be conducted before the tubewell is commissioned to confirm the water is safe for consumption. Periodic disinfection and testing may also be required (e.g. after flooding, after maintenance).

The corrosion potential of the groundwater source needs to be considered when selecting components for the hand pump. If the groundwater has low pH, high salinity and high chloride, corrosion-resistant materials are required.

When constructing new tubewells or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme, including for lead-free or low-lead materials).

[d] For deeper tubewells that require motorized pumps, refer to the *Sanitary inspection package: borehole with a motorized pump*, which can be adapted for tubewells.

[e] For guidance on determining appropriate minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

[f] See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating boreholes, (WHO & WEDC, 2013).

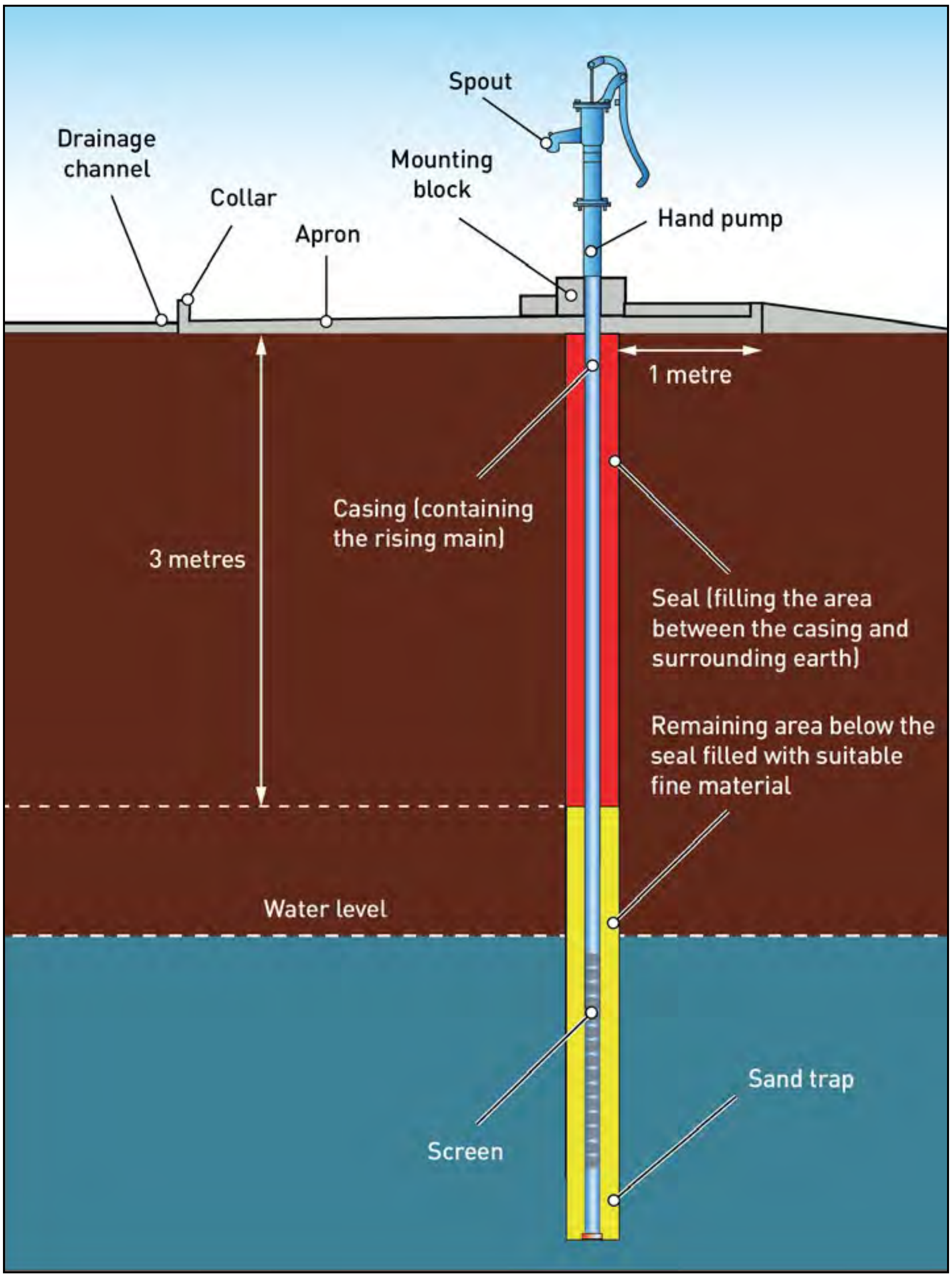

Figure 2. A tubewell with a hand pump in a sanitary condition (section view)

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Tubewell with a hand pump

This management advice sheet provides guidance for the safe management of a tubewell with a hand pump, which supports the sanitary inspection of this drinking-water source.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the tubewell and hand pump in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained owner, user or caretaker/operator (e.g. simple maintenance tasks such as cleaning the tubewell area). Larger repairs and maintenance tasks (e.g. repairing the apron, pump maintenance) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the tubewell and hand pump should be inspected routinely to help prevent contaminants entering the tubewell. Any damage or faults should be repaired immediately (e.g. deep cracks in the apron, broken fence, soil erosion around the apron). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. removing the hand pump for maintenance, inspecting the screen). These should be followed by trained individuals so the work is carried out safely and the tubewell is not contaminated during the work.

Consultation with the relevant authorities may be required to ensure that sanitation infrastructure (e.g. latrine pits, septic tanks, sewers, soakage fields) is not built near the tubewell unless hydrogeological studies show that it is safe to do so. Consideration should also be given to catchment activities that extract groundwater (e.g. for irrigation, mining, power) to ensure an adequate quantity of drinking-water to meet the needs of users.

Activities other than the collection of drinking-water (e.g. laundry, washing, bathing) should not be permitted at the tubewell area. These should be carried out at a safe distance downhill from the tubewell.

Adequate treatment/disinfection are required before consuming the drinking-water if the tubewell is vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the tubewell facility, including the spout. Remove any polluting materials (e.g. faeces, rubbish). • Check that the hand pump is working.[a] Perform pump maintenance as needed, repair or replace damaged parts, then clean and disinfect (e.g. with chlorine) the hand pump. • Check that the drainage channel is clear and in good condition. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed.
Annually	• Perform a detailed inspection of the tubewell structure (including the screen) for signs of damage or failure. Repair or replace damaged parts as needed.[b]

Table 1. ...continued

Frequency	Activity
As the need arises[c]	• Remove sediment, and clean (e.g. via high pressure water jetting) and disinfect the tubewell (e.g. with chlorine).[d] • Unclog the screen. • Rehabilitate the tubewell (e.g. deepen the tubewell).[b] • Replace any eroded earth around the tubewell, and fill any depressions in the ground where water ponds. • Monitor water yield and use to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] Where practical, a broader assessment of hand pump functionality and condition can be performed during the sanitary inspection. For basic guidance on functionality checks, preventive maintenance and repair for common hand pump types, refer to the pump-specific guidance manuals at https://www.rural-water-supply.net/en/resources/, or the relevant manufacturer's guide.

[b] For guidance on construction aspects, refer to Hand-dug shallow wells: series of manuals on drinking-water supply, Vol. 5 (Collins, 2000).

[c] See Table 2 for potential problems that could trigger these activities.

[d] See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating boreholes (WHO & WEDC, 2013), which can be adapted for tubewells. This activity is required following a contamination event (e.g. flooding, *E. coli* detection).

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only persons with relevant training/skills should undertake the activities in Table 1. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form.* Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a tubewell source, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The hand pump is in poor condition, or it is loose at the point of attachment to the mounting block, which could allow contaminants to enter the water.	• Repair any damaged or severely corroded components of the hand pump. Then clean and disinfect the hand pump (e.g. with chlorine). • If the tubewell spout is dirty, clean and disinfect it. • Fix the hand pump unit so that it is firmly attached to the mounting block with no gaps. • Communicate the importance of routine cleaning/maintenance of the hand pump.
2	The area around the tubewell seal is dirty (e.g. signs of pollution such as animals, faeces), which could allow contaminants to enter the tubewell.	• Clean the area directly around the seal. • Communicate to the operator or caretaker the importance of maintaining the area around the tubewell seal in a clean condition.
3	The apron around the tubewell is absent, or it is in poor condition (e.g. with gaps, deep cracks, signs of erosion under the apron), which could allow contaminants to enter the tubewell (e.g. from contaminated surface water).	• If the apron is absent, construct an apron at least 1 metre around the casing, ensuring that it slopes downward to a defined collar. • If the apron is damaged or has deep cracks, repair it to ensure that it is adequately sealed. • If the area around or under the apron shows signs of erosion, replace any eroded earth to ensure that it is adequately sealed. (Where the erosion is caused by poor drainage, see row 4.)
4	The drainage is inadequate (absent, damaged or blocked drainage channel or soakaway), which could result in stagnant water contaminating the tubewell.	• If a drainage channel or soakaway is absent, dig a temporary channel to divert water away from the tubewell area. Construct a permanent solution as soon as possible. • If a drainage channel or soakaway is not working, consider whether maintenance is needed (e.g. repairing, cleaning), or if deepening, widening or extending is required.
5	The fence or barrier around the tubewell is absent or inadequate, which could allow animals to contaminate or damage the tubewell area.	• If absent, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the tubewell area is damaged and/or does not close securely, repair or replace it.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
6	There is sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer line) within 15 metres of the tubewell that could contaminate the tubewell (e.g. from overflow, seepage).[e]	• Involve local authorities to assess the significance of the risk from the sanitation infrastructure. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise the household to treat the water before consumption). • Consult with local authorities to consider appropriate steps to relocate or eliminate the source of pollution.
7	There is sanitation infrastructure on higher ground within 30 metres of the tubewell that could contaminate the tubewell.[e]	
8	There are other sources of pollution (e.g. open defecation, animals, drinking trough for livestock, rubbish, commercial activity, fuel storage) within 15 metres of the tubewell that could contaminate the tubewell.[e]	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the tubewell area in a clean condition. • Consult with local authorities and users to consider: ◦ appropriate actions to relocate or eliminate the source of pollution ◦ other actions to minimize the issue from occurring again (e.g. signage, enforcement measures).
9	There is an unprotected point of entry to the aquifer (e.g. open or uncapped well or borehole) within 100 metres of the tubewell that could provide a direct pathway for contaminants to enter the groundwater and contaminate the tubewell.[e]	• Consult with local authorities to: ◦ assess the significance of the risk from the unprotected point of entry to the aquifer ◦ cover the point of entry in the immediate term ◦ consider what actions are appropriate to permanently seal, decommission or relocate the point of entry.

[e] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and the volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

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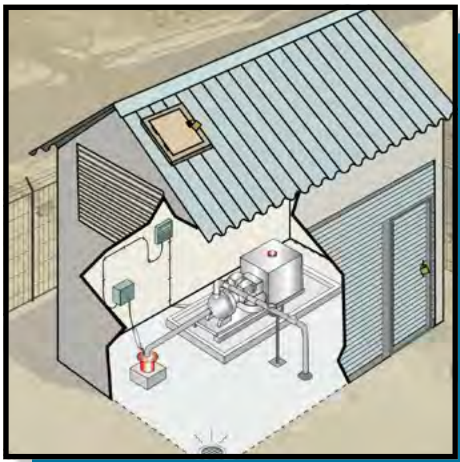

5

Sanitary inspection package

Borehole with a motorized pump

Borehole with a motorized pump

A. GENERAL INFORMATION

A.1. Borehole information

Borehole location (e.g. village, town, community, parish, district, province, state)							
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)							
Year of construction of borehole	**Borehole depth** (including units)	**Approximate number of households using this water source** Circle one of the options below					
		1–10	11–50	51–100	101–500	>500	
Source of power for the motorized pump Tick (✓) the appropriate box(es) and provide further information where applicable		❑ Fuel ❑ Solar ❑ Electricity ❑ Wind ❑ Other. Describe:					
Circle one of the options below				If **Yes**, describe (e.g. type of back-up power supply, how reliable it is)			
Is there a back-up power supply for the motorized pump?	Unsure	No	Yes				
Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)			
Is the borehole affected by flooding?	Unsure	No	Yes				
Is the borehole affected by drought?	Unsure	No	Yes				

A.2. System functionality

Circle **Yes** or **No** to indicate if water is currently available from the borehole. If **No**, describe why (e.g. faulty pump, no power supply, low water level) and then go to Section B. In Section C, record the corrective actions needed for the borehole to provide water, and record the details of any alternative water source(s) currently being used.

Is water currently available from the borehole?		If **No**, describe why (then go to Section B)
Yes	No	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.5)	Yes										
Parameter tested		*E. coli*[a]		*or* Thermotolerant (faecal) coliforms[a]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

- ❑ **No treatment applied.**
- ❑ **Treatment applied at the borehole.** Describe (e.g. chlorine dose, frequency of dosing, how it is applied).[b]
- ❑ **Treatment applied downstream of the borehole.** Describe (e.g. water treatment plant, household water treatment).

a The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as increased disinfection at or downstream of the borehole, additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice).
Note – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

b Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For general information on chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

General notes

- This form is intended for use on a single borehole with a motorized pump. Where there are multiple boreholes to be inspected, additional forms will be needed. Boreholes may be inspected on a rotational basis where there are too many to cover during each inspection.
- If other water sources are in use (e.g. spring, rainwater collection), the borehole feeds a piped distribution system (including filling station or kiosk), or if users collect and store water in the home, carry out additional sanitary inspections using the corresponding sanitary inspection packages.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the borehole. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the borehole being inspected.
3. Tick the **No** box if the question does apply to the borehole being inspected, but the risk factor ***is not present***.

4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.

5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

Figure 1. Typical risk factors associated with a borehole with a motorized pump

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Is the borehole cap missing or in poor condition?** Contaminants could enter the borehole if there is no borehole cap in place, or if the cap is in poor condition (e.g. damaged, severely corroded, does not fit tightly). This could also happen if there are gaps in the borehole cap (e.g. unsealed holes that allow electrical cables to pass through).	❑	❑	❑	
2	**Is the area directly around the borehole seal dirty?**[C] Contaminants could enter the borehole if the area directly around the borehole seal is dirty or shows signs of pollution (e.g. animals, faeces).	❑	❑	❑	
3	**Is the pump in a location where fuel or oil could enter the borehole?** Chemical contaminants could enter the borehole from fuel or oil leaks if the pump is located above, or immediately beside, the borehole. This could also happen if there is accidental spillage during re-fuelling or maintenance.	❑	❑	❑	
4	**Does the floor around the borehole allow water to pass through it?** Contaminants could enter the borehole if the floor is permeable and allows water to pass through it (e.g. an earthen floor). This could also happen if the floor has deep cracks or gaps that allow water to pass through.	❑	❑	❑	
5	**Is drainage inadequate, which could allow water to accumulate in the borehole area?** Stagnant water could contaminate the borehole if there is no drainage system in place. This could also happen if the drainage system is damaged (e.g. deep cracks) or blocked (e.g. from leaves, sediment). *Note* – the presence of pooled water during the inspection may indicate poor drainage.	❑	❑	❑	
6	**Are the borehole and pump inadequately covered?** Contaminants may enter the borehole if the borehole and pump are not covered (e.g. housed outside in the open). This could also happen if they are housed in a structure that is in poor condition and open to the environment (e.g. a pump house with a damaged roof).	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
7	**Is the fence or barrier around the borehole and pump missing or inadequate?** Animals or unauthorized people could contaminate or damage the borehole area if the fence or barrier around the borehole area is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	
8	**Is there sanitation infrastructure within 100 metres of the borehole?**[d] Sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer pipes) close to the borehole may affect water quality. For example, waste could seep into the groundwater or overflow and be washed into the borehole, particularly after rain. Visually check structures in this area, and ask community members, to see if the structures are sanitation related.	❑	❑	❑	
9	**Can other sources of pollution be seen within 50 metres of the borehole (e.g. open defecation, animals, open drains, rubbish, commercial/industrial activity, fuel storage/disposal)?**[d] The presence of animals or faeces on the ground close to the borehole poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could be washed into the borehole during rain or may seep into the groundwater.	❑	❑	❑	
10	**Is there any unprotected entry point to the aquifer within 100 metres of the borehole?**[d] An unprotected entry point to the aquifer (e.g. uncapped borehole, open dug well) could allow contaminants to enter the groundwater and contaminate the borehole.	❑	❑	❑	
	Total number of Yes responses				

c A seal protects the borehole from surface water contamination, filling the underground area between the borehole casing and the surrounding earth. Refer to the *Technical fact sheet* for further information.

d General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

C. ADDITIONAL DETAILS

Include any additional risk factors,[e] recommendations, observations or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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[e] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ______________________

Organization: ______________________

Designation/title of inspector: ______________________

Signature: ______________________ Date: __________

Name of water supply representative: ______________________

Contact number (if available): ______________________

Signature (if available): ______________________ Date: __________

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World Health Organization

Borehole with a motorized pump

This technical fact sheet provides background information on a borehole with a motorized pump, which supports the sanitary inspection of this drinking-water source.[a]

A borehole consists of a drilled hole in the ground with a secure water-lifting device (e.g. motorized pump, hand pump) that is used to bring groundwater to the surface.

Groundwater is considered to be better quality than surface water in many places. Boreholes that access deeper groundwater are generally better quality than boreholes that access shallower groundwater. However, appropriate treatment/disinfection are required for groundwater sources that are vulnerable to contamination.

Boreholes can be constructed using machinery-powered techniques (e.g. percussion drilling).[a] The borehole should be lined with a casing and screen and fitted with a secure water-lifting device, such as a motorized pump in the case of deeper boreholes.[b]

Boreholes are generally 0.1–0.25 metres in diameter. For this reason, boreholes cannot be physically accessed by a person for maintenance or cleaning (e.g. sediment removal and disinfection). These activities must be carried out from ground level once the borehole cap has been removed.

Boreholes should have adequate capacity (i.e. have an appropriate depth below the water table) to meet the needs of users at all times of the year. Limited capacity could result in users seeking alternative drinking-water sources that could be less safe. If water is collected directly from the borehole facility by users (e.g. at a public borehole tap), the water collection area should be built so it is accessible for all users.[c]

Figure 1 shows a common type of borehole with a motorized pump. Treatment/disinfection of the water may take place on-site at the borehole facility, or off-site (e.g. at a downstream water treatment plant, as per the example shown in Figure 1). A section view of the belowground elements of the borehole is shown in Figure 2. These figures show a typical design. Other designs can also provide safe drinking-water.

Typical risk factors associated with a borehole with a motorized pump are presented in the corresponding *Sanitary inspection form.*

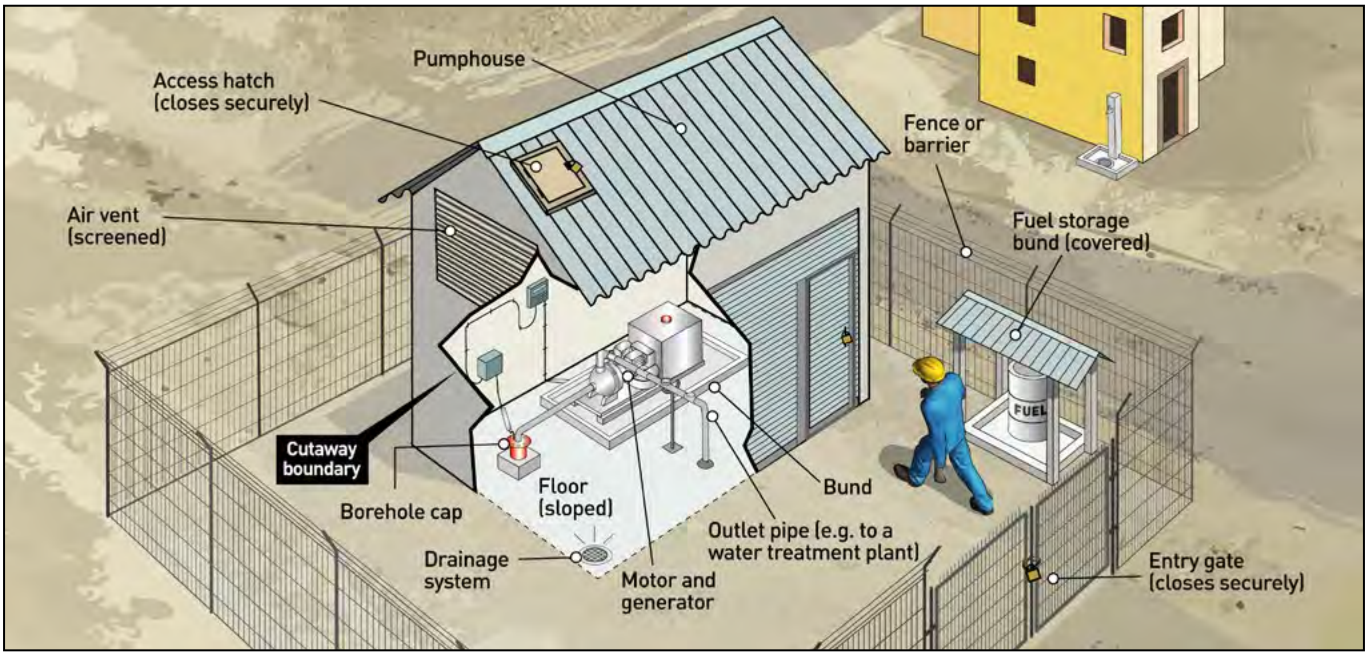

Figure 1. A common borehole with a motorized pump in a sanitary condition

[a] This fact sheet is not intended to serve as a guide to construction. For detailed guidance on the design and construction of a borehole, refer to Technical review: borehole drilling and rehabilitation under field conditions (ICRC, 2012).

[b] Hand pumps (levered type) may be suitable for water abstraction depths of up to approximately 45 metres. Deeper than 45 metres, geared hand pumps or motorized pumps are typically required.

[c] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones & Reed, 2005).

A borehole with a motorized pump typically includes the following main components.

Borehole

- **Borehole cap:** Covers the top of the borehole to prevent contaminants entering the borehole. The cap should be fitted tightly. Any gaps in the borehole cap (e.g. to allow pipework or electrical cables to enter the borehole) should be sealed to prevent the entry of contaminants (using a sealant that is safe for contact with drinking-water).
- **Seal:** Provides structural protection for the upper part of the borehole, and protects the borehole from surface water contamination. The seal is typically constructed using a mixture of cement, bentonite (clay) and sand. The seal should fill the gap between the casing and surrounding ground, and should not allow water to pass through it. For adequate protection, the seal should extend to a depth of at least 3 metres.
- **Casing:** Provides structural support for the walls of the borehole and protects the pipe that delivers water to the surface (i.e. the **rising main**) and pumping mechanism. The casing should have sufficient strength to resist collapse, and is typically made from water-resistant materials such as metals, plastic or fiberglass. To protect from surface water contamination, the casing should ideally extend to at least 0.5 metres above the ground.
- **Screen:** Provides structural support for the borehole and allows water to enter the casing (acting also as a barrier to prevent larger particles from entering the rising main). The screen material should be resistant to corrosion and have sufficient strength to resist collapse.

Motorized pump

- **Motor and generator:** Provides power to the pump for water lift. In this example, a diesel-powered motor is shown. However, other fuel- (e.g. petrol), electricity- and solar-powered motors are also common.[d] The pump should be installed in a place where fuel or oil cannot directly contaminate the borehole (e.g. from leakages or spillages; see bund below).
- **Bund:** Captures and contains any fuel or oil leaks and spillages. Fuel storage bunds that are housed outside should be covered to prevent rain accumulating in the bund – which could reduce the volume of fuel that the bund can capture in the event of a leak from the fuel container.
- **Pump:** Draws groundwater from the borehole and delivers it through the rising main to the surface. The pump should be appropriately sealed to prevent any leakage of oil or lubricant into the borehole.
- **Floor:** Protects the borehole from contaminants (e.g. contaminated surface water). The floor should not allow water to pass through it, and is typically constructed from brick or concrete. The floor should slope down from the borehole to a defined drainage system.
- **Pump house:** A covered structure to protect the borehole and pump from the external environment. The pump house should prevent the entry of vermin (e.g. sealed roof and walls, vermin-proof screens on air vents and drains). Adequate air/exhaust vents are required for fuel-powered motors to stop the motor from overheating and to prevent the build-up of exhaust fumes during operation. A removable roof or **access hatch** may be required to facilitate borehole maintenance (e.g. replacement of casing).

  In some settings, the borehole may be housed externally (i.e. separate to the pump) in a closed sealed chamber.[d]
- **Drainage system:** Directs water away from the borehole and pump house area to a drainage system. The drainage system should slope down from the facility to stop water ponding and stagnating, which could contaminate the borehole.
- **Fence or barrier:** A physical barrier to stop animals from contaminating the borehole area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked. Where practical, the fence or barrier should ideally be constructed at least 15 metres from the borehole (general guidance only).[e]

Additional considerations

Before the borehole is constructed, sources of naturally occurring contaminants (e.g. arsenic, fluoride) and contamination from human activities (e.g. agriculture, industry) should be investigated to determine their impact on groundwater quality. Latrines and other sanitation facilities should be identified before choosing a site for the borehole.

The borehole design should be appropriate for the local geological conditions (e.g. the casing should be deep enough to prevent contamination from shallower aquifers).

[d] For guidance on different borehole and pump types, refer to *Compendium of drinking water systems and technologies from source to consumer* (WHO, in preparation).

[e] For guidance on determining appropriate minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

The corrosion potential of the groundwater should be considered when selecting components for the borehole. If the groundwater has low pH, high salinity and high chloride, corrosion-resistant materials are required.

When constructing new boreholes or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme).

After a new borehole is constructed, it should be cleaned, flushed and disinfected (e.g. with chlorine), and flushed again, to disinfect the components before the water is used.[f] Ideally, water quality testing should be conducted before the borehole is commissioned to confirm the water is safe for consumption. Periodic disinfection and testing may also be required (e.g. after flooding, after maintenance).

A second "stand-by" pump should ideally be in place to maintain continuous water supply during planned maintenance, or if the primary "duty" pump fails. For electrical pumps, a back-up power supply (e.g. generator) should be available if there are frequent power outages, to ensure the continuity of supply.

To ensure operator safety, any electrical or mechanical installation work should be carried out by a qualified person according to the relevant safety standards.

If the borehole supplies a piped distribution network, the pump should be fitted with a one-way valve on the discharge side of the pump to prevent the backflow of contaminated water into the borehole.

For shallower boreholes with hand pumps, refer to the *Sanitary inspection package: tubewell with a hand pump*, which may be adapted for boreholes.

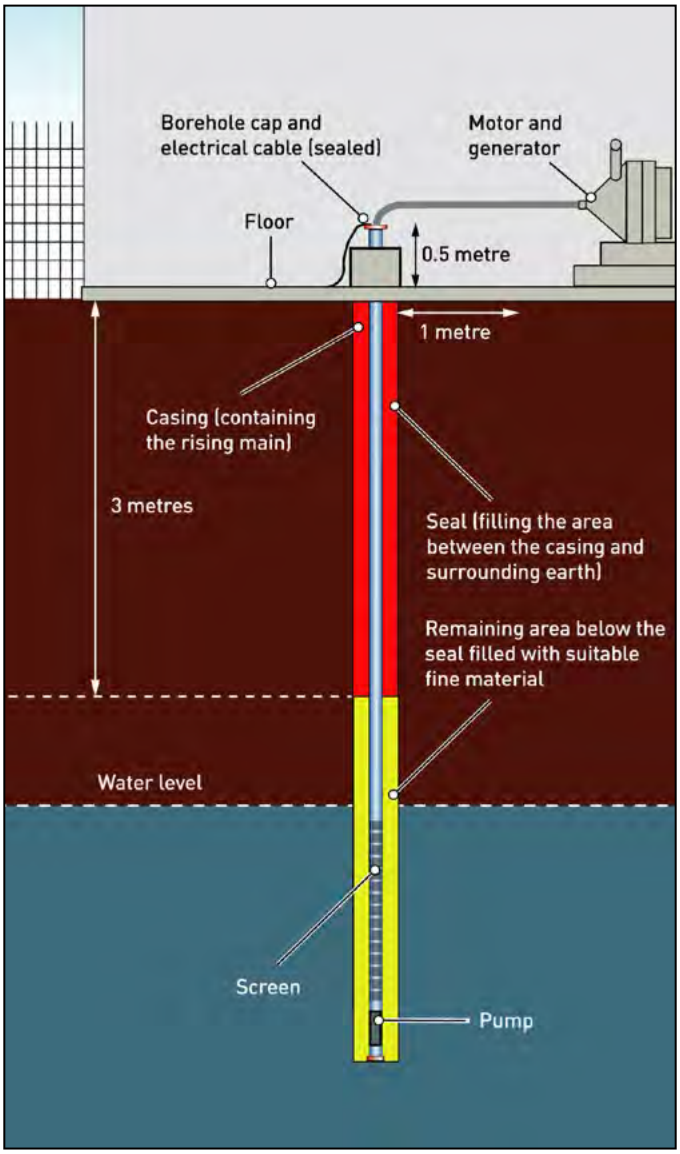

Figure 2. A borehole with a motorized pump in a sanitary condition (section view)

[f] See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating boreholes (WHO & WEDC, 2013).

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Borehole with a motorized pump

This management advice sheet provides guidance for the safe management of a borehole with a motorized pump, which supports the sanitary inspection of this drinking-water source.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the borehole and motorized pump in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained owner, user or caretaker/operator (e.g. simple maintenance tasks such as cleaning the borehole area, checking fuel/oil levels of the pump). Larger repairs and maintenance tasks (e.g. repairing the screen, pump maintenance) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the borehole and motorized pump should be inspected routinely to help prevent contaminants entering the water supply. Any damage or faults should be repaired immediately (e.g. deep cracks in the floor, broken fence, intermittent pump mechanical fault). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. removing the borehole cap for maintenance, replacing the screen). These should be followed by trained individuals so the work is carried out safely and the borehole is not contaminated during the work. All electrical and mechanical maintenance and repairs should be conducted by a qualified person in accordance with the relevant safety standards.

Consultation with the relevant authorities may be required to ensure that sanitation infrastructure (e.g. latrine pits, septic tanks, sewers, soakage fields) is not built near the borehole unless hydrogeological studies show that it is safe to do so. Consideration should also be given to catchment activities that extract groundwater (e.g. for irrigation, mining, power) to ensure an adequate quantity of drinking-water to meet the needs of users.

If a public tap is provided immediately at the borehole area, activities other than the collection of drinking-water (e.g. laundry, washing, bathing) should not be permitted in the area. These should be carried out at a safe distance downhill from the borehole.

Adequate treatment/disinfection are required before consuming the drinking-water if the borehole is vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the borehole facility, including the area around the seal. Remove any polluting materials (e.g. faeces, rubbish). • Check that the fuel and oil levels of the pump are adequate. Re-fill as needed. • Check that the pump is working.[a] Perform pump maintenance as needed, repair or replace damaged parts, then clean and disinfect the pump (e.g. with chlorine). • Check that the drainage channel is clear and in good condition. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed. • Record relevant information in operational logs (e.g. meter readings, instrumentation readings, valve checks, static water level, fuel levels etc.).

Table 1. ...continued

Frequency	Activity
Annually	• Perform detailed inspection of the borehole structure (including the screen) for signs of damage or failure. Repair or replace damaged parts as needed.[b]
As the need arises[c]	• Remove sediment, and clean (e.g. via high pressure water jetting) and disinfect the borehole e.g. with chlorine).[d] • Unclog the screen. • Rehabilitate the borehole (e.g. deepen the borehole, replace casing/screen, repair the seal).[b] Replace any eroded earth around the borehole, and fill any depressions in the ground where water ponds. • Monitor water yield and use to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] For guidance on functionality checks and preventative maintenance for the motorized pump, refer to manufacturers' guidance or local tradespeople as required. *Note* – where there is a secondary stand-by (or "back-up") pump or generator, these should also be routinely checked and maintained.

[b] For guidance on construction and rehabilitation aspects, refer to Technical review: borehole drilling and rehabilitation under field conditions (ICRC, 2012).

[c] See Table 2 for potential problems that could trigger these activities.

[d] See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and rehabilitating boreholes (WHO & WEDC, 2013). Disinfection is required following a contamination event (e.g. after flooding, *E. coli* detection).

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be taken when working with electricity. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form.* Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a borehole with a motorized pump, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The borehole cap is missing, is in poor condition (e.g. damaged, severely corroded, does not fit tightly) or has unsealed gaps, which could allow contaminants to enter the borehole.	• If a borehole cap is missing or in poor condition, provide a temporary seal (e.g. impermeable plastic sheeting) over the casing to minimize the entry of contaminants into the borehole. Install or repair the borehole cap as soon as possible. • Ensure that all gaps in the borehole cap (e.g. for electrical cables) are sealed with a sealant that is safe for contact with drinking-water.
2	The area directly around the borehole seal is dirty (e.g. animals, faeces), which could allow contaminants to enter the borehole.	• Clean the area around the borehole seal. • Communicate the importance of maintaining the area around the seal in a clean condition.
3	The pumping mechanism is in a location where fuel or oil could directly enter the borehole (e.g. located directly above the borehole).	• Ensure any potential source of fuel or oil is stored in an appropriately-sized fuel bund to contain any spills/leaks. • If the bund is located outside, ensure the bund is adequately covered to prevent rain accumulating within it, which could reduce the bund capacity to capture fuel in the case of a leakage. • If required, seek support from relevant tradespeople to reconfigure the system to minimize the risk of fuel or oil entering the borehole (e.g. relocating the pumping mechanism from above the borehole to an adjacent position).
4	The floor around the borehole and pumping mechanism allows water to pass through it, which could allow contaminants to enter the borehole (e.g. from contaminated surface water).	• If the floor allows water to pass through it, construct an impermeable (e.g. concrete) floor around the borehole and pumping mechanism, ensuring it slopes down from the borehole, towards a drainage system. • If the floor is damaged (e.g. has deep cracks), repair the floor to ensure it is adequately sealed.
5	The drainage is inadequate (e.g. absent, damaged or blocked drain), which could result in stagnant water contaminating the borehole.	• If a drainage system is absent, provide a temporary drainage channel to divert water away from the borehole area. Construct a permanent solution as soon as possible. • If the drainage system is not working, consider whether maintenance is needed (e.g. repair, cleaning), or if deepening, widening or extending is required.
6	The borehole and pumping mechanism are inadequately covered (e.g. out in the open, in a pump house or chamber that is in poor condition and exposed to the environment), which could allow contaminants to enter the borehole.	• If the borehole and pumping mechanism are housed out in the open, provide a suitable temporary cover where practical. Construct a permanent lockable structure as soon as possible (e.g. chamber, pump house). • If the pump house or chamber structure is damaged or in poor condition, repair it as soon as possible.
7	The fence or barrier around the borehole and pump house is missing, or inadequate to prevent animals or unauthorized people from contaminating the area or damaging borehole components.	• If absent, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the borehole area is damaged and/or does not close securely, repair or replace it.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
8	There is sanitation infrastructure (e.g. latrine pit, septic tank, soakage field, sewer line) within 100 metres of the borehole and pumping mechanisms that could contaminate the borehole (e.g. from overflow, seepage).[e]	• Involve local authorities to assess the significance of the risk from the sanitation infrastructure. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise the household to treat the water before consumption). • Consult with local authorities to consider appropriate steps to relocate or eliminate the source of pollution.

9	There are other sources of pollution (e.g. open defecation, animals, open drains, rubbish, commercial activity, fuel storage/disposal) within 50 metres of the borehole and pumping mechanism that could contaminate the borehole.[e]	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the borehole area in a clean condition.
		• Consult with local authorities and users to consider:
		  ◦ appropriate actions to relocate or eliminate the source of pollution
		  ◦ other actions to minimize the issue from occurring again (e.g. signage, enforcement measures).

10	There is an unprotected point of entry to the aquifer (e.g. open or uncapped well or borehole) within 100 metres of the borehole and pumping mechanism that could provide a direct pathway for contaminants to enter the groundwater and contaminate the borehole.[e]	• Consult with local authorities to:
		  ◦ assess the significance of the risk from the unprotected point of entry to the aquifer
		  ◦ cover the point of entry in the immediate term
		  ◦ consider what actions are appropriate to permanently seal, decommission or relocate the point of entry.

[e] General guidance only. Appropriate minimum safe distances depend on local factors including soil type and permeability, depth of the water table, and the volume and concentration of contaminants. For guidance on determining minimum safe distances for polluting activities, refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

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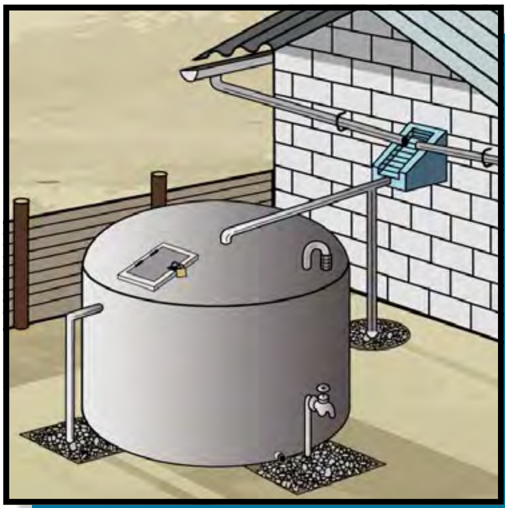

6

Sanitary inspection package

Rainwater collection and storage

Rainwater collection and storage

A. GENERAL INFORMATION

A.1. Rainwater collection system

System location (e.g. building name or number, village, town, community, parish, district, province, state)

Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)							
Year of construction of the system	**Approximate rainwater catchment area** (e.g. roof size, including units)	**Approximate number of people using this water source** Circle one of the options below					
		1–5	6–15	16–30	31–50	>50	
Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)			
Is the system affected by flooding?	Unsure	No	Yes				
Is the system affected by drought?	Unsure	No	Yes				

A.2. System functionality

Circle **Yes** or **No** to indicate if water is currently available from the rainwater collection system. If **No**, describe why (e.g. broken gutters, low rainfall) and then go to Section B. In Section C, record the corrective actions needed for the rainwater collection system to provide water, and record the details of any alternative water source(s) currently being used.

Is water currently available from the rainwater collection system?		If **No**, describe why (then go to Section B)
Yes	No	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.5)	Yes										
Parameter tested		*E. coli*[a]		*or* Thermotolerant (faecal) coliforms[a]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

❑ **No treatment applied.**

❑ **Treatment applied at the storage tank.** Describe (e.g. chlorine dose, frequency of dosing, how it is applied).[b]

❑ **Treatment applied downstream of the storage tank.** Describe (e.g. household water treatment).

[a] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[b] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For general information on chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

General notes

- This form is intended for use on a single rainwater collection system. Where there are multiple rainwater systems to be inspected, additional forms will be needed. Rainwater systems may be inspected on a rotational basis where there are too many to cover during each inspection.
- If other water sources are in use (e.g. spring, borehole), or if users collect and store water in the home, carry out additional sanitary inspections using the corresponding sanitary inspection packages.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the rainwater collection system. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the rainwater collection system being inspected.
3. Tick the **No** box if the question ***does apply*** to the rainwater collection system being inspected, but the risk factor is not present.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

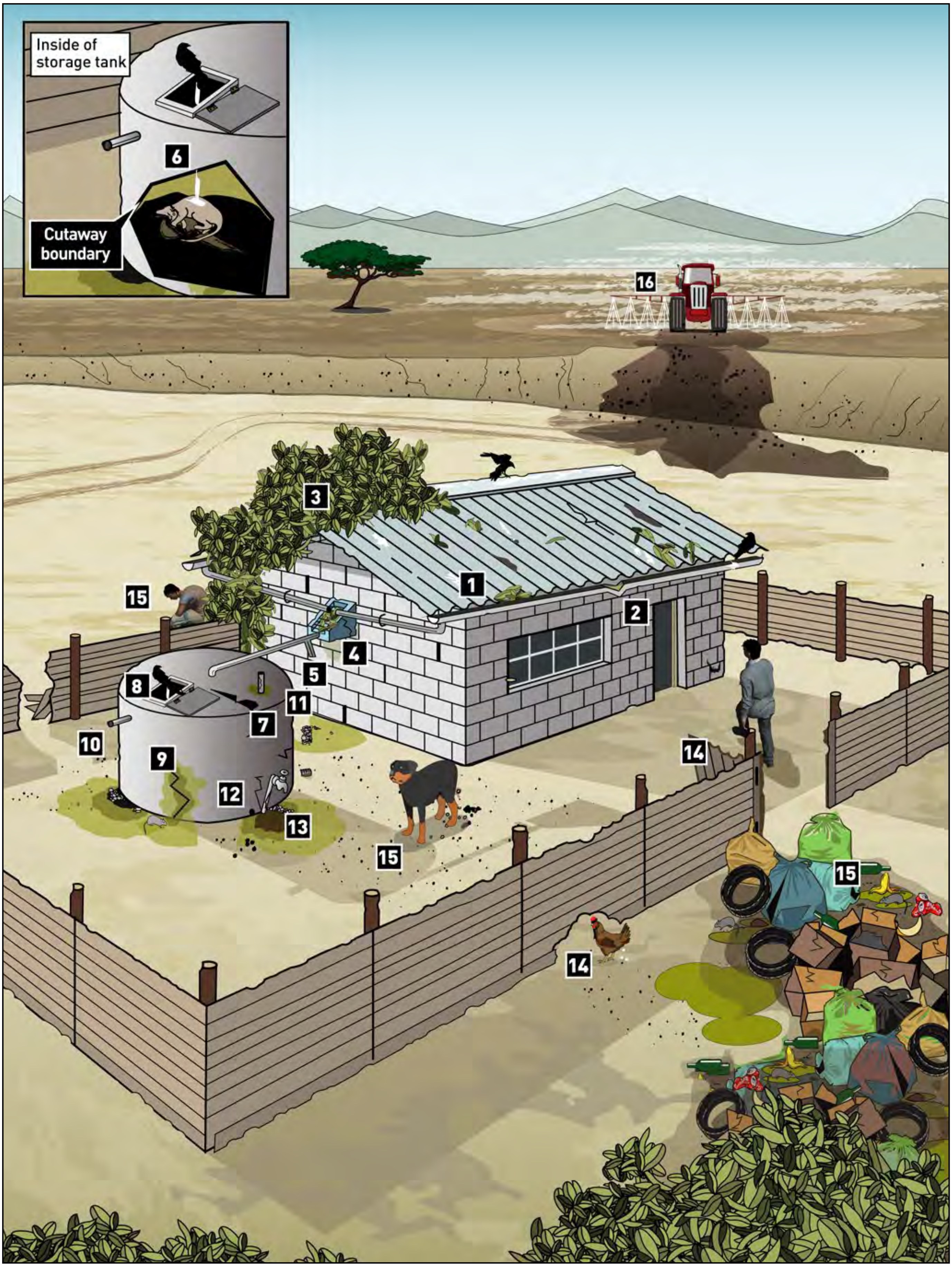

Figure 1. Typical risk factors associated with a rainwater collection system

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Are there any visible contaminants on the roof or in the guttering channels?** Contaminants on the roof or in the guttering channels (e.g. from animal faces, corroded or damaged roof or gutter materials, leaves, moss) could contaminate the water. This could also cause blockages and an overflow, which could result in water loss.	❑	❑	❑	
2	**Do the roof or guttering channels have an inadequate slope for drainage?** Stagnant water could contaminate the water supply if the roof or guttering channels do not have a downward slope for water to fully drain into the storage tank. *Note* – ponding of water on the roof or in the guttering channels may indicate an inadequate drainage slope.	❑	❑	❑	
3	**Is there any vegetation or structures above the roof?** Contaminants (e.g. from animal faeces) could enter the water supply if there is overhanging vegetation, balconies or wires above the roof. Fallen leaves could also block gutters and cause an overflow, which could result in water loss.	❑	❑	❑	
4	**Is the filter box absent, damaged or blocked?** Contaminants could enter the water supply if the filter box is absent. This could also happen if it is damaged (e.g. holes or gaps in the filter screen) or blocked (e.g. from sediment, leaves). A clogged filter box could also cause an overflow, which could result in water loss.	❑	❑	❑	
5	**Is the first flush system absent, damaged or blocked?**[c] Contaminants from the first flush of rainwater could enter the water supply if the first flush system is absent. This could also happen if it is damaged (e.g. not flushing completely) or blocked. A blocked first flush system could also cause an overflow, which could result in water loss.	❑	❑	❑	

[c] Between rain events, contaminants may accumulate on the roof. Following rain, the first flush system diverts this first portion of poor quality water out of the system so it does not enter the storage tank. For more information, refer to the *Technical fact sheet.*

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
6	**Are there any signs of contaminants inside the storage tank?** The presence of animals or faeces inside the storage tank is a serious risk to the safety of the drinking-water, and indicates that harmful microorganisms are present. Sediments may also contain harmful microorganisms and other contaminants (such as metals) that can affect the safety or acceptability of the water.	❑	❑	❑	
7	**Is the storage tank cover absent or in poor condition?** Contaminants could enter the storage tank, particularly after rain, if the tank cover is absent. This could also happen if the tank cover is damaged (e.g. broken, missing sections, deep cracks).	❑	❑	❑	
8	**Is the storage tank inspection hatch lid missing or in poor condition?** Contaminants could enter the storage tank (e.g. from the entry of contaminated water following rain, entry of animals) if the inspection hatch lid is missing (or open, unlocked). This could also happen if the lid is damaged (e.g. deep cracks, severely corroded, does not fit tightly when closed).	❑	❑	❑	
9	**Are the storage tank walls cracked or leaking?** Contaminants could enter the storage tank if the tank walls are damaged (e.g. with deep cracks). A leaking tank could also result in stagnant water contaminating the collection area, as well as water loss.	❑	❑	❑	
10	**Does the overflow pipe lack adequate protection from vermin?** Contaminants could enter the storage tank (e.g. from insects, rodents, birds) if the overflow pipe is not covered with a vermin-proof screen (e.g. mesh, gauze).	❑	❑	❑	
11	**Are the air vents poorly designed so that contaminants could enter the storage tank?** Contaminants could enter the storage tank if the air vents are facing upwards, or are not covered with a vermin-proof screen.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
12	**Is the storage tank tap dirty or in poor condition?** Contaminants could enter the water if the tap is dirty. This could also happen if the tap is damaged (e.g. broken, severely corroded) or leaking. A leaking tap could result in stagnant water contaminating the area, and water loss.	❑	❑	❑	
13	**Is drainage inadequate, which could allow water to accumulate in the collection area?** Stagnant water could contaminate the collection area if there is no drainage system in place. This could also happen if the drainage system is damaged or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water during the inspection may indicate poor drainage.	❑	❑	❑	
14	**Is the fence or barrier around the water collection area missing or inadequate so that animals could enter the collection area?** Animals could contaminate or damage the collection area if the fence or barrier is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	
15	**Can other sources of pollution be seen in the water collection area (e.g. open defecation, animals, drinking troughs for livestock, rubbish, commercial activity, fuel storage)?** The presence of animals or faeces on the ground close to the collection area poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could also be washed into the area during rain and contaminate the water during collection.	❑	❑	❑	
16	**Is there local activity (e.g. industry, agriculture) that could contaminate the roof?** [d] Airborne contaminants from local activities (e.g. slurry spreading, crop spraying, burning, mining) could land on the roof and contaminate the water supply following rain.	❑	❑	❑	
	Total number of Yes responses				

[d] For appropriate setback distances for specific activities, consult with the local environmental authority.

C. ADDITIONAL DETAILS

Include any additional risk factors,[e] recommendations, observations (e.g. roof material, guttering material, storage tank construction material, tank volume) or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

[e] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector:

Organization:

Designation/title of inspector:

Signature: Date:

Name of water supply representative:

Contact number (if available):

Signature (if available): Date:

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World Health Organization

Rainwater collection and storage

This technical fact sheet provides information on a rainwater collection system, which supports the sanitary inspection of this drinking-water source.[a]

A rainwater collection system consists of a catchment area (e.g. the roof of a building) and guttering channels that direct rainwater into a collection vessel (e.g. storage tank).

Rainwater typically contains lower levels of contaminants compared to groundwater or surface water sources. However, rainwater can become contaminated during collection and storage. For this reason, rain collected for drinking-water purposes should be appropriately treated/disinfected.

Rainwater collection can be applied in many places, from individual household systems to systems serving multiple households or institutions (e.g. schools). Rainwater can be the primary source of drinking-water where there is sufficient rainfall all year round and adequate storage capacity. Often, rainwater collection is used to supplement other sources of water.

Rainwater collection (L/year) can be estimated by multiplying the rainfall (mm/year) by the roof catchment area (m^2) by a run-off coefficient, using the following formula:

$$\textbf{Rainwater collection (L/year)} = \text{Rainfall (mm/year)} \times \text{Roof area } (m^2) \times \text{Run-off coefficient}$$

The run-off coefficient will depend on the roof material, and considers water losses (e.g. from evaporation, gutter overflow, leaks from pipes). The coefficient value is always less than 1 and may range from 0.9 for metal roofing to >0.4 for organic roofing materials.[a]

Figure 1 shows a common type of rainwater collection system. Figure 2 shows a common type of first flush device. These figures show a typical design. Other designs can also provide safe drinking-water.

For communal systems, the water collection area should be built so it is accessible for all users.[b]

Typical risk factors associated with a rainwater collection system are presented in the corresponding *Sanitary inspection form.*

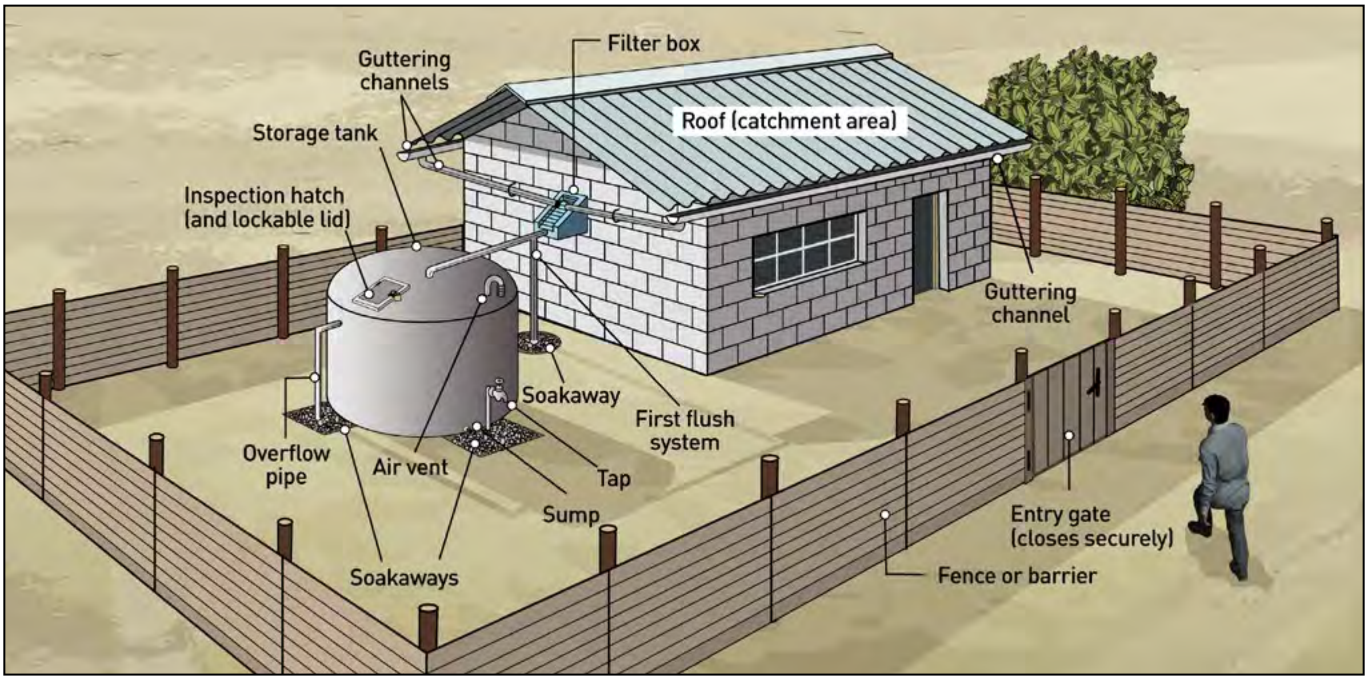

Figure 1. A common rainwater collection system in a sanitary condition

[a] This fact sheet is not intended to serve as a design guide. For guidance on the design of rainwater collection systems, refer to Rainwater collection: WEDC Guide No. 43 (Skinner, 2022).

[b] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones and Reed, 2005).

Rainwater collection systems typically include the following main components.

- **Roof (catchment area):** A non-permeable surface (e.g. the roof of a house, school, shed) that captures rainwater and directs it via guttering channels to a collection system (e.g. water storage tank). Roof catchment areas are typically made from galvanized corrugated iron/steel, aluminium, stones, tiles, slates. *Note* – rainwater can also be collected from free standing structures that are not associated with a building (e.g. plastic sheeting).
- **Guttering channels:** Directs water from the catchment area to a collection system. Guttering channels are typically made from polyvinylchloride (PVC), aluminium, galvanized iron/steel or zinc.
- **Filter box:** Consists of a coarse filter that prevents larger pieces of debris (e.g. leaves, moss) from entering the storage tank. This type of filter will not effectively remove harmful microorganisms.
- **First flush system:** Diverts the first flush of rainwater away from the water storage tank (see Figure 2). This first flush of rainwater is typically of poorer quality due to the build-up of contaminants on the roof between rain events. The first flush system should be big enough relative to the size of the roof, to allow the first flush of rainwater to divert to waste (or for uses other than drinking-water).
- **Water storage tank:** Stores rainwater that has been collected from the catchment area. Storage tanks are commonly made from high density polyethylene (HDPE), PVC, ferro-cement, metal or concrete. The tank should be covered and sealed to stop contaminants entering the storage tank.
- **Inspection hatch:** Allows access to the storage tank for inspection or operations and maintenance. The inspection hatch should have a lid that is tightly fitting and lockable to stop contaminants from entering the tank, and to stop unauthorized access by people.
- **Tap:** Allows users to collect water from the storage tank in a sanitary way, minimizing water wastage or spillage. The tap should be raised off the floor-level of the tank to minimize the risk of withdrawing sediment from the bottom of the tank during use. The tap also allows easy collection of water quality samples for analysis.
- **Overflow pipe:** Directs excess water from the storage tank to a drainage point (e.g. soakaway, drain). This stops the tank overflowing in an uncontrolled way, which could contaminate the collection area or damage components. The overflow pipe should be facing downwards and have a vermin-proof screen (e.g. gauze or mesh) to prevent contaminants entering the storage tank. Water from the overflow pipe should not erode the ground beneath the pipe, as this could undermine and damage the tank, which could lead to contamination or water loss.
- **Air vent:** Allows ventilation in the storage tank. The air vent should be facing downwards and have a vermin-proof screen to stop contaminants entering the tank.
- **Storage tank sump:** Allows the storage tank to be emptied for cleaning and maintenance. The sump should be located at the lowest point of the tank floor to ensure the tank can be drained completely.
- **Fence or barrier:** A physical barrier to stop animals from contaminating the collection area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked.
- **Soakaway:** A hole in the ground filled with coarse material (e.g. gravel, stones, rocks), or that has a permeable wall, that allows water to drain back into the ground. This prevents water ponding and stagnating, which could contaminate the collection area. More robust drainage options (e.g. drainage channel or drain) may be required for higher volumes of overflow. Drainage water may be used to provide water for livestock or other activities, provided that these activities occur at a safe distance from the storage tank.

Additional considerations

After a new rainwater collection system is constructed, it should be cleaned, flushed and disinfected (e.g. with chlorine), and flushed again, to disinfect the components before the water is used.[c] Ideally, water quality testing should be conducted before the system is commissioned to confirm the water is safe for consumption. Periodic disinfection and testing may also be required (e.g. after long periods without rain, after maintenance).

Construction materials (e.g. lead, copper, certain metallic paints) could affect the safety of the drinking-water. When constructing new rainwater collection systems or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme).

[c] See Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013).

Mud or organic roof materials (such as thatch) should be avoided where possible, as they typically result in lower volumes of rainwater being collected (i.e. have a lower run-off coefficient) and could contaminate the rainwater during collection.

Where asbestos-containing roof materials are in place, the materials should be sealed with appropriate paint or resin to prevent fibres entering the water.

Rainwater collected from asbestos roofing should be allowed to settle before use (i.e. allowing fibres to settle to the bottom of the container, before decanting off the water).

Efforts should be made to minimize activities that can result in the degradation and release of asbestos fibres (e.g. roof cutting, drilling, use of high-pressure roof cleaning materials).

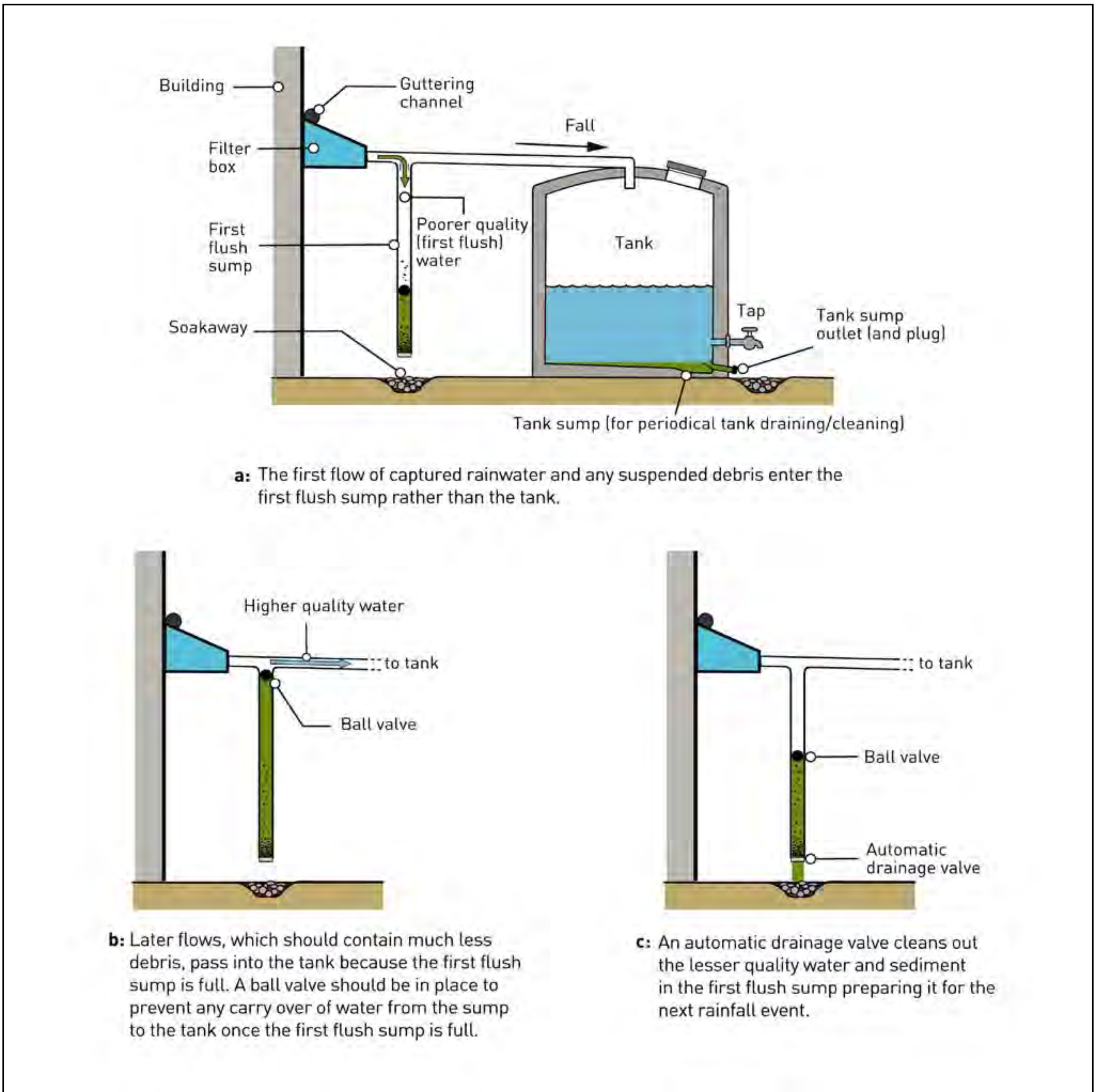

Figure 2. A common first flush system used in rainwater collection systems

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World Health Organization

Rainwater collection and storage

This management advice sheet provides guidance for the safe management of a rainwater collection system, which supports the sanitary inspection of this drinking-water source.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the rainwater collection system in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained owner, user or caretaker (e.g. simple maintenance tasks such as cleaning the roof and guttering channels). Larger repairs and maintenance tasks (e.g. repairing the filter box, replacing guttering channels) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the rainwater collection system should be inspected routinely to help prevent contaminants entering the water supply. Any damage or faults should be repaired immediately (e.g. cracks in the guttering channels, leaking tap, broken fence).

Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. inspecting and repairing the storage tank). These should be followed by trained individuals so the work is carried out safely and the water supply is not contaminated during the work.

The rainwater storage tank should only contain drinking-water - no other liquids, including water of lesser quality, should be stored in the tank. Taps and related fittings should be maintained routinely. The storage tank should be periodically cleaned and disinfected according to SOPs.

Where there is no first flush system in place, the first portion of rainwater should be manually diverted away from the storage tank - this water could contain contaminants that have accumulated on the roof between rain events (e.g. from animal excrement, insects, dust, leaves).

Adequate treatment/disinfection of the rainwater is required before consuming the drinking-water (e.g. by household water treatment).

Activities other than drinking-water collection (e.g. laundry, washing, bathing) should not be conducted at the water collection point. Certain activities can result in airborne contaminants, such as mining or spray drifts from local agricultural practices (e.g. manure spreading, crop spraying, burning). This could contaminate the roof catchment area. Consultation with the relevant authorities may be needed to ensure that such activities are carried out at a safe distance from the roof catchment area (ideally downwind of the rainwater collection system based on the prevailing wind direction). The impact from other events on drinking-water quality (e.g. bushfires, volcanic eruptions) should also be considered if relevant in the local context.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the area around the rainwater collection system, including the tap. Remove any polluting materials (e.g. faeces, rubbish). • Check that the inspection hatch lid is in place and in good condition, and is closed and locked securely. Repair or replace damaged parts, and lock as needed. • Check that the inside of the storage tank is clean (e.g. free from animals, faeces, sediment build-up). Drain as needed, then clean and disinfect the tank (e.g. with chlorine).[a] • Check that the soakaway or drain is clear and in good condition. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair or replace damaged parts.
Weekly to monthly	• Check that the following are clean and in good condition: filter box; first flush system; guttering channels; roof. Clean, repair or replace these components as needed. • Check that the storage tank air vent and overflow pipe are in good condition. Ensure that protective vermin-proof screens are securely fitted and in good condition. Repair or replace damaged parts.
Annually	• Perform a detailed inspection of the roof, guttering channels and storage tank (and the tank support base if present) for signs of damage or failure. Repair or replace damaged parts.[b]
As the need arises[c]	• Drain the storage tank, remove sediment and clean the internal tank walls (e.g. using a brush and clean water), and then disinfect (e.g. with chlorine) the storage tank.[a] • Drain the first flush system if manual draining is in place. • Remove vegetation that is overhanging the roof (or other catchment area). • Monitor activities in the surrounding area that could result in airborne contaminants landing on the roof. • Monitor water use and yield (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] For guidance on safely cleaning and disinfecting storage tanks, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013). This activity is required following a contamination event (e.g. presence of animals in the storage tank, *E. coli* detection). *Note* – in water scarce areas, consult with local health authorities before draining the storage tank to make sure that the risk to water quality justifies the water loss. Alternative water supply arrangements may then be needed to ensure that users have sufficient water quantity to meet domestic needs.

[b] For guidance on the appropriate design of rainwater collection systems, refer to Rainwater collection: WEDC Guide No. 43 (Skinner, 2022).

[c] See Table 2 for potential problems that could trigger these activities.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when entering a storage tank for inspection or maintenance. Safety risks such as storage tank collapse or asphyxiation should be appropriately managed. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form.* Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a rainwater collection system, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	There are visible contaminants (e.g. from animal faces, corroded or damaged roof or gutter materials, vegetative matter such as leaves) on the roof or in the guttering channels which could contaminate the water, or cause blockages.	• Clear the roof and guttering channels. • Repair or replace any damaged or corroded sections of the roof or guttering channels. • Communicate the importance of regular inspection and maintenance to prevent this issue from recurring.
2	The roof or guttering channels are inadequately sloped, which could result in stagnant water contaminating the storage tank.	• For the guttering channel, increase the slope of the gutters to encourage rainwater to fully drain towards the storage tank. Repair or replace any damaged gutters. • For the roof, speak to local craftspeople about appropriate options to increase the roof slope, or seek an alternative rainwater catchment option (e.g. a free-standing structure made from plastic sheeting or galvanized corrugated iron).
3	There are vegetation or structures overhanging the roof that could contaminate the catchment area (e.g. by encouraging animals), or cause blockages (e.g. from fallen leaves) which may lead to water loss.	• Remove any overhanging vegetation. • Deter birds or other animals from any structures overhanging the roof area. • Where practical, relocate any overhanging structures (e.g. move overhanging wires in consultation with the responsible authority).
4	The filter box is absent, or it is damaged or blocked, which could introduce contaminants into the water, or lead to water loss.	• If the filter box is absent, engage local craftspeople to install a filter box unit. In the interim, provide a temporary filter with a suitable mesh or gauze to prevent debris from entering the storage tank. • If the filter box is damaged, provide a temporary filter (as per above). Repair or replace the filter box as soon as possible. • If the filter box is blocked, remove the material and clean the unit.
5	The first flush system is absent, or it is damaged or blocked, which could introduce contaminants into the storage tank, or lead to water loss.	• If the first flush system is absent or damaged, engage local craftspeople to install or repair the system as soon as possible. Until the system is operational, manually divert the first flush of rainwater following rain. • If the first flush system is blocked, manually drain and clean the system.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
6	There are signs of contaminants in the storage tank (e.g. animals, faeces, sediment build-up) that could present a serious risk to water quality.	• Remove the contaminants immediately if possible. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to treat the water before consumption). • Drain, clean and disinfect (e.g. with chlorine) the storage tank.[a] • Consider appropriate measures to minimize the risk of contamination entering the storage tank from this source in the future (e.g. install a storage tank cover, lock inspection hatch lid, fence the collection area).
7	The storage tank is inadequately covered, which could allow contaminants to enter the storage tank.	• Provide a temporary cover (e.g. impermeable plastic sheeting) to minimize the entry of contaminants into storage tank. Install or repair the tank cover as soon as possible. • Clean and disinfect (e.g. with chlorine) the storage tank.[a]
8	The inspection hatch lid is missing (or open, unlocked) or in poor condition (e.g. deep cracks, severely corroded, does not fit tightly when closed), which could allow contaminants to enter the storage tank.	• If the inspection hatch lid is missing, or it is in poor condition, provide a temporary seal (e.g. impermeable plastic sheeting) over the inspection hatch to minimize the entry of contaminants. Repair or replace the hatch and/or lid as soon as possible. • If the inspection hatch lid is open or unlocked, communicate the importance of closing and locking the lid securely when not in use.
9	The storage tank walls are cracked or leaking, which could allow contaminants to enter the water, or result in water loss.	• If the storage tank walls are cracked or leaking, engage local craftspeople to repair or replace the storage tank as needed. • Clean and disinfect (e.g. with chlorine) the storage tank.[a]
10	The overflow pipe is inadequately protected (e.g. with a mesh or gauze), which could allow vermin (e.g. insects, rodents, birds) to enter the storage tank and contaminate the water.	• If the overflow pipe is unprotected, cover the pipe with a vermin-proof screen (e.g. gauze or mesh). • If the overflow pipe screen is damaged (e.g. ripped. broken) or has wide gaps, replace with a functioning vermin-proof screen.
11	The air vents are poorly designed (e.g. facing upwards) or unprotected (e.g. without a vermin-proof screen), which could allow contaminants to enter the storage tank.	• If the air vents are facing upwards, modify the vents so they face downwards. • If the air vent screens are absent, cover the vents with vermin-proof screens. • If the air vent screens are damaged or have wide gaps, replace with functioning vermin-proof screens.
12	The storage tank tap is dirty or in poor condition (e.g. damaged, severely corroded, leaking), which could allow contaminants to enter the water during collection, or result in water loss.	• If the tap is dirty, clean and disinfect the tap (e.g. with chlorine). • If the tap is in poor condition, repair or replace the tap as needed, then clean and disinfect it. • Communicate the importance of routine cleaning/maintenance to the caretaker or owner.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
13	The drainage is inadequate (e.g. absent, damaged or blocked drainage channel or soakaway), which could result in stagnant water contaminating the collection area.	• If a drainage channel or soakaway is absent, dig a temporary channel to divert water away from the water collection area. Construct a permanent drainage system as soon as possible. • If a drainage channel or soakaway is not working, consider whether maintenance is needed (e.g. repair, cleaning), or if deepening, widening or extending is required.
14	The fence or barrier around the storage tank is absent or inadequate, which could allow animals to contaminate or damage the collection area.	• If absent, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent animal access, repair or replace it. • If the entry point (e.g. gate) to the collection area is damaged and/or does not close securely, repair or replace it.
15	There are sources of pollution (e.g. open defecation, animals, drinking trough for livestock, rubbish, commercial activity, fuel storage) around the storage tank that could contaminate the water collection area.	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the collection area in a clean condition. • Consult with local authorities and users to consider: ◦ appropriate actions to relocate or eliminate the source of pollution ◦ other actions to minimize the issue from occurring again (e.g. signage, enforcement measures).
16	There is spray drift from local activity (e.g. industry, agriculture) that could contaminate the roof catchment area.	• Consider what immediate actions should be taken to minimize the risk to public health (e.g. suspend rainwater collection until the activity has ceased). • Clean the roof and allow the wash water to drain to waste (i.e. ensure it does not enter the storage tank). • Clean and disinfect (e.g. with chlorine) the storage tank if contaminated water has entered it.[a] • Consider appropriate steps to eliminate the hazard, liaising with the responsible individuals or groups and the local environmental authority as required.

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World Health Organization

7

Sanitary inspection package

Surface water source and intake

Surface water source and intake

A. GENERAL INFORMATION

A.1. Surface water source information[a]

Surface water source location (e.g. catchment, village, town, community, parish, district, province, state)			
Name of waterbody		**Average flowrate** (if known; including units)	

A.2. Intake structure information

Intake structure location State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)					
Name of entity responsible for management of the intake structure (e.g. name of water utility, community group, private operator)			**Year of construction of the intake**		
Intake structure material Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Masonry ❑ Concrete ❑ Earthen clay ❑ Other. Describe:				
Approximate number of households using this water supply Circle one of the options	1–50	51–100	101–500	501–1000	>1000

Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)
Is the intake structure affected by flooding?	❑ Unsure	❑ No	❑ Yes	
Is the intake structure affected by drought?	❑ Unsure	❑ No	❑ Yes	
Does the responsible management entity have a *Water safety plan* in place (or an equivalent risk management approach)?	Circle one of the options below			If **Yes**, details (e.g. how long it has been in place)
	❑ Unsure	❑ No	❑ Yes	

A.3. System functionality

Circle **Yes** or **No** to indicate if water is currently available from the intake. If **No**, describe why (e.g. damaged or blocked component, low water level) and then go to Section B. In Section C, record the corrective actions needed to ensure the intake can provide water, and record the details of any alternative water source(s) currently being used.

Is water currently available from the intake structure?		If **No**, describe why (then go to Section B)
Yes	No	

[a] This sanitary inspection package is for flowing surface water sources, such as a river or stream. For non-flowing surface water sources (e.g. pond, lake, reservoir) see the *Technical fact sheet* for additional considerations.

A.4. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.5. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.6)	Yes										
Parameter tested		*E. coli*[b]		*or* Thermotolerant (faecal) coliforms[b]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.6. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

- ❑ **No treatment applied.**[c]
- ❑ **Treatment applied at the intake structure.** Describe the treatment steps (e.g. coagulation, roughing filter, chlorination).[d]
- ❑ **Treatment applied downstream of the intake structure** (e.g. at a water treatment plant, household water treatment). If so, describe treatment steps if known (e.g. coagulation/flocculation, sedimentation, filtration, disinfection).

[b] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination, which is common in surface water sources. Detection at levels of concern (e.g. significantly higher than established background levels) should lead to consideration of further action, such as optimizing downstream water treatment processes (e.g. increased disinfection at a water treatment plant), and further sampling and investigation of potential sources of contamination. *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[c] Surface water sources are often vulnerable to contamination and rapid changes in water quality - even frequent water quality testing of surface waters cannot give a reliable indication of safety. For this reason, surface water should always be treated/disinfected before consumption.

[d] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.5. Where possible, turbidity and pH should also be measured. For general information on chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the surface water source and intake structure. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the surface water source and intake structure being inspected.

3. Tick the **No** box if the question does apply to the surface water source and intake structure being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

Figure 1. Typical risk factors associated with a surface water source and intake structure

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
Intake structure					
1	**Does the intake lack a functioning protective structure?** Contaminants could enter the intake water if there is no protective structure in place (e.g. no protective wall or intake channel). This could also happen if there is a protective structure in place but it is in poor condition (e.g. damaged, deep cracks, significant erosion).	❑	❑	❑	
2	**Does the intake structure lack a functioning screen?** Contaminants could enter the intake water (e.g. animals, vegetation) if there is no screen in place. This could also happen if there is a screen in place, but it is in poor condition (e.g. missing or bent bars, severely corroded). A clogged screen could also reduce the flow rate, which could reduce the quantity of water available.	❑	❑	❑	
3	**Does the intake structure lack a functioning flow control mechanism?** Uncontrolled flows could pass through the intake structure if a flow control mechanism is absent, or if it is damaged (e.g. broken or seized valve). This could damage the intake components (or affect downstream water treatment processes, if present).	❑	❑	❑	
4	**Is there a build-up of sediment around the intake structure?** Sediment could block the intake channel, which could reduce the flow rate and affect the quantity of water available. Sediment may also contain harmful microorganisms and other contaminants (e.g. metals) that could affect the quality or acceptability of the water.	❑	❑	❑	
5	**Is there a build-up of vegetation around the intake structure?** Excessive vegetation growth (e.g. aquatic weeds) could reduce the flow rate and affect the quantity of water available. Decomposing vegetation could also affect water quality.	❑	❑	❑	
6	**Is the area around the intake structure dirty?** Contaminants could enter the intake water if there is pollution (e.g. faeces, rubbish) around the intake structure.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
7	**Is the fence or barrier around the intake missing or inadequate, so that animals could enter the intake area?** Animals could contaminate or damage the intake area if the fence or barrier around the intake is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	
8	**Does the intake structure lack a functioning weir?** If the surface water source has periods of low flow, an absent or damaged weir (or dam) could reduce the quantity of water available when water levels are low. This could also affect water quality.	❑	❑	❑	
9	**Are there signs of an algal bloom around the intake structure?** An algal bloom could block the intake structure (and affect downstream water treatment processes, if present). Certain algal blooms could affect the taste and odour of the water, and in some cases, may be harmful to health (e.g. in the case of cyanobacteria blooms).	❑	❑	❑	
10	**Is there any human activity around the intake structure?** Contaminants could enter the intake water if there is human activity taking place around the intake (e.g. washing, bathing, swimming).	❑	❑	❑	
Surface water source					
11	**Are there human settlements upstream of the intake structure?**[e] Contaminants could enter the source water from run-off from human settlements (e.g. containing harmful microorganisms from open defecation or domestic waste).	❑	❑	❑	
12	**Is there any sanitation infrastructure upstream of the intake structure?**[e] Contaminants could enter the source water from direct discharges, seepage or run-off from sanitation infrastructure (e.g. containing harmful microorganisms in effluents from latrine pits, wastewater treatment facilities).	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
13	**Is there any stormwater infrastructure upstream of the intake structure?**[e] Contaminants could enter the source water from stormwater discharges (e.g. containing harmful microorganisms or chemicals in storm drain effluent).	❑	❑	❑	
14	**Are there any farming activities upstream of the intake structure?**[e] Contaminants could enter the source water from direct discharges or run-off from farming activities (e.g. containing harmful microorganisms from manure spreading, chemicals from fertilizer or pesticide application). This could also happen if there is livestock directly within, or adjacent to, the surface water source.	❑	❑	❑	
15	**Are there any roads upstream of the intake structure?**[e] Contaminants could enter the source water from run-off from roads (e.g. containing fuel, oil, sediment, metals).	❑	❑	❑	
16	**Are there any other commercial or industrial activities upstream of the intake structure?**[e] Contaminants (e.g. harmful microorganisms, petroleum products, radioactive substances, heavy metals, pesticides, nutrients, sediments) could enter the source water from direct discharges or run-off from commercial or industrial activities (e.g. former or current markets, mechanics, fuel stations, vehicle washing, livestock sales yards, slaughter houses, manufacturing facilities, mining, military sites, waste dumps, forestry, aquaculture, boat traffic).	❑	❑	❑	
	Total number of Yes responses				

[e] It is not possible to prescribe a "safe" distance for direct (including faecally-loaded) upstream discharge into surface waterbodies, in particular if the surface water is consumed without treatment. Appropriate minimum safe distances for polluting activities upstream of the intake structure must consider local factors (refer to Section A of the *Management advice sheet*).

The person conducting the inspection should aim to visually inspect a distance upstream of the intake structure that can be practically observed during the inspection. These questions can also be answered by speaking with community members, the water supply management entity or stakeholders present during the inspection. For further information, refer to the *Management advice sheet.*

C. ADDITIONAL DETAILS

Include any additional risk factors,[f] recommendations, observations or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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[f] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ___

Organization: ___

Designation/title of inspector: ___

Signature: ___ Date: ___

Name of water supply representative: ___

Contact number (if available): ___

Signature (if available): ___ Date: ___

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Surface water source and intake

This technical fact sheet provides background information on a surface water source (such as a river) and intake, which supports the sanitary inspection of a drinking-water supply.

An intake structure collects source water and directs it to a defined location via gravity or pumping (e.g. to a storage reservoir or directly to a water treatment plant).

Surface water sources are vulnerable to contamination (e.g. from catchment run-off), and are typically poorer quality than groundwater sources. The quality of surface water sources can change rapidly. For this reason, appropriate treatment/disinfection of surface water is required before consumption.

The intake should be located where sediment is unlikely to build-up (e.g. avoiding river bends), and where flowing water can be abstracted (i.e. avoiding low-flow areas that may be stagnant and poorer quality). Where possible, the intake should be located upstream of polluting activities, and the structure should be accessible to operational staff at all times of the year for inspection and operations and maintenance.

Intake structures vary greatly in their scale and design depending on the volume of water they abstract and the characteristics of the surface water source. Figure 1 shows a common type of surface water intake for a river source (referred to as a protected side-intake configuration). A section view of the intake is shown in Figure 2. These figures show a typical design, although other designs are possible.

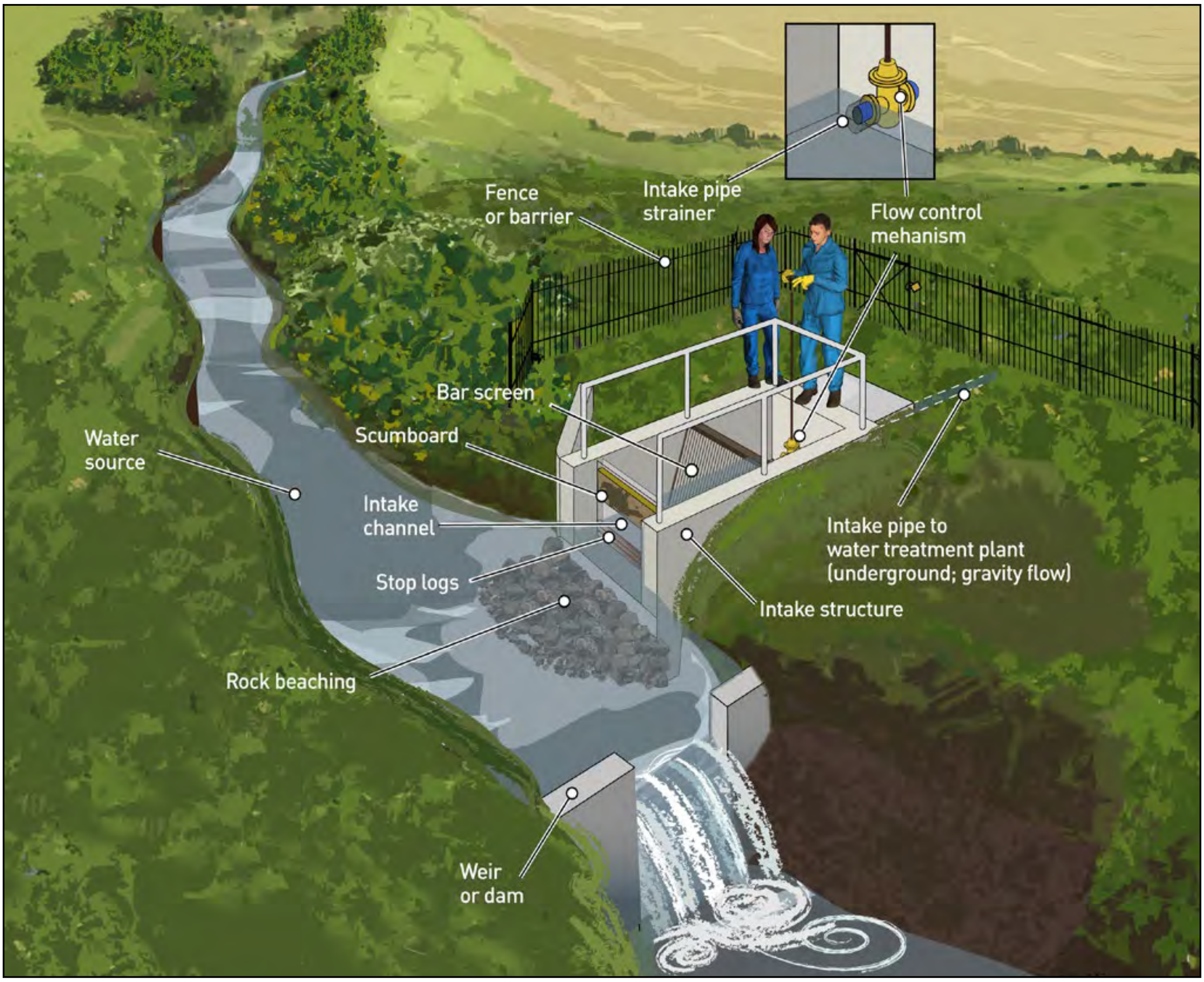

Figure 1. A common surface water intake structure (for flowing waterbodies, such as a river) in a sanitary condition

Typical risk factors associated with surface water sources and intake structures are presented in the corresponding *Sanitary inspection form.*

Surface water intake structures typically include the following main components.

- **Water source:** The source of water for the drinking-water supply. In this example, the source is river water that is diverted via the intake structure and flows by gravity to a downstream water treatment plant.
- **Intake structure:** Protects the intake components from damage (e.g. from debris or rocks during high-flow events). The intake structure typically consists of protective walls (e.g. concrete or masonry) and erosion control (such as **rock beaching** or boulders) to prevent scouring.
- **Intake pipe:** Transfers surface water via the **intake channel** to a defined location. Typically, the intake pipe is constructed from ductile iron (DI), polyethylene (PE), high density polyethylene (HDPE) or polyvinyl-chloride (PVC). The pipe should be protected by the intake structure, and located close to the riverbank. The intake pipe should be at a depth that can draw water at all times of the year, but it should be raised above the riverbed to avoid sediment.
- **Flow control mechanism:** Typically a valve (such as a sluice or gate valve) that controls the flow rate through the intake pipe. The mechanism protects the intake pipe (and downstream water treatment processes, if present).
- **Intake pipe strainer:** Perforated metal cover that is secured over the mouth of the intake pipe to prevent smaller debris (such as grit, stones, sediment), animals or fish entering the intake pipe.
- **Screen:** Consists of parallel metal bars that prevent larger debris (e.g. branches, logs) from damaging or blocking the intake pipe. There may be just one screen in place, or there may be several screens in a series (e.g. with decreasing width between the bars to improve the removal of debris). *Note* – to improve screening, the intake structure may also have a **stop log** (for larger material that may be dragged along the river bed) and/or a **scumboard** (for floating material or scums).
- **Weir or dam:** A barrier across the width of a river to help ensure a minimum water level for abstraction. A weir or dam is used in rivers that have periods of low flow (i.e. when water levels are low). The weir or dam is typically constructed from rocks, masonry or metal plates, and is located downstream of the intake structure.
- **Fence or barrier:** A physical barrier to prevent animals from contaminating the intake area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and locked.

Additional considerations

The design of the intake structure should allow safe and efficient abstraction of source water at all times of the year, considering factors such as flow rate, water level fluctuation, sediment load, and the riverbed depth and physical characteristics (e.g. rocky, sandy, muddy).

In addition to what is shown in Figure 1, intake designs can also include floating intakes (used to abstract water near the surface to avoid sediment which may form at the bottom of riverbeds), riverbank filtration, and sand spears (both suitable for rivers where water levels change significantly across seasons).[a]

Intakes may also require a spillway which allows excessive flows (e.g. during a flood) to be diverted away from the intake to protect the structure.

In some settings, water may be treated or pretreated at the intake structure itself. This can include the addition of coagulants, filtration (e.g. roughing, sand or gravel filters) and/or chlorination.

Any materials used (e.g. pipes, fittings, valves) should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme) when constructing new intake structures or rehabilitating old ones.

Considerations for non-flowing surface water sources

Non-flowing surface waterbodies (such as ponds, lakes and reservoirs) have certain characteristics that are different from flowing surface waters (such as rivers, streams). This may include different risk profiles for sediment accumulation, erosion (e.g. from wind and wave action in lakes), pollutant dilution (in particular, faecal contamination), stagnation, stratification, and algal (i.e. cyanobacterial) blooms.

Intake structure configurations for non-flowing surface waterbodies can include multi-level intake structures such as abstraction towers in lakes or reservoirs, and floating pontoons.[a]

This sanitary inspection package should be adapted for non-flowing surface water sources considering the locally-relevant waterbody characteristics and risk factors.

[a] For additional information, refer to *Compendium of drinking-water systems and technologies from source to consumer* (WHO, in preparation).

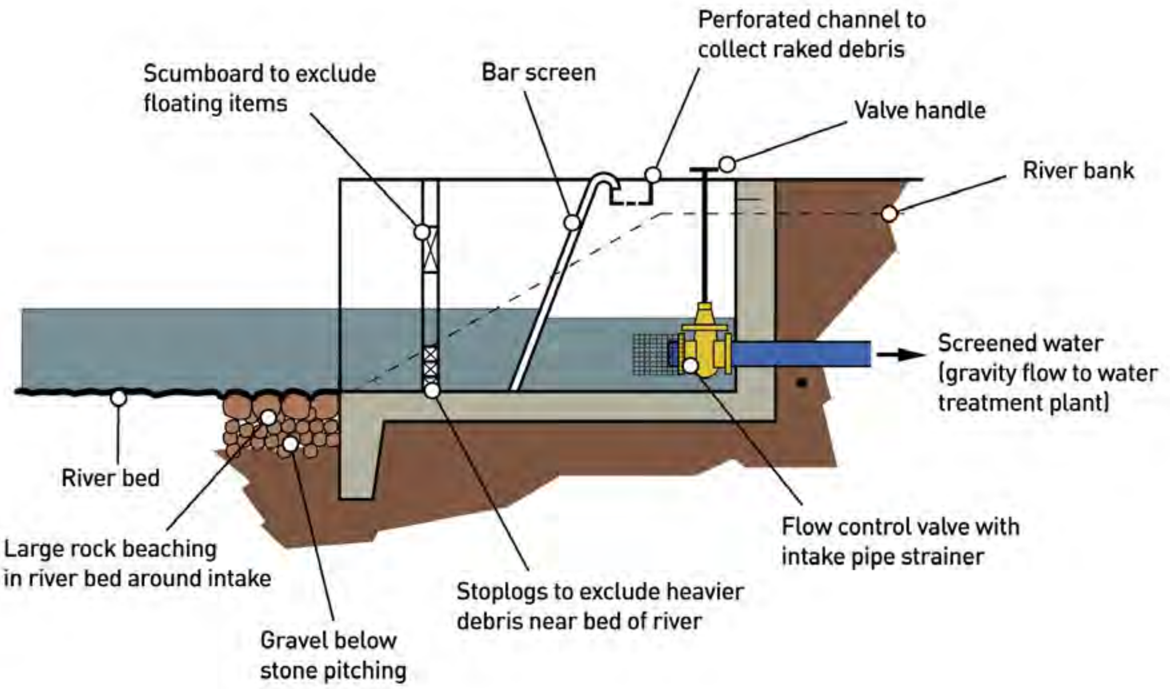

Figure 2. A common surface water intake structure for flowing surface water bodies (section view)

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Surface water source and intake

This management advice sheet provides guidance for the safe management of a surface water source (such as a river) and intake, which supports the sanitary inspection of this water source.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1 including suggested frequencies for each activity. These activities are important for keeping the intake in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained caretaker or operator (e.g. simple maintenance tasks such as clearing the screen). Larger repairs and maintenance tasks (e.g. repairing the intake structure, maintaining the flow control valve, dredging the weir) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the intake structure should be inspected routinely to help prevent contaminants entering the water supply. Any damage or faults should be repaired immediately (e.g. damaged screen, seized flow-control valve, broken fence). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. cleaning the intake channel, inspecting the intake pipe strainer). These should be followed by trained individuals so the work is carried out safely and the water supply is not contaminated during the work.

Vegetation management programmes should be in place to help ensure that excessive vegetation (e.g. aquatic weeds) does not block screens and reduce the flow rate, or damage the structure (e.g. masonry damage from tree roots, fallen branches). Decomposing vegetation (e.g. aquatic weeds around the intake) can also affect water quality.

Where possible, the surface water should be selectively abstracted (e.g. closing the flow control mechanism when water quality deteriorates following a heavy rainfall event, and re-opening the intake once the water quality improves). The water supplier should also establish and maintain communication protocols with catchment stakeholders, so that source water abstraction can be stopped in the event of planned works upstream of the intake (e.g. annual pesticide spraying by the catchment authority, dredging works in the river) or in the event of an emergency (e.g. fuel spillage following a road accident adjacent to a surface water source).

Sources of pollution upstream of the intake (e.g. open defecation, sanitation infrastructure, washing/bathing, agriculture, commercial activity, roads) should be investigated to determine their potential impact on source water quality. The risks from such polluting activities depends on several factors, including:

- the type and intensity of the activities
- the distance of the activities from the intake structure
- the nature and concentration of the contaminant
- the natural reduction in the contaminant concentration during contaminant transport on land and in the waterbody (e.g. through natural processes, such as degradation, adsorption, dilution)
- the catchment characteristics (e.g. slope of the land, vegetation coverage)
- the presence and effectiveness of source protection and contaminant containment measures
- the presence and effectiveness of measures at the abstraction site (e.g. variable-level intake, raw (untreated) water storage reservoir).

External support should be sought as needed to help the water supplier assess the risks from polluting activities in the catchment (e.g. drinking-water quality surveillance agency representatives, hydrologists, hydrogeologists, microbiologists, chemists, catchment managers).

The water supplier should routinely inspect the catchment area upstream of the intake (e.g. every 1-3 years), and maintain an inventory of polluting activities, and the effectiveness of existing protection measures. Consideration should also be given to catchment activities that affect the quantity of water available (e.g. surface water extraction for irrigation, mining, power production). Catchment authorities may already have an existing list of catchment activities that can be used as a starting point. This list can then be verified through field inspection and built upon as needed (e.g. through several field visits over time).

Although the entity managing the water supply often does not have direct responsibility for implementing surface water protection measures in the catchment, they may be able to indirectly influence such actions, for example, through close cooperation between the water supplier, relevant authorities, catchment land users, the community and other stakeholders. Authorization of new upstream activities in surface water catchments (e.g. new wastewater treatment facility, commercial forestry site, mine) should be based on site-specific assessments to demonstrate that they will not affect the supply of safe drinking-water.

Routine monitoring is required to help ensure the integrity of potentially polluting structures (e.g. septic tanks, wastewater sludge storage bunds, fuel or chemical storage tanks) and the effective operation of protective measures within the catchment (e.g. rock beaching at riverbank bends, riverbank vegetation strips, stock exclusion fencing). Such monitoring is often not the responsibility of the water supplier. For this reason, this advice sheet provides broad guidance regarding activities that can be conducted by the operators of the water supply, as well as recommendations for engaging with other responsible authorities and stakeholders.

Surface water sources are typically vulnerable to contamination and often experience rapid changes in water quality (e.g. from surface run-off after rain). For this reason, surface water should always be treated/disinfected before consumption (e.g. at a water treatment plant, and/or at the household level as an interim solution). If not already in place, the responsible management entity should work towards the development of a water safety plan (or equivalent risk management approach). This should cover the entire water supply (i.e. source/catchment, water treatment plant (if present), distribution and storage, and user practices). This will help ensure the safe management of the water supply. The water safety plan should reflect the complexity of the water supply and the local resources and capacity (e.g. a more basic water safety plan is appropriate for simple water supplies where resources and capacity are limited).[a]

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check that the intake area is clean. Remove any polluting materials (e.g. faeces, rubbish) and clean the area as needed. • Check that the bar screen is clear. Remove debris as needed (e.g. vegetation, fish, animals, debris, sediment). • Check that the intake pipe strainer is clear. Remove debris as required, back-flushing the pipe if needed. • Check that the intake channel is clear. Remove debris as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed. • Check for evidence of polluting activities around the intake. Notify the relevant authorities as necessary.
Annually	• Perform a detailed inspection of the intake structure (including the walls, intake channel, intake pipe, valves, weir or dam) for signs of damage or failure. Repair as needed.

[a] For information on water safety planning, refer to Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities (WHO, 2012).

Table 1. ...continued

Frequency	Activity
As the need arises[b]	• Repair the intake infrastructure (e.g. repair cracks in protective wall, weld screens). • Adjust the flow control mechanism to regulate flows or to selectively abstract water. • Where present, adjust the height of the stop log and scumboard (e.g. when seasonal water levels change). • Dredge the weir or dam area. • Remove vegetation from the intake area. • Monitor water levels and use to identify changes (e.g. during periods of flooding or drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[b] See Table 2 for potential issues that could trigger these activities.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. More frequent checks may be required during the rainy season or flood events. However, less frequent checks may be needed for practical reasons (e.g. where intake structures are hard to access due to seasonal track closures). A suitable O&M schedule should be made for each site, including who is responsible for the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when undertaking any activities that require entering the water (e.g. inspection of the intake pipe strainer).
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form.* Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

In addition to the corrective actions listed for problems 10-16 in Table 2, the following general actions should be considered in the local context, engaging the relevant local authorities and stakeholders as required.

- Consult with upstream catchment stakeholders and waterbody users to raise awareness on how their activities can contaminate the water supply; incentivize actions where appropriate.
- Where practical, relocate polluting activities downstream of the intake, or alternatively, relocate the intake structure upstream of polluting activities.
- In the immediate-term, optimize downstream water treatment processes to ensure surface water contaminants are removed.

Table 2. Common issues associated with a surface water source and intake, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
Intake structure		
1	The intake lacks a functioning protective structure, which could allow contaminants to enter the intake water.	• If there is no protective structure in place, seek the relevant skilled help to construct a protective wall and erosion control around the intake. • If the protective structure is in poor condition, repair the structure as needed (e.g. repair mortar or brickwork) and provide adequate protection to minimize future damage (e.g. reinforce walls, provide rock beaching to minimize erosion).
2	The intake structure lacks a functioning screen, which could allow debris to damage the intake, or contaminate the intake water.	• If there is no screen in place, seek the relevant skilled help to construct a screen. • If the screen is in poor condition, repair the screen (e.g. via welding), or replace it. • If the screen is blocked, clear the screen to remove debris.
3	The intake structure lacks a functioning flow control mechanism, which could allow uncontrolled flows to damage the intake (or affect downstream water treatment processes, if present).	• If there is no flow control in place, seek the relevant skilled help to construct one. Consult with an engineer on the appropriate flow rates to be maintained, accounting for seasonal flows and flood events. • If the flow control mechanism is damaged (e.g. broken, heavily corroded, seized), repair or replace the mechanism.
4	There is a build-up of sediment around the intake structure, which could allow contaminants to enter the intake water, or reduce the flow rate.	• Remove the sediment from the intake area (e.g. by dredging, ensuring that the intake valve is closed during the works). • Consult with the relevant authorities to explore upstream management options to reduce sediment entering the waterbody (e.g. riverbank vegetation strips, riverbank reinforcement via rock beaching).
5	There is a build-up of vegetation around the intake, which could allow contaminants to enter the intake water, or reduce the flow rate.	• Remove the vegetation from the intake area. • Establish a routine vegetation management programme to prevent future vegetation build-up. • Consult with the relevant authorities to explore longer-term options for reducing nutrient loads in the catchment to manage aquatic weed growth (e.g. optimize slurry or fertilizer application practices, establish riverbank vegetation strips).
6	The area around the intake structure is dirty, which could allow contaminants to enter the intake water.	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). • Communicate the importance of maintaining the intake area in a clean condition. • Consult with the local community to raise awareness that their activities around the intake structure (e.g. open defecation, presence of animals, rubbish disposal) can contaminate the water supply.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
7	The fence or barrier around the intake structure is missing or inadequate, which could allow animals or unauthorized people to contaminate or damage the intake area.	• If missing, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the intake area is damaged and/or does not close securely, repair or replace it.
8	The intake structure lacks a functioning weir (or dam), which could affect the quality or quantity of water available for abstraction during periods of low flow.	• If there is no weir in place, and one is required, seek the relevant skilled help to construct one. • If the weir is damaged, repair or replace it. • If excessive sediment has accumulated in the weir area (i.e. reducing its effectiveness), remove the sediment (e.g. by dredging).
9	There are signs of an algal bloom around the intake structure.	• If there is adequate water storage capacity (e.g. an off-stream raw water storage reservoir), close the intake structure and wait for the bloom to pass. • If present, ensure the scumboard is set at an appropriate height to remove surface algal scums. • Consult with the relevant authorities to explore longer-term options for reducing nutrient loads in the catchment to manage algal growth (e.g. optimize slurry or fertilizer application practices, establish riverbank vegetation strips).
10	Human activity is taking place around the intake structure which may contaminate the surface water source.	• Encourage sanitary behaviour around the intake area (e.g. avoiding bathing or open defecation in the waterbody, avoiding water contact in case of illness). This can be done through direct communication with the population, distributing leaflets or through installing information signs. • Consult with relevant authorities to encourage relocation of these activities downstream of the intake structure. This can be done through participatory processes, installing information signs, or by fencing the area where activities should be discouraged or banned.
Surface water source		
11	Human settlements are present upstream of the intake structure, which could allow contaminants to enter the surface water source.[c]	• Encourage sanitary behaviour (e.g. avoiding open defecation, dumping of rubbish). This can be done both through direct communication with the population, distributing leaflets or by installing information signs. • Consult with the relevant authorities to promote the installation of safe sanitary facilities and their ongoing inspection, with regular maintenance and waste collection.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
12	Sanitation infrastructure, activities or discharges are present upstream of the intake, which could allow contaminants to enter the surface water source.[c]	• Where periodic overflow of sewerage systems cannot be avoided in the shorter-term (e.g. following heavy rainfall where there are combined stormwater and sewerage systems), develop a protocol for temporary closure of the intake, re-opening only when the event has passed. • Consult with the local authorities to: ◦ encourage the provision of adequate coverage and capacity of sanitation systems that are accepted by the population to avoid open defecation ◦ promote the design and construction of sanitation systems that can avoid overflow ◦ raise awareness that any new sanitation infrastructure, activities or effluent discharges should be located downstream of the intake structure, or at a safe distance upstream ◦ encourage the safe containment, reuse or disposal of human wastes.
13	Stormwater infrastructure or discharges are present upstream of the intake structure, which could allow contaminants to enter the surface water source.[c]	• Where stormwater discharges cannot be avoided in the shorter-term, develop a protocol for temporary closure of the intake during storm flow events (e.g. heavy rainfall), re-opening only when the event has passed. • Consult with the local authorities to: ◦ raise awareness that new infrastructure or discharges should be located downstream of the intake structure, or at a safe distance upstream ◦ encourage the safe containment, reuse or disposal of stormwater ◦ encourage optimized operation of storm water systems and ongoing maintenance ◦ promote the design and construction of stormwater systems that can avoid overflow.
14	Farming activities are present upstream of the intake structure, which could allow contaminants to enter the surface water source.[c]	• Fence the area in which farming activities should be avoided and livestock excluded. • Consult with the local farmers to: ◦ raise awareness that any new farming activities should be located downstream of the intake structure, or at a safe distance upstream ◦ raise awareness of the need to keep livestock out of the waterbody and away from the riverbank; where necessary, encourage the provision of off-stream watering for livestock ◦ encourage best practice application of animal manure, fertilizers and pesticides (e.g. avoiding application when rain is forecast) ◦ raise awareness on the importance of safe containment of animal wastes (e.g. slurry, manure), fuels and chemicals.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
15	Traffic or roads are present upstream of the intake structure, which could allow contaminants to enter the surface water source.[c]	• Discourage vehicle washing in, or adjacent to, the waterbody. This can be done through direct communication with the population, distributing leaflets or by installing information signs. • Consult with the relevant authorities to encourage the construction of interception channels to divert road run-off away from, and preferably downstream of the intake.
16	There are other commercial activities present upstream of the intake structure which may contaminate the surface water source.[c]	• Consult with the relevant authorities to: ○ raise awareness that any new commercial activities should be located downstream of the intake structure, or at a safe distance upstream ○ encourage the construction of interception barriers to prevent run-off from commercial activities ○ discourage the disposal of untreated commercial wastewater upstream of the intake ○ encourage safe storage and containment or disposal of substances hazardous to health ○ raise awareness on, and encourage reduced use of, substances hazardous to water, or replace them with less hazardous alternatives ○ promote the design and construction of facilities in a way that enables them to operate with minimal impact to the surface water.

[c] The term "upstream" in this context refers to a reasonable distance upstream of the intake structure that can be practically observed during the inspection.

It is not possible to prescribe a "safe" distance for direct (including faecally-loaded) upstream discharge into surface waterbodies, in particular if the surface water is consumed without treatment. Appropriate minimum safe distances for polluting activities upstream of the intake structure are dependent on a number of local factors, as outlined in Section A. For more detailed guidance on managing surface water risks, refer to Protecting surface water for health: identifying, assessing and managing drinking-water quality risks in surface-water catchments (WHO, 2016).

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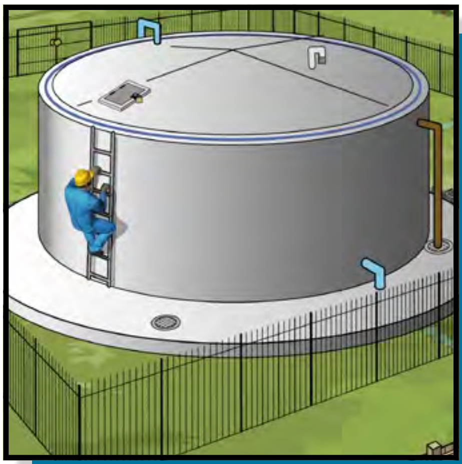

8

Sanitary inspection package

Piped distribution - storage tank

Piped distribution – storage tank

A. GENERAL INFORMATION

A.1. Storage tank information

Storage tank location (e.g. village, town, community, parish, district, province, state)			
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)			
Name of entity responsible for the management of the storage tank (e.g. name of water utility, private operator, community group)			
Year of construction of storage tank		**Storage tank volume** (including units)	
Storage tank construction material Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Ductile iron (DI) ❑ Ferrocement ❑ Concrete ❑ Lead ❑ Polyvinylchloride (PVC) ❑ High density polyethylene (HDPE) ❑ Other. Describe:		
Is the storage tank underground, at ground level, or elevated? Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Underground[a] ❑ Ground level ❑ Elevated. Approximate height (including units):		

Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)
Is the storage tank affected by flooding?	Unsure	No	Yes	
Is the storage tank affected by drought?	Unsure	No	Yes	

A.2. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.3. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.4)	Yes										
Parameter tested		*E. coli*[b]		*or* Thermotolerant (faecal) coliforms[b]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.4. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

Location	Is the water treated?			If **Yes,** describe (e.g. type of treatment, chlorine dose, frequency of dosing, if known)[c]
Before the storage tank (e.g. at a water treatment plant)	❑ Unsure	❑ No	❑ Yes	
At the storage tank	❑ Unsure	❑ No	❑ Yes	
Downstream of the storage tank (e.g. household water treatment)	❑ Unsure	❑ No	❑ Yes	

[a] This form is intended for use on ground level or elevated storage tanks. For underground storage tanks, the form should be adapted. For more information, see the *Technical fact sheet.*

[b] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as increased disinfection before or at the storage tank, additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice).
Note – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[c] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested during the inspection and the result recorded in Section A.3. Where possible, turbidity and pH should also be measured. For guidance on adequate chlorine disinfection, see the *Management advice sheet.*

General notes

- This form is intended for use on a single treated water storage tank. Where there are multiple storage tanks to be inspected, additional forms will be needed. Storage tanks may be inspected on a rotational basis where there are too many to cover during each inspection.
- If water from the storage tank feeds a piped distribution network, tapstand, kiosk or filling station, or if users collect and store water in the home, carry out an inspection using the corresponding sanitary inspection packages.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the storage tank. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the storage tank being inspected.
3. Tick the **No** box if the question does apply to the storage tank being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

Figure 1. Typical risk factors associated with a drinking-water storage tank

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Is the storage tank cover (or roof) absent or in poor condition?** Contaminants could enter the tank, particularly after rain, if the cover is absent. This could also happen if the cover is damaged (e.g. broken, missing sections, severely corroded, deep cracks).	❑	❑	❑	
2	**Is the storage tank inspection hatch lid missing or in poor condition?** Contaminants could enter the tank (e.g. from the entry of contaminated water following rain, entry of animals) if the inspection hatch lid is missing (or open, unlocked). This could also happen if the lid is damaged (e.g. cracked, severely corroded, does not fit tightly when closed).	❑	❑	❑	
3	**Is the overflow pipe poorly designed so that overflow water falls from a height onto the ground?** The tank may be undermined and damaged if water from the overflow pipe falls from a height and erodes the ground beneath the tank. This could affect water quality, or result in water loss.	❑	❑	❑	
4	**Does the overflow pipe lack adequate protection from vermin?** Contaminants could enter the tank (e.g. from insects, rodents, birds) if the overflow pipe is not covered with a vermin-proof screen (e.g. mesh, gauze).	❑	❑	❑	
5	**Are the air vents poorly designed so that contaminants could enter the storage tank?** Contaminants could enter the tank if the air vents are angled upwards, or are not covered with a vermin-proof screen.	❑	❑	❑	
6	**Are the storage tank walls cracked or leaking?** Contaminants could enter the tank if the walls are damaged (e.g. with deep cracks). A leaking tank could also result in stagnant water contaminating the tank area, as well as water loss.	❑	❑	❑	
7	**Are there any signs of contaminants inside the storage tank?** The presence of animals or faeces inside the tank is a serious risk to the safety of the drinking-water, and indicates that harmful microorganisms are present. Sediments may also contain harmful microorganisms and other contaminants (such as metals) that can affect the safety or acceptability of the water.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
8	**Is drainage inadequate, which could allow water to accumulate in the storage tank area?** Stagnant water could contaminate the tank area if there is no drainage system in place. This could also happen if the drainage system is damaged or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water during the inspection may indicate poor drainage.	❑	❑	❑	
9	**Is the fence or barrier around the storage tank missing or inadequate so that animals could enter the storage tank area?** Animals or unauthorized people could contaminate or damage the tank area if the fence or barrier around the storage tank is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close and lock securely.	❑	❑	❑	
10	**Is there any vegetation or structures above the storage tank?** Contaminants (e.g. from animal faeces) could enter the tank if there is overhanging vegetation, balconies or wires above the tank. Heavy vegetation could also physically damage the tank (e.g. fallen tree branch during a storm; tree roots undermining the tank structure). This could affect water quality, or result in water loss.	❑	❑	❑	
11	**Can sources of pollution be seen in the storage tank area (e.g. open defecation, animals, rubbish, commercial activity, open drains)?** The presence of animals or faeces on the ground close to the storage tank poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could also be washed into the storage tank area during rain.	❑	❑	❑	
12	**Is the storage tank excluded from routine maintenance and quality control programmes?**[d] Failure of the responsible management entity to routinely inspect, maintain and monitor the quality of water at the tank may result in unsafe drinking-water being supplied.	❑	❑	❑	

Sanitary inspection questions		NA	No	Yes	If Yes, what corrective action is needed?
13	**Does the storage tank water lack disinfection?**[c,d] Failure to adequately disinfect water with chlorine (or provide an alternative appropriate means of disinfection, such as ultraviolet [UV] or ozone) can result in unsafe drinking-water being supplied.	❑	❑	❑	
	Total number of Yes responses				

[d] Risk factor is not illustrated in Figure 1. To answer this question, interview the operator. Check network activity log books for confirmation. Provide further information in Section C to support your answer if necessary.

C. ADDITIONAL DETAILS

Include any additional risk factors,[e] recommendations, observations or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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[e] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ____________________

Organization: ____________________

Designation/title of inspector: ____________________

Signature: ________________ Date: ________

Name of water supply representative: ____________________

Contact number (if available): ____________________

Signature (if available): ________________ Date: ________

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Website: https://www.who.int/health-topics/water-sanitation-and-hygiene-wash

World Health Organization

Piped distribution – storage tank

This technical fact sheet provides background information on a storage tank, which supports the sanitary inspection of a drinking-water supply.

Storage tanks hold drinking-water prior to delivery to users. They are a common feature of piped distribution systems, and their storage capacities can vary greatly (typically ranging from kilolitres to megalitres).

Storage tanks can provide a buffer to help ensure the continuity of supply (e.g. during peak usage times, intermittent supply outages, unplanned supply outages). They can also help to provide stable pressure throughout the piped distribution network.

Storage tanks can store untreated source water or treated water, and can be located either underground, at ground level, or be elevated (e.g. water towers).

Drinking-water should always be stored in a sanitary manner (i.e. in a clean storage tank that is protected from contamination).

If chlorine disinfection is practised, there should be an adequate free chlorine residual concentration to help protect the water from harmful microorganisms during storage and distribution.[a]

Figure 1 shows a common type of storage tank in a piped distribution network (storing treated drinking-water at ground level). This figure shows a typical design. Other designs can also provide safe drinking-water.

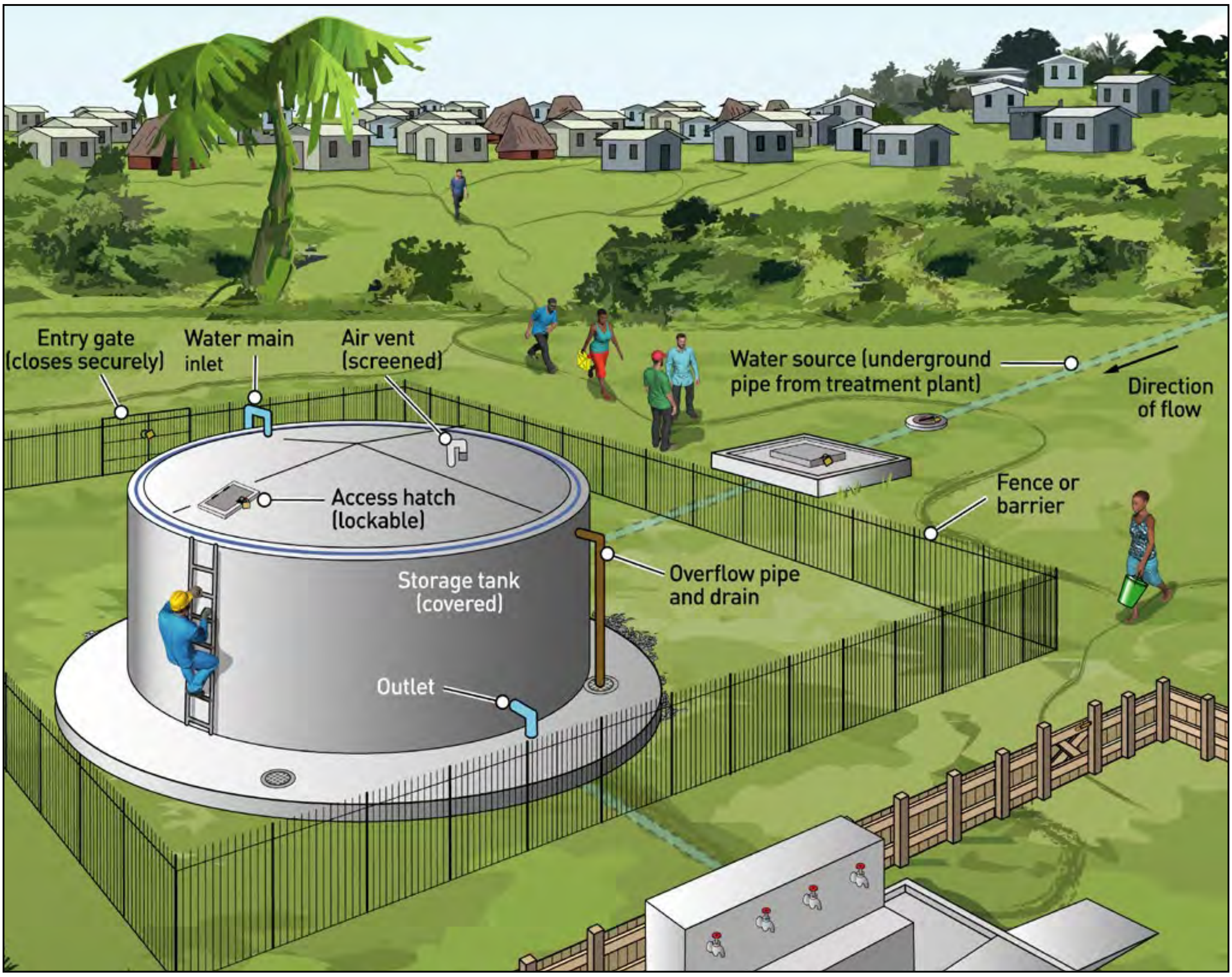

Figure 1. A common drinking-water storage tank in a sanitary condition

Note – For guidance on the piped network and tapstand components, see the corresponding sanitary inspection packages.

[a] For guidance on adequate chlorine disinfection, refer to the *Management advice sheet.*

Typical risk factors associated with storage tanks are presented in the corresponding *Sanitary inspection form.*

Storage tanks typically include the following main components.

- **Water source:** Typically provided from a water treatment plant via a piped distribution network (as shown in Figure 1), or from surface water or groundwater sources (e.g. river, borehole, spring). The source water should be treated/disinfected as required to ensure it is safe for human consumption.
- **Water main inlet:** Pipe that delivers drinking-water into the storage tank (e.g. from a water treatment plant).
- **Water storage tank:** Stores water prior to distribution to the users. Storage tanks are commonly made from high density polyethylene (HDPE), polyvinylchloride (PVC), ferro-cement, metal or concrete. The storage tank should be covered and sealed to stop contaminants entering the tank. The tank should have a sump (not shown in Figure 1) to allow cleaning and maintenance. The sump should be located at the lowest point of the tank floor to ensure the tank can be drained completely.
- **Inspection hatch:** Allows access to the storage tank for inspection or operations and maintenance. The inspection hatch should have a lid that is tightly fitting and lockable to stop contaminants from entering the tank, and to stop unauthorized access by people.
- **Air vent:** Allows ventilation in the storage tank. The air vent should be facing downwards and have a vermin-proof screen to stop contaminants entering the tank.
- **Overflow pipe:** Directs excess water from the storage tank to a drainage system. This stops the tank overflowing in an uncontrolled way, which could contaminate the tank area or damage the components. The overflow pipe should face downwards and have a vermin-proof screen (e.g. gauze or mesh) to prevent contaminants entering the tank. Water from the overflow pipe should not erode the ground beneath the pipe, as this could undermine and damage the tank, which could lead to contamination or water loss.
- **Drainage system:** Directs water away from the storage tank. The drainage system should slope down from the tank to ensure adequate drainage. This prevents water ponding and stagnating, which could contaminate the tank area.
- **Fence or barrier**: A physical barrier to prevent animals or unauthorized people from contaminating the storage tank area or damaging the components. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked.

Additional considerations

Before a new tank is used to store drinking-water, cleaning and disinfection is required (e.g. with chlorine).[b] Water quality testing should then be conducted before the storage tank is commissioned to confirm the water is safe for consumption. Periodic disinfection of the storage tank and testing may also be required (e.g. after maintenance).

When constructing new storage tanks or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme, including for lead-free or low-lead materials).

Storage tank inlet and outlet pipes should be designed to avoid flow short-circuiting, which can affect water quality (e.g. contamination from harmful microorganisms as a result of chlorine decay; formation of disinfection by-products; taste and odour issues). Consult with a local engineer as needed to determine the risk from flow short-circuiting in the tank. If required, take appropriate corrective actions (e.g. installation of internal baffles to ensure adequate mixing within the tank).

For underground storage tanks, consider additional risk factors associated with contaminated water entering the underground tank (e.g. poor drainage leading to the entry of surface water run-off, infiltration of groundwater due to poor tank condition).

[b] Guidance for disinfecting water storage tanks may be found in Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013).

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Piped distribution – storage tank

This management advice sheet provides guidance for the safe management of a storage tank, which supports the sanitary inspection of a drinking-water supply.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the storage tank in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained network operator (e.g. checking the free chlorine residual, cleaning and disinfecting the storage tank). Larger repairs and maintenance tasks (e.g. repairing the storage tank cover, replacing the tank liner) may need skilled labour, which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the storage tank and all related components and fittings should be inspected routinely to help prevent contaminants entering the water supply. Any damage or faults should be repaired immediately (e.g. deep cracks in the storage tank walls, damaged inspection hatch, broken fence). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. inspecting and repairing the storage tank). These should be followed by trained individuals so the work is carried out safely and the water supply is not contaminated during the work.

The storage tank should only contain drinking-water – no other liquids, including water of lesser quality, should be stored in the tank. The storage tank should be periodically cleaned and disinfected according to SOPs.[a]

Adequate treatment/disinfection are required before consuming the drinking-water (e.g. at a water treatment plant). Where chlorine disinfection is practised, operators should make sure there is an adequate free chlorine residual concentration by monitoring at regular intervals (see Table 1) and the results recorded (e.g. in a log book). As needed, the free chlorine residual concentration should be optimized upstream of the storage tank (e.g. at a water treatment plant) and/or by batch chlorine disinfection of the storage tank water (with all related activities conducted by trained operators according to SOPs).[b] Chemicals (e.g. chlorine) or testing reagents should be used before their expiry date and stored appropriately according to manufacturer's instructions.

If not already in place, the responsible management entity should work towards the development of a water safety plan (or equivalent risk management approach). This should cover the entire water supply (i.e. source/catchment, water treatment plant (if present), distribution and storage, and user practices). This will help ensure the safe management of the water supply. The water safety plan should reflect the complexity of the water supply and the local resources and capacity (e.g. a more basic water safety plan is appropriate for simple piped supplies where resources and capacity are limited).[c]

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check that the storage tank facility is clean. Remove any polluting materials (e.g. faeces, rubbish) and clean the area as needed. • Check the storage tank cover (e.g. roof) is in good condition. Repair or replace damaged parts. • Check that the storage tank inspection hatch lid is in place and in good condition, and is closed and locked securely. Repair or replace damaged parts, and lock as needed. • Check that the storage tank air vent and overflow pipe are in good condition, with protective vermin-proof screens securely fitted and functional. Repair or replace damaged parts. • Check that the inside of the storage tank is clean (e.g. free from animals, faeces, sediment build-up). Drain as needed, then clean and disinfect the storage tank.[a] • Check that the drainage system is clear and functioning. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed. • Where chlorination of the water supply is practised, check that the free chlorine residual concentration in the storage tank is adequate. Optimize the chlorine concentration before or within the water storage tank as needed (e.g. by increasing the chlorine dose at a water treatment plant, batch dosing the storage tank).[a,b]
Monthly to every three months	• Inspect the storage tank (and the tank support base if present) for signs of damage or failure. Repair or replace damaged parts as needed.
As the need arises[d]	• Drain the storage tank, remove sediment and clean the internal tank walls (e.g. using a brush and clean water), and then disinfect the storage tank (e.g. with chlorine).[a] • Perform maintenance tasks (e.g. tank liner maintenance). • Monitor water use to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] For guidance on O&M, including safely cleaning and disinfecting water storage tanks, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013). This activity is required following a contamination event (e.g. presence of animals in the storage tank; *E. coli* detection). *Note* – in water scarce areas, consult with local health authorities before draining a storage tank to ensure that the risk to water quality justifies the water loss. Alternative water supply arrangements may then be needed to ensure that users have sufficient water quantity to meet domestic needs.

[b] Where chlorine disinfection is practised, the free chlorine residual concentration should be at least 0.2 mg/L at the point of use. This means that the free chlorine residual concentration at the storage tank should be higher (e.g. at least 0.5 mg/L at pH less than 8 after at least 30 minutes contact time) - this can allow for chlorine decay during distribution, and subsequent storage and handling at the household level. Note that chlorine effectiveness is impacted by several factors including turbidity, pH and temperature. Chlorine doses or contact times will need to be adjusted to ensure adequate chlorine residual concentrations based on the local context. The free chlorine residual concentration in the water should also consider user acceptability. For more information, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

During outbreaks of waterborne disease, or when faecal contamination of a drinking-water supply is detected, the residual free chlorine concentration should be increased to at least 0.5 mg/L throughout the network as a minimum immediate response pending further investigation. *Note* – the concentration of chlorine should always be less than 5 mg/L in drinking-water prior to consumption.

[c] For information on water safety planning, refer to Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities (WHO, 2012).

[d] See Table 2 for potential problems that could trigger these activities.

General notes on Table 1

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when entering a storage tank for inspection or maintenance. Safety risks such as storage tank collapse or asphyxiation should be appropriately managed. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form*. Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a storage tank, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The storage tank is inadequately covered, which could allow contaminants to enter the tank.	• Provide a temporary cover (e.g. impermeable plastic sheeting) to minimize contaminants entering the storage tank. Install or repair the tank cover as soon as possible. • Clean and disinfect the storage tank (e.g. with chlorine).[a]
2	The storage tank inspection hatch lid is missing (or open, unlocked), or it is in poor condition (e.g. deep cracks, severely corroded, does not fit tightly when closed), which could allow contaminants to enter the tank.	• If the inspection hatch lid is absent or in poor condition, provide a temporary cover (e.g. impermeable plastic sheeting) over the inspection hatch to minimize the entry of contaminants. Repair or replace the hatch and/or lid as soon as possible. • If the inspection hatch lid is open or unlocked, communicate the importance of closing and locking the lid securely when not in use.
3	The overflow pipe is poorly designed and allows overflow water to fall from a height and erode the ground beneath the pipe, which could damage the tank and affect water quality, or result in water loss.	• Modify or extend the overflow pipe to direct the overflow water away from the storage tank area (e.g. via a drainage system).
4	The overflow pipe is inadequately protected (e.g. with a vermin-proof screen) which could allow vermin to enter the storage tank and contaminate the water.	• If the overflow pipe is unprotected, cover the pipe with a vermin-proof screen (e.g. gauze or mesh). • If the overflow pipe screen is damaged (e.g. ripped, broken) or has wide gaps, replace with a functioning vermin-proof screen.
5	The air vents are poorly designed (e.g. facing upwards) or unprotected (e.g. without a vermin-proof gauze), which could allow contaminants to enter the storage tank.	• If the air vents are facing upwards, modify the vents so they face downwards. • If the air vent screens are absent, cover the vents with vermin-proof screens. • If the air vent screens are damaged or have wide gaps, replace with functioning vermin-proof screens.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
6	The storage tank walls are cracked or leaking, which could allow contaminants to enter the tank, or result in water loss.	• If the storage tank is cracked or leaking, engage local craftspeople to repair or replace the storage tank as needed. • Clean and disinfect the storage tank (e.g. with chlorine).[a]
7	There are signs of contaminants in the storage tank (e.g. animals, faeces, sediment build-up) that could present a serious risk to water quality.	• Remove the contaminants immediately if possible. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to treat the water before consumption). • Drain, clean and disinfect the storage tank (e.g. with chlorine).[a] • Consider appropriate measures to minimize the risk of contamination entering the storage tank from this source in the future (e.g. install a storage tank cover if not present, lock inspection hatch lid).
8	The drainage is inadequate (e.g. absent, damaged or blocked drain), which could result in stagnant water contaminating the storage tank area.	• If a drainage system is absent, dig a temporary channel to divert water away from the tank area. Construct a permanent solution as soon as possible. • If a drainage system is not functioning correctly, consider whether maintenance is needed (e.g. repair, cleaning), or if deepening, widening or extending is required.
9	The fence or barrier around the storage tank is missing or inadequate, which could allow animals or unauthorized people to contaminate or damage the storage tank area.	• If missing, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the storage tank area is damaged and/or does not close securely, repair or replace it.
10	There are vegetation or structures overhanging the storage tank that could attract animals which may contaminate the tank area with faecal material, or damage the tank components.	• Remove any overhanging vegetation. • Deter birds or other animals from any structures overhanging the storage tank. • Where practical, relocate any overhanging structures (e.g. move overhanging wires in consultation with the responsible authority).
11	There are sources of pollution (e.g. open defecation, animals, rubbish, commercial activity, open drains) around the storage tank that could affect water quality.	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). • Communicate the importance of maintaining the storage tank area in a clean condition. • Consult with local authorities and users to consider: ◦ appropriate actions to relocate or eliminate the source of pollution ◦ other actions to minimize the issue from occurring again (e.g. signage, enforcement measures).

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
12	The storage tank is excluded from routine maintenance and quality control programmes.	• Develop and implement an appropriate routine maintenance and quality control programme, liaising with relevant authorities if appropriate. • Where needed, ensure adequate provision is made for water quality testing equipment and consumables, alongside appropriate SOPs and training for operators.
13	The water in the storage tank is not adequately disinfected.[b]	• Develop the necessary SOPs and provide operator training on adequate disinfection practices (including on the use of free chlorine residual test kits where chlorination is practised, and turbidity and pH where possible). • Ensure adequate provision is made to procure chlorine (or an appropriate alternative means of disinfection), along with water quality testing equipment and consumables for monitoring. • Ensure disinfection is practised correctly and consistently, and is optimized through routine monitoring and water quality testing.

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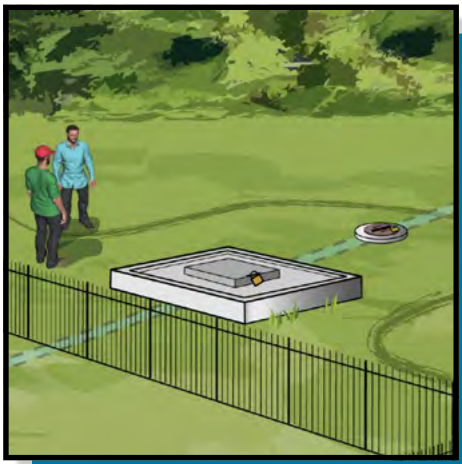
World Health Organization



9

Sanitary inspection package

Piped distribution - network

Piped distribution – network

A. GENERAL INFORMATION

A.1. Network information[a]

Network location (e.g. village, town, community, parish, district, province, state)			
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)			
Name of entity responsible for the management of the network (e.g. name of water utility, private operator, community group)			
Source of the network water[b] Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Surface water ❑ Borehole ❑ Spring ❑ Other. Describe:		
Total number of storage tanks present in the network		**Total number of tapstands present in the network**	
Approximate population supplied by this network (if known)			
Number of household connections (if known)		**Number of commercial connections** (if known)	
Average water supply service times	.... hours per day .... days per week	**Average total volume of water distributed per week** (if known, including units)	
Network pipe material Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Ductile iron (DI) ❑ High density polyethylene (HDPE) ❑ Polyvinylchloride (PVC) ❑ Ferrocement ❑ Lead ❑ Other. Describe:		

Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)
Is the network affected by flooding?	Unsure	No	Yes	
Is the network affected by drought?	Unsure	No	Yes	

Circle one of the options below				If **Yes**, describe (e.g. how long it has been in place)
Does the responsible management entity have a *Water safety plan* in place (or an equivalent risk management approach)?	Unsure	No	Yes	

A.2. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.3. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.4)	Yes										
Parameter tested		*E. coli*[c]		*or* Thermotolerant (faecal) coliforms[c]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.4. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

Location	**Is the water treated?**			If **Yes,** describe (e.g. type of treatment, chlorine dose, frequency of dosing, if known)[d]
Before the distribution network (e.g. at a water treatment plant)	❑ Unsure	❑ No	❑ Yes	
Within the distribution network	❑ Unsure	❑ No	❑ Yes	
Downstream of the distribution network (e.g. household water treatment)	❑ Unsure	❑ No	❑ Yes	

[a] Depending on the size of the piped distribution network, the inspector may check all, or part, of the network during the inspection. Record in Section C how much of the network was inspected (e.g. name/number of service areas inspected or estimated percentage of the network inspected). The network may be inspected on a rotational basis using additional forms, where the network is too large to cover during each inspection.

[b] Carry out sanitary inspections using the corresponding sanitary inspection packages.

[c] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as increased disinfection upstream of the network (e.g. at a water treatment plant, storage tank), additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[d] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.3. Where possible, turbidity and pH should also be measured. For guidance on adequate chlorine disinfection, see the *Management advice sheet.*

General note

- If water from the network feeds a storage tank, tapstand, kiosk or filling station, or if users collect and store water in the home, carry out an inspection using the corresponding sanitary inspection package.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the network. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.

2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the network being inspected.

3. Tick the **No** box if the question does apply to the network being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

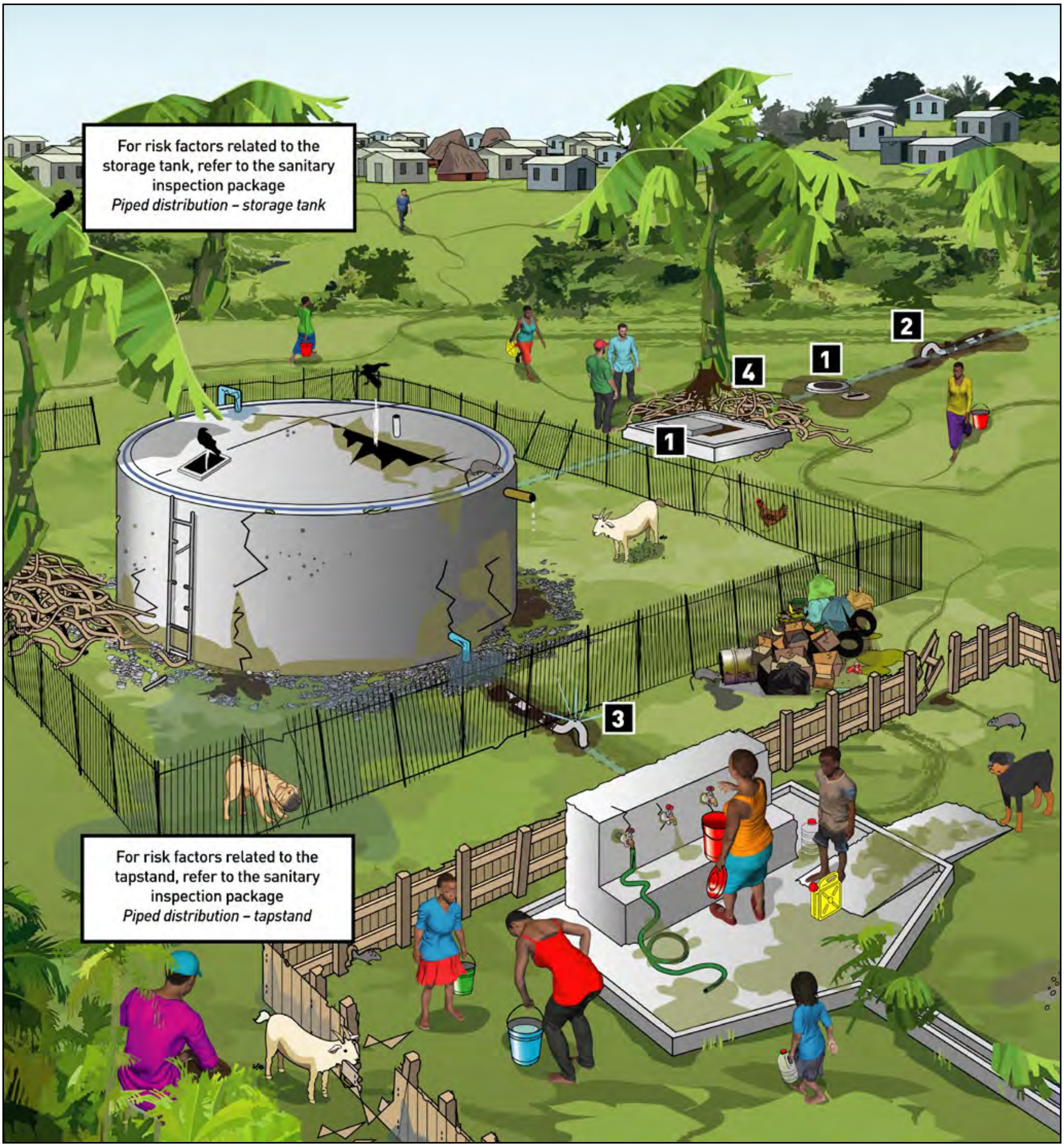


Figure 1. Typical risk factors associated with a piped distribution network

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Are valve box or break-pressure tank covers absent or in poor condition?** Contaminants could enter the network, particularly after rain, if valve box or break-pressure tank covers are absent (or open or unlocked). This could also happen if the covers are damaged (e.g. broken, missing sections, severely corroded, deep cracks).	❑	❑	❑	
2	**Are there any exposed network pipes visible?** Exposed network pipes (e.g. caused by soil erosion from surface water, traffic or footfall) in public places are at risk from damage and illegal connections. This could result in contaminants entering the water supply (e.g. surface water entering the network via cracked pipes), or water loss through leakages.	❑	❑	❑	
3	**Are there any water leakages visible from the network assets (e.g. pipes, valves, fittings)?** Contaminants could enter the network from leaking pipes or valves. This can also result in water loss. *Note* – underground leakages may be indicated by water ponding on the surface along the network pipelines. Unusual vegetation growth in dry areas may also indicate leakages. In both cases, the source of the water in these areas should be further investigated.	❑	❑	❑	
4	**Is there vegetation present that could damage network assets?** Contaminants could enter the network if roots penetrate and damage network components (e.g. break-pressure tanks, pipes). This could also result in water loss from leakages.	❑	❑	❑	
5	**Are there problems with illegal connections within the network?**[e] Contaminants could enter the network via illegal connections (i.e. where users connect to the network without permission from the relevant authority). These connections may be poor quality, and are not on routine inspection or maintenance programmes. Leakages from illegal connections can also result in water loss.	❑	❑	❑	
6	**Are there problems with cross-connections within the network?**[e] Contaminants could enter the network directly via cross connections (i.e. when drinking-water pipes are connected to pipes containing contaminants, such as a sewer pipe).	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
7	**Are there problems with backflow within the network?**[e] Contaminants could enter the network directly via backflow (e.g. the flow of contaminated water from household or commercial premises into the network).	❑	❑	❑	
8	**Does the network have intermittent supply?**[e] Contaminants can enter the network during intermittent supply outages due to low pressure conditions within the network pipes (e.g. resulting in contaminated water entering the network pipes).	❑	❑	❑	
9	**Is the network excluded from routine maintenance and quality control programmes?**[e] Failure of the responsible management entity to routinely inspect, maintain and monitor the quality of water in the network may result in unsafe drinking-water being supplied.	❑	❑	❑	
10	**Does the network water lack disinfection?**[d,e] Failure to adequately disinfect water with chlorine (or provide an alternative appropriate means of disinfection, such as ultraviolet [UV] or ozone) can result in unsafe drinking-water being supplied.	❑	❑	❑	
	Total number of Yes responses				

[e] Risk factor is not illustrated in Figure 1. To answer this question, interview the operator or management entity as appropriate. Check activity log books for confirmation. Provide further information in Section C to support your answer if necessary.

C. ADDITIONAL DETAILS

Include any additional risk factors,[f] recommendations, observations or remarks from users of the network (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

f These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ______________________

Organization: ______________________

Designation/title of inspector: ______________________

Signature: ______________________ Date: __________

Name of water supply representative: ______________________

Contact number (if available): ______________________

Signature (if available): ______________________ Date: __________

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World Health Organization

Piped distribution – network

This technical fact sheet provides background information on a piped distribution network, which supports the sanitary inspection of a drinking-water supply.

A piped distribution network delivers water (e.g. from a water treatment plant) to designated points of delivery (e.g. tapstand, household connection). A typical piped distribution network includes distribution pipes, break-pressure tanks and associated valves.

The scale of piped distribution networks varies widely, ranging from networks supplying a single communal collection point (e.g. a tapstand), to more complex networks supplying large numbers of communal collection points, and household and commercial connections.

Water supplied from piped distribution networks should be appropriately treated/disinfected, and distributed in a sanitary way (i.e. in clean pipes that are maintained in good condition). If chlorine disinfection is practised, the network water should have an adequate disinfection residual to help protect the water from harmful microorganisms during distribution.[a]

Figure 1 shows a typical small-scale piped distribution network. This figure shows a typical design. Other designs can also provide safe drinking-water.

Figure 1. A common piped distribution network in a sanitary condition

Note – For guidance on the storage tank and tapstand components, see the corresponding sanitary inspection packages.

[a] For guidance on adequate chlorine disinfection, refer to the *Management advice sheet.*

Typical risk factors associated with piped distribution networks are presented in the corresponding *Sanitary inspection form.*

Piped distribution networks typically include the following main components.

- **Network water source:** Typically extracted from groundwater or surface water sources in small drinking-water supplies. The network water source should be treated/disinfected (e.g. at a water treatment plant) to ensure it is safe for human consumption.
- **Break-pressure tank:** Allows hydraulic pressure to be reduced in the network to protect downstream assets from damage (e.g. valves, pipes). The tank should be covered and have a lid that is tightly fitting and lockable. This will help to stop contaminants entering the network and unauthorized access by people.
- **Network pipe:** Distributes water to points of delivery to users. Pipes are typically constructed of ferrocement, ductile iron (DI), high density polyethylene (HDPE) or polyvinylchloride (PVC).
- **Valve box:** Protects network valves from contamination and unauthorized operation or vandalism. The valve box should be covered and have a lid that is tightly fitting and lockable. This will help to stop contaminants entering the network and unauthorized access by people.

Additional considerations

Before new pipes are used to distribute drinking-water, cleaning, disinfection and flushing is required (e.g. with chlorine). Ideally, water quality testing should then be conducted before the pipes are commissioned to confirm the water is safe for consumption. Periodic disinfection of the pipes and testing may also be required (e.g. after maintenance).

When constructing new sections of the network or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme, including for lead-free or low-lead materials).

Piped distribution networks should be designed to avoid "dead legs" (i.e. sections of the network where water does not flow through) and areas of low flow, as both of these can affect water quality (e.g. via contamination from harmful microorganisms as a result of chlorine decay, formation of disinfection by-products, taste and odour issues). If there is a risk from dead legs or low flow sections of the network, consult with a local engineer to determine appropriate corrective actions.

For larger networks, "booster" (or secondary) chlorination stations may be required within the network to ensure the free chlorine residual concentration is adequate throughout the entire network.[a] Network pH control may also be required to ensure effective residual disinfection, and to manage corrosion issues.

Connections to user premises, in particular commercial premises, should be fitted with an appropriate backflow prevention device, to minimize the risk of contaminated water entering the piped network (e.g. during low-pressure events such as a mains break or supply outage). This should be supported by an ongoing inspection and maintenance programme (see the *Management advice sheet*).

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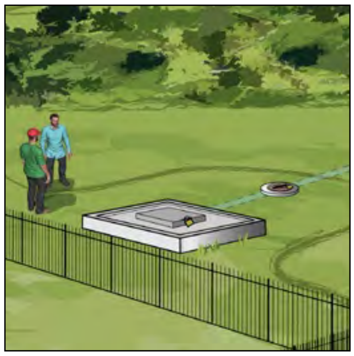
World Health Organization

Piped distribution – network

This management advice sheet provides guidance for the safe management of a piped distribution network, which supports the sanitary inspection of a piped distribution system.



Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the network in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained network operator (e.g. checking the free chlorine residual concentration, cleaning/flushing network pipes). Larger repairs and maintenance tasks (e.g. valve maintenance, back-flow prevention device inspection) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the network components should be inspected routinely to help prevent contaminants entering the network. Any damage or faults should be repaired immediately (e.g. leaking pipes, seized valves, exposed pipework from soil erosion). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. leak detection, management of low-pressure events in the network). These should be followed by trained individuals so the work is carried out safely and the water supply is not contaminated during the work.

Particular attention should be given to sanitary pipe maintenance practices (e.g. pipe repair, replacement, reinstatement of supply). SOPs should include the use of dedicated drinking-water tools only (e.g. tools colour-coded blue to avoid cross contamination with sewer network tools), trench dewatering, and pipe flushing and final water quality checks before the water supply is reinstated. Minimally, water quality checks should include a visual observation that the water from the affected section of the network is clear (e.g. the water appears clear in a white bucket). Ideally, this should also include a turbidity and free chlorine residual measurement to confirm these parameters are within acceptable limits before supply is reinstated (e.g. a free chlorine residual concentration of at least 0.2 mg/L).[a]

Drinking-water pipes should be stored in a sanitary way before they are used (e.g. stored off the ground with the ends of the pipe capped to prevent contamination during storage).

[a] Where chlorine disinfection is practised, the free chlorine residual concentration should be at least 0.2 mg/L at the point of use. This means that the free chlorine residual concentration in the network should ideally be between 0.2 and 0.5 mg/L - this can allow for chlorine decay during distribution, and subsequent storage and handling at the household level. Note that chlorine effectiveness is impacted by several factors including turbidity, pH and temperature. Chlorine doses or contact times will need to be adjusted to ensure adequate chlorine residual concentrations based on the local context. The free chlorine residual concentration in the water should also consider user acceptability. For more information, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

During outbreaks of waterborne disease, or when faecal contamination of a drinking-water supply is detected, the free residual chlorine concentration should be increased to at least 0.5 mg/L throughout the network as a minimum immediate response pending further investigation. *Note* – the concentration of chlorine should always be less than 5 mg/L in drinking-water prior to consumption.

Adequate treatment/disinfection are required before consuming the drinking-water. Where chlorine disinfection is practised, operators should make sure there is an adequate free chlorine residual concentration throughout the network by monitoring at regular intervals (see Table 1) and the results recorded (e.g. in a log book).[a] Monitoring locations should ensure geographic spread throughout the network, and include vulnerable populations (e.g. schools, healthcare facilities) and locations where there are known water quality issues (i.e. "hot spots").[b] As needed, upstream disinfection (e.g. at a water treatment plant) should be optimized and/or batch chlorine disinfection of storage tank water should be carried out. Chemicals (e.g. chlorine) or testing reagents should be used before their expiry date and stored appropriately according to manufacturer's instructions.

A routine programme of pipe cleaning (e.g. flushing, air scouring or pigging) should be undertaken to maintain the network pipes in a sanitary condition. This can remove "slimes" (i.e. microbial biofilms) and accumulated sediment from the pipes. In particular, dead leg or low flow sections of the network should be proactively maintained to minimize water quality issues. Abnormal flow events in the network (e.g. high-flow events or changes in the direction of flow) should be avoided where possible, as this may release slimes or resuspend sediment in the pipe. To avoid valves seizing, or valve leakages, a routine programme of valve inspection and maintenance should be undertaken.

Where possible, piped distribution networks should always be pressurized and operate with continuous supply (i.e. water supplied 24 hours per day, 7 days a week). This can help to avoid negative pressure in the network and issues associated with intermittent water supply (e.g. entry of contamination during periods of no service or low pressure, challenges maintaining an adequate free chlorine residual concentration, higher maintenance costs).

Pipe freezing and thawing can lead to pipe breaks, with subsequent leakages or water outages. This can be prevented by burying pipes at a depth that is below the likely ground frost-level, and maintaining a constant flow through the network pipes during very cold conditions. During periods of drought, vigilance is required (including leak detection programmes) to ensure that soil movement does not break network pipes. Water suppliers should also consider programmes to improve water efficiency (e.g. reducing the amount of wash-water produced at a water treatment plant that goes to waste, leak reduction in the network) as well as measures to reduce demand (e.g. user education on water conservation).

Where lead-containing materials are present in a network and/or elevated concentrations of lead are detected in drinking-water, appropriate corrective actions should be considered. This may include the use of corrosion inhibitors, network flushing, advisories on point of use treatment, and the progressive replacement of lead containing components.[c]

If not already in place, the responsible management entity should work towards the development of a water safety plan (or equivalent risk management approach). This should cover the entire water supply (i.e. source/catchment, water treatment plant (if present), distribution and storage, and user practices). This will help ensure the safe management of the water supply. The water safety plan should reflect the complexity of the water supply and the local resources and capacity (e.g. a more basic water safety plan is appropriate for simple piped supplies where resources and capacity are limited).[d]

[b] For basic guidance on optimizing and monitoring chlorine disinfection in piped distribution networks, refer to Principles and practices of drinking-water chlorination: a guide to strengthening chlorination practices in small-to medium sized water supplies (WHO SEARO, 2017).

[c] For information on managing lead in drinking-water, refer to Lead in drinking-water: health risks, monitoring and corrective actions (WHO, 2022).

[d] For information on water safety planning, refer to Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities (WHO, 2012).

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Where chlorination of the water supply is practised, check that the free chlorine residual concentration throughout the network is adequate.[a] Optimize the upstream chlorine concentration as needed (e.g. by increasing the chlorine dose at the water treatment plant, batch dosing a storage tank). Once the chlorine concentration has been optimized, flush the affected sections of the network as needed until an adequate disinfection residual is obtained.[e]
Ongoing routine programmes	• Conduct network pipe cleaning (e.g. flushing or scouring of network pipes). • Inspect and maintain critical network components (e.g. break-pressure tanks, valve boxes, valves) to ensure they are in good working order. • Conduct leak detection and pipe repair/replacement in the network. • Inspect the network to assess and manage vulnerabilities from: ○ backflow ○ ageing pipework ○ cross connections ○ illegal connections ○ vegetation growth.
As the need arises[f]	• Perform maintenance tasks (e.g. pipe maintenance). • Monitor water distribution to identify changes (e.g. during periods of drought). • Replace any eroded earth around exposed pipework. • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[e] In water scarce areas, consult with local health authorities before flushing to make sure that the risk to water quality justifies the loss of water. Alternative water supply arrangements may then be needed to ensure that users have sufficient water quantity to meet domestic needs.

[f] See Table 2 for potential problems that could trigger these activities.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form*. Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a piped distribution network, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	Valve box or break-pressure tank covers are missing (or open, unlocked), or in poor condition (e.g. deep cracks, severely corroded, does not fit tightly when closed), which could allow contaminants to enter the network (e.g. via surface water, entry of animals).	• If the cover is missing, or it is in poor condition, provide a temporary cover to minimize entry of contaminants. Repair or replace the cover as soon as possible. • If the cover is open or unlocked, communicate the importance of closing and locking the cover securely when it is not in use.
2	There are exposed pipes within the distribution network, which could allow contaminants to enter the network.	• Where pipes are exposed unintentionally (e.g. ground cover has been washed away), cover the pipes (e.g. with earth). Investigate the cause of the pipe exposure and take appropriate action to prevent the issue from happening again (e.g. divert upstream surface water flow to a drainage gully). • If exposed pipes are damaged, repair or replace the affected sections immediately. *Note* – Pipes that are intentionally aboveground should ideally be buried for their protection where possible, or minimally, fenced-off to the public.
3	There are water leakages from network assets, which could allow contaminants to enter the network, or result in water loss.	• Repair or replace the leaking network component in accordance with SOPs. • Implement a proactive leak detection programme.
4	There is vegetation present that could damage network assets (e.g. fallen branches, damage from roots), which could allow contaminants to enter the network, or result in water loss.	• Remove any vegetation that may damage network assets. • Implement a proactive vegetation management programme to prevent damage to network assets from vegetation.
5	There are illegal connections present in the network, which could allow contaminants to enter the network, or result in water loss.	• Implement a programme to detect illegal connections to identify and eliminate unauthorized connections in the network. • Raise awareness in the community on the potential health risks associated with illegal connections. • Where possible, ensure that alternative authorized connections are provided, especially for vulnerable and disadvantaged groups (e.g. provision of tapstands in informal settlements).
6	There are cross-connections present in the network, which could allow contaminants to enter the network.	• Liaise with the relevant local authority (e.g. those with responsibility for sanitation services) to implement a cross-connection detection programme to identify and eliminate cross-connections. • Raise awareness with the relevant local stakeholders (e.g. plumbing association) on the potential health risks associated with cross connections. Provide education programmes on how the issue can be avoided.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
7	There are backflow issues present in the network, which could allow contaminants to enter the network.	• Establish a backflow detection programme to identify high-risk connections to premises within the network, and fit the appropriate backflow prevention devices. • Ensure an ongoing inspection and maintenance programme is established for backflow prevention devices at high-risk premises. • Raise awareness with the relevant local stakeholders (e.g. plumbing association) on the potential health risks associated with backflow. Provide education programmes on how the issue can be avoided.
8	There is intermittent water supply, which can allow contaminants to enter the network.	• Routinely monitor and optimize the free chlorine residual throughout the network to the fullest extent possible. • Conduct regular mains cleaning to minimize contamination from microbial biofilms and sediments (which can be resuspended when intermittent service returns). • Conduct education programmes for users on point of use treatment and safe household storage practices.[g]
9	The network is excluded from routine maintenance and quality control programmes.	• Develop and implement an appropriate routine maintenance and quality control programme, liaising with relevant authorities if appropriate. • Where needed, ensure adequate provision is made for water quality testing equipment and consumables, alongside appropriate SOPs and training for operators.
10	The water in the network is not adequately disinfected.[a]	• Develop the necessary SOPs and provide operator training on adequate disinfection practices (including on the use of free chlorine residual test kits where chlorination is practised, and turbidity and pH where possible). • Ensure adequate provision is made to procure chlorine (or an appropriate alternative means of disinfection), along with water quality testing equipment and consumables for monitoring. • Ensure disinfection is practised correctly and consistently, and is optimized through routine monitoring and water quality testing.

[g] In addition to these corrective actions, parallel work should also be undertaken at a higher-level with stakeholders (e.g. local government representatives responsible for water supply, sanitation and health) to achieve the necessary improvements in infrastructure and management practices, towards the ultimate provision of a continuous water supply.

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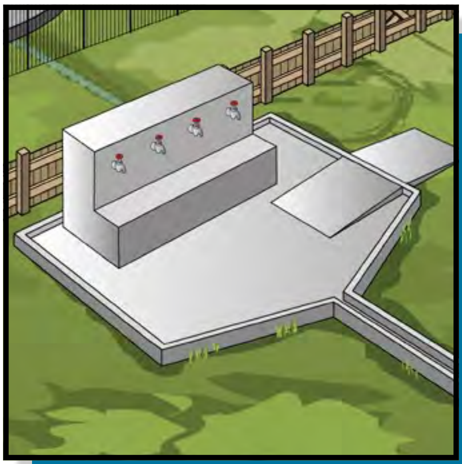

10

Sanitary inspection package

Piped distribution - tapstand

Piped distribution – tapstand

A. GENERAL INFORMATION

A.1. Tapstand information

Tapstand location (e.g. village, town, community, parish, district, province, state)				
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)				
Name of entity responsible for the management of the tapstand (e.g. name of water utility, private operator, community group)				
Tap material Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Brass ❑ Other. Describe:	❑ Stainless steel		
Circle the options below				If **Yes**, describe (e.g. what happens, how often, for how long)
Is the tapstand affected by flooding?	Unsure	No	Yes	
Is the tapstand affected by drought?	Unsure	No	Yes	

A.2. Tapstand functionality

Circle **Yes** or **No** to indicate if water is currently available from the tapstand. If **No**, describe why (e.g. broken tap, water supply outage) and then go to Section B. In Section C, record the corrective actions needed for the tapstand to provide water (if known), and record the details of any alternative water source(s) currently being used.

Is water currently available from the tapstand?		If **No**, describe why (then go to Section B)
Yes	No	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**	**Sample identification code**	**Other information**
No (go to A.5)	Yes			

Parameter tested	*E. coli*[a]		*or* Thermotolerant (faecal) coliforms[a]		Additional parameter		Additional parameter		Additional parameter	
Results and units	Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

Location	Is the water treated?			If **Yes,** describe (e.g. type of treatment, chlorine dose, frequency of dosing, if known)[b]
Before the tapstand (e.g. at a water treatment plant)	❑ Unsure	❑ No	❑ Yes	
At the tapstand	❑ Unsure	❑ No	❑ Yes	
Downstream of the tapstand (e.g. household water treatment)	❑ Unsure	❑ No	❑ Yes	

[a] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as increased disinfection upstream of the tapstand (e.g. at a water treatment plant, storage tank), additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[b] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For guidance on adequate chlorine disinfection, see the *Management advice sheet.*

General notes

- This form is intended for use on a single public tapstand (also known as a stand post). Where there are multiple tapstands to be inspected, additional forms will be needed. Tapstands may be inspected on a rotational basis where there are too many to cover during each inspection.
- This form can be adapted for private taps as required (e.g. yard tap or household tap within the boundary of a user's premises).
- Where the water from the tapstand comes from a piped distribution network or storage tank, and where users collect and store water in the home, carry out an inspection using the corresponding sanitary inspection package.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the tapstand. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the tapstand being inspected.
3. Tick the **No** box if the question does apply to the tapstand being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

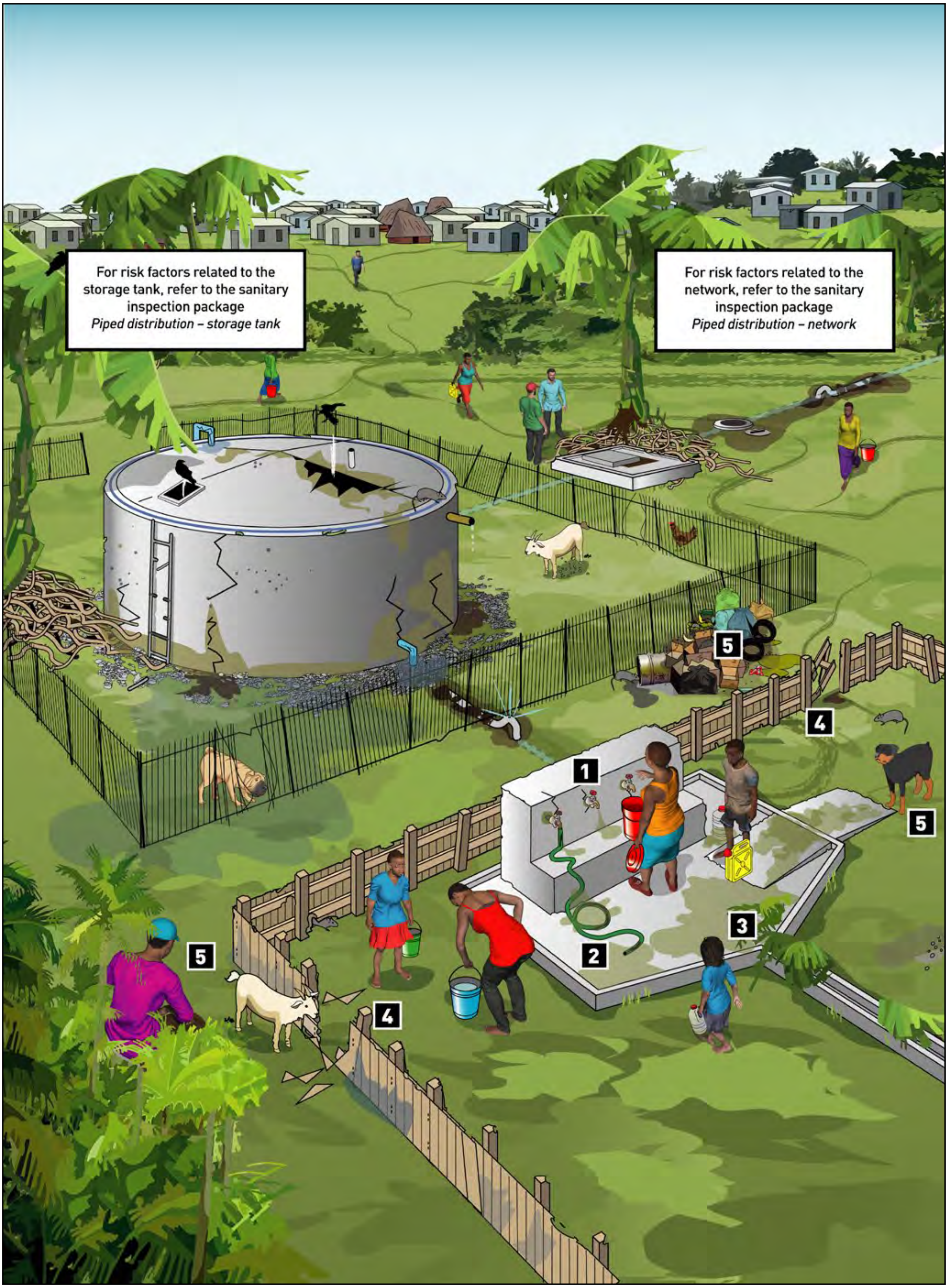

Figure 1. Typical risk factors associated with a drinking-water tapstand

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Is the tap dirty or in poor condition?** Contaminants could enter the water if the tap is dirty. This could also happen if the tap is damaged (e.g. broken, severely corroded) or leaking. A leaking tap could result in stagnant water contaminating the area, and water loss.	❑	❑	❑	
2	**If there is a tap attachment, is it dirty?** Contaminants could enter the water if there is a dirty tap attachment (e.g. a hose). This could also happen if the tap attachment is stored in a way that it may become dirty when it is not in use (e.g. stored on the ground in a wet area).	❑	❑	❑	
3	**Is drainage inadequate, which could allow water to accumulate in the tapstand area?** Stagnant water could contaminate the collection area if there is no drainage system in place. This could also happen if the drainage system is damaged or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water may indicate poor drainage.	❑	❑	❑	
4	**Is the fence or barrier around the tapstand missing or inadequate?** Animals or unauthorized people could contaminate or damage the tapstand area if the fence or barrier around the tapstand is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	
5	**Can sources of pollution be seen in the tapstand area (e.g. open defecation, animals, rubbish, commercial activity, open drains)?** The presence of animals or faeces on the ground close to the water collection area poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could also be washed into the area during rain and contaminate the water during collection.	❑	❑	❑	
6	**Is the tapstand excluded from routine maintenance and quality control programmes?**[C] Failure of the responsible management entity to routinely inspect, maintain and monitor the quality of water at the tapstand may result in unsafe drinking-water being supplied.	❑	❑	❑	

Sanitary inspection questions		NA	No	Yes	If Yes, what corrective action is needed?
7	**Does the tapstand water lack disinfection?**[b,c] Failure to adequately disinfect water with chlorine (or provide an alternative appropriate means of disinfection, such as ultraviolet [UV] or ozone) can result in unsafe drinking-water being supplied.	❑	❑	❑	
	Total number of Yes responses				

c Risk factor is not illustrated in Figure 1. To answer this question, interview the operator or management entity as appropriate. Check activity log books for confirmation. Provide further information in Section C to support your answer if necessary.

C. ADDITIONAL DETAILS

Include any additional risk factors,[d] recommendations, observations or remarks from users of the water source (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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d These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: _______________

Organization: _______________

Designation/title of inspector: _______________

Signature: _______________ Date: _______________

Name of water supply representative: _______________

Contact number (if available): _______________

Signature (if available): _______________ Date: _______________

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Piped distribution – tapstand

This technical fact sheet provides background information on a tapstand, which supports the sanitary inspection of a drinking-water supply.

A tapstand (also referred to as a standpost)[a] provides a point of delivery to users from which drinking-water is collected and transported (e.g. collected in a jerrycan and transported to a home).

Water supplied from tapstands should be appropriately treated/disinfected. If chlorine disinfection is practised, the tapstand water should have an adequate disinfection residual to help protect the water from harmful microorganisms during user transport, storage and handling.[b]

Figure 1 shows a typical drinking-water tapstand supplied by a piped distribution network. This figure shows a typical design. Other designs can also provide safe drinking-water.

The water collection area should be built so it is accessible for all users.[c]

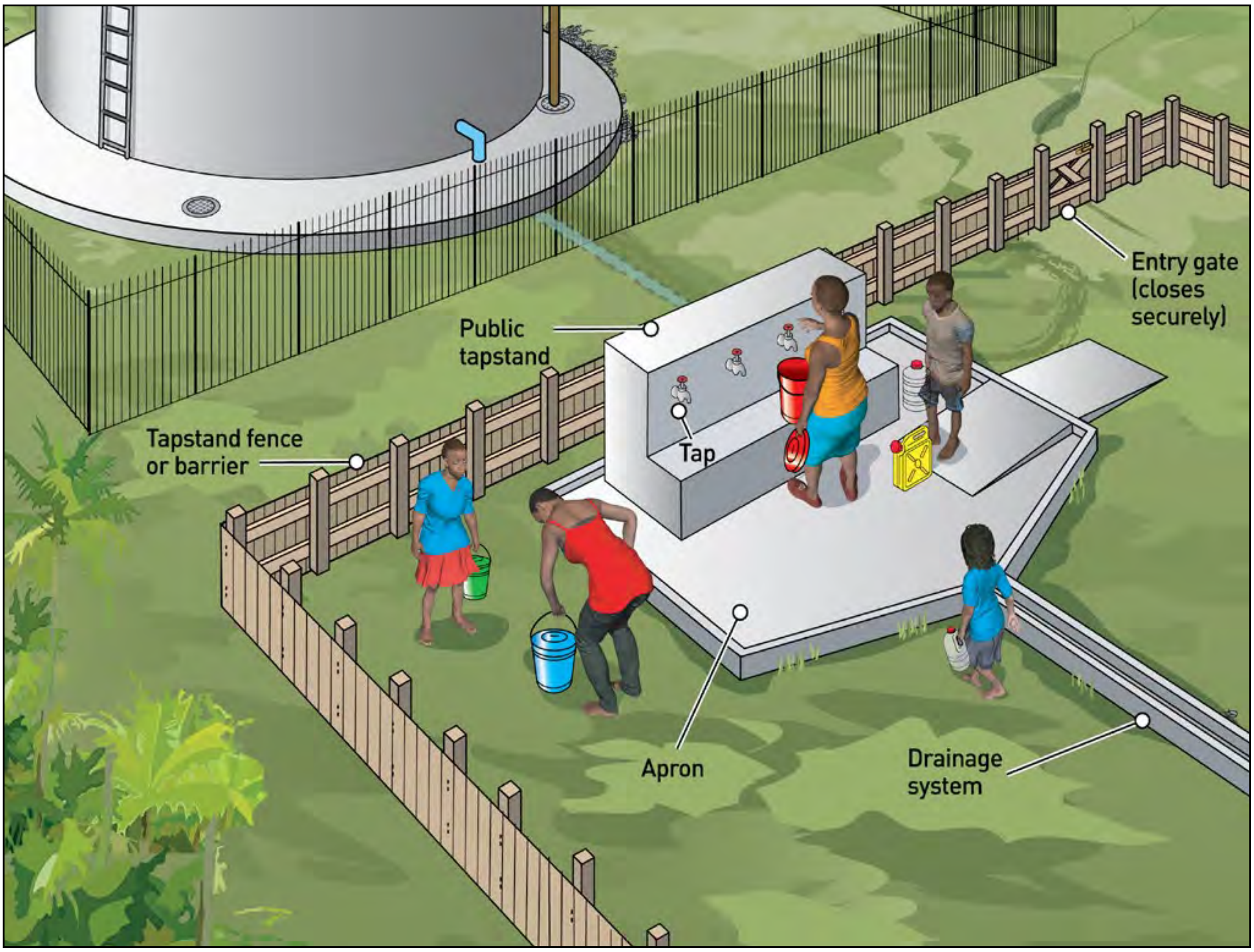

Figure 1. A common drinking-water tapstand in a sanitary condition

Note – For guidance on the storage tank and piped network components, see the corresponding sanitary inspection packages.

[a] This guidance may be adapted for private taps as required (e.g. yard tap or household tap within the boundary of a user's premises).

[b] For guidance on adequate chlorine disinfection, refer to the *Management advice sheet.*

[c] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones & Reed, 2005).

Typical risk factors associated with tapstands are presented in the corresponding *Sanitary inspection form.*

Tapstands typically include the following main components.

- **Tap:** Allows users to collect water from the tapstand in a sanitary way, minimizing water wastage or spillage. The tap also allows easy collection of water quality samples for analysis. The tap should be raised off the ground to minimize the risk of contamination during water collection.
- **Apron:** A reinforced stone, brick or concrete floor built around the tapstand to drain water away from the collection area. The apron should slope down from the collection area to a drainage system. The apron also provides a standing area for users when collecting water.
- **Drainage system:** Directs water away from the collection area to a drainage area or soakaway. The drainage system should slope down from the apron. This helps to prevent water ponding and stagnating, which could contaminate the collection area.
- **Fence or barrier:** A physical barrier to prevent animals from contaminating the tapstand area or damaging the components. It may also prevent unauthorized access by people. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked.

Additional considerations

When constructing new tapstands or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme, including for lead-free or low-lead materials).

Tapstands should be fitted with appropriate backflow prevention devices to minimize the risk of contaminated water entering the piped network (e.g. during low pressure events such as pipe breaks or supply outages).

The tapstand should be designed in a way that avoids the need to use tap attachments (e.g. hoses) when filling collection vessels. If tap attachments are necessary, they should have a dedicated sanitary storage area for when they are not in use (e.g. a clean, dry storage area raised off the ground, with a securely fitting hose cap).

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Piped distribution – tapstand

This management advice sheet provides guidance for the safe management of a tapstand, which supports the sanitary inspection of a drinking-water supply.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the tapstand in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained user, caretaker or operator (e.g. simple maintenance tasks such as cleaning the water collection area). Larger repairs and maintenance tasks may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the tapstand and components should be inspected routinely to help prevent contaminants entering the water supply. Any damage or faults should be repaired immediately (e.g. leaking tap, blocked drainage system, broken fence). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. replacing a tap). These should be followed by trained individuals so the work is carried out safely and the water supply is not contaminated during the work.

Particular attention should be given to maintaining the tap in a clean and good working condition. Where possible, the use of tap attachments (e.g. hoses) should be avoided. Where tap attachments must be used, these should be stored in a sanitary way (e.g. in a clean, dry area, off the ground, capped ends) and cleaned and disinfected regularly.

Adequate treatment/disinfection are required before consuming the drinking-water if the water source is vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home. Where chlorine disinfection is practised, trained operators should have access to a chlorine testing kit. Operators should ensure an adequate free chlorine residual concentration[a] at the tapstand by monitoring at regular intervals following SOPs (see Table 1) and the results recorded (e.g. in a log book).[b] Chemicals (e.g. chlorine) or testing reagents should be used before their expiry date and stored appropriately according to manufacturer's instructions.

If not already in place, the responsible management entity should work towards the development of a water safety plan (or equivalent risk management approach). This should cover the entire water supply (i.e. source/catchment, water treatment plant (if present), distribution and storage, and user practices). This will help ensure the safe management of the water supply. The water safety plan should reflect the complexity of the water supply and the local resources and capacity (e.g. a more basic water safety plan is appropriate for simple piped supplies where resources and capacity are limited).[c]

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the tapstand facility, including the taps. Remove any polluting materials (e.g. faeces, rubbish). • Check that the taps are working. Repair or replace damaged parts as needed, then clean and disinfect the tap (e.g. with chlorine). • If there is a tap attachment (e.g. a hose), check and clean it. Ensure it is stored in a sanitary way (e.g. fully drained, off the ground). • Check that the drainage system is clear and functioning. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed. • Where chlorination of the water supply is practised, check the free chlorine residual concentration at the tapstand. Optimize the chlorine concentration upstream as needed (e.g. by increasing the chlorine dose at a water treatment plant, batch dosing the storage tank).[a] Once the chlorine concentration has been optimized, flush the affected sections of the network as needed until an adequate disinfection residual is obtained.[d]
Monthly to every three months	• Inspect the tapstand structure in detail for damage or failure. Repair as needed.
Ongoing routine programmes	• Maintain tapstand components (e.g. routine replacement of tap O-rings, washers, valves to avoid tap seizing or leakages, or backflow).
As the need arises[e]	• Perform maintenance tasks (e.g. tap maintenance). • Monitor water use to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] Where chlorine disinfection is practised, the free chlorine residual concentration should be at least 0.2 mg/L at the point of use. This means that the free chlorine residual concentration at the tapstand should be higher (e.g. at least 0.5 mg/L at pH less than 8 after at least 30 minutes contact time) - this can allow for chlorine decay during user transportation, storage and handling. Note that chlorine effectiveness is impacted by several factors including turbidity, pH and temperature. Chlorine doses or contact times will need to be adjusted to ensure adequate chlorine residual concentrations based on the local context. The free chlorine residual concentration in the water should also consider user acceptability. For more information, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

During outbreaks of waterborne disease, or when faecal contamination of a drinking-water supply is detected, the residual free chlorine concentration should be increased to at least 0.5 mg/L throughout the network as a minimum immediate response pending further investigation. *Note* – the concentration of chlorine should always be less than 5 mg/L in drinking-water prior to consumption.

[b] For basic guidance on optimizing and monitoring chlorine disinfection in piped networks, refer to Principles and practices of drinking-water chlorination: a guide to strengthening chlorination practices in small-to medium sized water supplies (WHO SEARO, 2017).

[c] For information on water safety planning, refer to Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities (WHO, 2012).

[d] In water scarce areas, consult with local health authorities before flushing to make sure that the risk to water quality justifies the loss of water. Alternative water supply arrangements may then be needed to ensure that users have sufficient water quantity to meet domestic needs.

[e] See Table 2 for potential problems that could trigger these activities.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form*. Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a tapstand, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The tap is dirty or in poor condition (e.g. damaged, severely corroded, leaking), which could allow contaminants to enter the water during collection, or result in water loss.	• If the tap is dirty, clean and disinfect the tap (e.g. with chlorine). • If the tap is in poor condition, repair or replace the tap, then clean and disinfect it. • Communicate the importance of routine tap cleaning/ maintenance.
2	There is a tap attachment (e.g. a hose) that is dirty, or stored in an unsanitary way, which could allow contaminants to enter the water.	• If dirty, clean and disinfect (e.g. with chlorine) the tap attachment. • If there is no dedicated sanitary storage place for the tap attachment, install a storage space (e.g. a hook raised off the ground, with a cap for the end of the hose). • Communicate the importance of routine cleaning/maintenance, and returning the tap attachment to the dedicated storage location after each use. Consider installing information signs at the tapstand to remind users of the risk. • Investigate modifications to the tapstand so that tap attachments are not required.
3	The drainage is inadequate (e.g. absent, damaged or blocked drainage channel or soakaway), which could result in stagnant water contaminating the tapstand area.	• If a drainage system is absent, dig a temporary channel to divert water away from the water collection area. Construct a permanent solution as soon as possible. • If a drainage system is not working correctly, consider whether maintenance is needed (e.g. repair, cleaning), or if deepening, widening or extending is required.
4	The fence or barrier around the tapstand is missing or inadequate, which could allow animals or unauthorized people to contaminate or damage the tapstand area.	• If absent, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the tapstand area is damaged and/or does not close securely, repair or replace it.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
5	There are sources of pollution (e.g. open defecation, animals, rubbish, commercial activity, open drains) around the tapstand that could contaminate the water collection area.	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the tapstand area in a clean condition. • Consult with local authorities and users to consider: ◦ appropriate actions to relocate or eliminate the source of pollution ◦ other actions to minimize the issue from occurring again (e.g. awareness raising, signage, enforcement measures).
6	The tapstand is excluded from routine maintenance and quality control programmes.	• Develop and implement an appropriate routine maintenance and quality control programme, liaising with relevant authorities if appropriate. • Where needed, ensure adequate provision is made for water quality testing equipment and consumables, alongside appropriate SOPs and training for operators.
7	The water at the tapstand is not adequately disinfected.[a]	• Develop the necessary SOPs and provide operator training on adequate disinfection practices (including on the use of free chlorine residual test kits where chlorination is practised, and turbidity and pH where possible). • Ensure adequate provision is made to procure chlorine (or an appropriate alternative means of disinfection), along with water quality testing equipment and consumables for monitoring. • Ensure disinfection is practised correctly and consistently, and is optimized through routine monitoring and water quality testing.

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11

Sanitary inspection package

Filling station and water cart

Filling station and water cart

A. GENERAL INFORMATION

A.1. Filling station information

Filling station location (e.g. village, town, community, parish, district, province, state)

Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)	
Name of entity responsible for the management of the filling station (e.g. name of water utility, community group, private operator)	
Water source for the filling station[a] Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Piped distribution network ❑ Other. Describe (e.g. direct from borehole, river etc.):
Average volume of water distributed from the filling station per week (including units)	

A.2. Water cart information

Ownership details (e.g. name of driver, name of entity that owns or operates the water cart)			
Vehicle registration number Put **NA** if not applicable		**Vessel capacity** (including units)	

A.3. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.4. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**	**Sample identification code**	**Other information**
No (go to A.5)	Yes			

Parameter tested	*E. coli*[b] *or* Thermotolerant (faecal) coliforms[b]				Additional parameter		Additional parameter		Additional parameter	
Results and units	Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.5. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

Location	Is the water treated?			If **Yes**, describe (e.g. type of treatment, chlorine dose, frequency of dosing, if known)[c]
Before the filling station (e.g. at a water treatment plant)	❑ Unsure	❑ No	❑ Yes	
At the filling station (e.g. on-site treatment before filling the water cart)	❑ Unsure	❑ No	❑ Yes	
In the water cart vessel (e.g. batch chlorination)	❑ Unsure	❑ No	❑ Yes	
Downstream of the water cart (e.g. household water treatment)	❑ Unsure	❑ No	❑ Yes	

[a] Carry out individual sanitary inspections for any sources of water that supply the filling station (e.g. borehole, surface water, piped distribution network), and for household practices, using the corresponding sanitary inspection packages.

[b] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as increased disinfection before or at the filling station or water cart, additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[c] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.4. Where possible, turbidity and pH should also be measured. For guidance on adequate chlorine disinfection, see the *Management advice sheet.*

General note

- This form is intended for use on a single filling station and water cart (also referred to as a water truck or water tanker). Where there are multiple filling stations and water carts, additional forms will be needed. Filling stations and water carts may be inspected on a rotational basis where there are too many to cover during each inspection.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the filling station and water cart. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the filling station and water cart being inspected.
3. Tick the **No** box if the question does apply to the filling station and water cart being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

Figure 1. Typical risk factors associated with a filling station and water cart vessel

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
Filling station					
1	**Is the filling station hose dirty?** Contaminants could enter the water cart vessel if the filling hose (or pipe) is dirty. This could also happen if the hose is stored in a place where it could get dirty when it is not in use (e.g. in a wet area, on the ground).	❑	❑	❑	
2	**Is drainage inadequate, which could allow water to accumulate in the filling area?** Stagnant water could contaminate the filling area if there is no drainage system in place. This could also happen if the drainage system is damaged or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water during the inspection may indicate poor drainage.	❑	❑	❑	
3	**Is the fence or barrier around the filling station missing or inadequate?** Animals or unauthorized people could contaminate or damage the filling station area if the fence or barrier around the filling station is missing. This could also happen if the fence or barrier is broken or poorly built (e.g. has large gaps), or the entry point (e.g. gate) does not close securely.	❑	❑	❑	
4	**Can sources of pollution be seen in the filling station area (e.g. open defecation, animals, rubbish, commercial activity, open drains, fuel storage/disposal)?** The presence of animals or faeces on the ground close to the filling area poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could be washed into the area during rain and contaminate the water during filling.	❑	❑	❑	
Water cart					
5	**Has the water cart vessel been used to store liquids other than drinking-water?** Contaminants could enter the water if liquids other than drinking-water have been stored in the vessel. This could include if the vessel has stored water of lesser quality, or human/animal waste, chemicals or fuels.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
6	**Are there any signs of contaminants inside the vessel?** The presence of animals or faeces inside the vessel is a serious risk to the safety of the drinking-water, and indicates that harmful microorganisms are present. Sediments may also contain harmful microorganisms and other contaminants (such as metals) that can affect the safety or acceptability of the water.	❑	❑	❑	
7	**Is the vessel inspection hatch or filling hatch lid missing or in poor condition?** Contaminants could enter the vessel (e.g. from contaminated water following rain, entry of animals) if the inspection hatch or filling hatch lid is missing (or open, unlocked). This could also happen if the lid is damaged (e.g. deep cracks, severely corroded, does not fit tightly when closed).	❑	❑	❑	
8	**Is the vessel cracked or leaking?** Contaminants could enter the vessel if it is damaged (e.g. with deep cracks, severely corroded). A leaking vessel could also result in stagnant water contaminating the area, as well as water loss.	❑	❑	❑	
9	**Is the vessel discharge hose dirty?** Contaminants could enter the water if the discharge hose is dirty. This could also happen if the hose is stored in a place where it could get dirty when it is not in use (e.g. stored in a wet area, on the ground, or with no end caps in place during storage).	❑	❑	❑	
10	**Are the air vents poorly designed so that contaminants could enter the vessel?** Contaminants could enter the vessel (e.g. road dust, insects, rodents) if the air vents are facing upwards, or are not covered with a vermin- and dust-proof screen.	❑	❑	❑	
11	**Is the vessel discharge tap dirty or in poor condition?** Contaminants could enter the water during delivery to the user if the vessel discharge tap is dirty. This could also happen if the tap is damaged (e.g. broken, severely corroded) or leaking. A leaking tap could also result in water loss.	❑	❑	❑	
12	**Does the vessel water lack adequate disinfection?**[c,d] Failure to adequately disinfect water with chlorine (or provide an alternative means of disinfection) can result in unsafe drinking-water being supplied.	❑	❑	❑	

Sanitary inspection questions		NA	No	Yes	If Yes, what corrective action is needed?
General					
13	**Is the filling station or water cart excluded from routine maintenance and quality control programmes?**[d] Failure of the responsible management entity to routinely inspect, maintain and monitor the quality of water at the filling station or water cart may impact the quality of the drinking-water supplied.	❑	❑	❑	
	Total number of Yes responses				

d Risk factor is not illustrated in Figure 1. The response to this question may be determined based on interview with the caretaker, operator or management entity as appropriate. Check activity log books for confirmation. Provide further information in Section C to support your answer where necessary.

C. ADDITIONAL DETAILS

Include any additional remarks, risk factors,[e] recommendations or observations (e.g. problems with the taste, odour or appearance of the water). Attach additional sheets and photographs as needed.

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e These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ______________________________

Organization: ______________________________

Designation/title of inspector: ______________________________

Signature: ______________________ Date: __________

Name of water supply representative: ______________________________

Contact number (if available): ______________________________

Signature (if available): ______________________ Date: __________

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Filling station and water cart

This technical fact sheet provides background information on a filling station and water cart, which supports the sanitary inspection of a drinking-water supply.

A filling station provides drinking-water in bulk quantities. This can be provided to a water cart,[a] which can then deliver the drinking-water to users (e.g. to fill a household storage tank).

A typical filling station supply chain includes a water source (e.g. mains supply from a piped distribution network), filling point and a water cart vessel (typically ranging in size from jerry cans [litres] on a cart to a larger vessel on a motor vehicle [kilolitres]).

Filling stations and water carts provide an interim approach to water supply where water services, particularly piped supplies, are inadequate to meet all needs of users. Water carting may also be used to supplement primary water sources during emergency situations (e.g. a contamination event in a piped network, major supply outage).

The water from the filling station should be appropriately treated/disinfected, and delivered to the water cart vessel using a clean hose.

The water carter should store, transport and deliver the water in a sanitary way (i.e. using a clean vessel dedicated to drinking-water only, which is protected from contamination, with clean discharge hoses and fittings). If chlorine disinfection is practised, there should be an adequate free chlorine residual concentration to help protect the water from harmful microorganisms during delivery and user storage and handling.[b]

Figure 1 shows a common type of filling station and water cart. This figure shows a typical design. Other designs can also provide safe drinking-water.

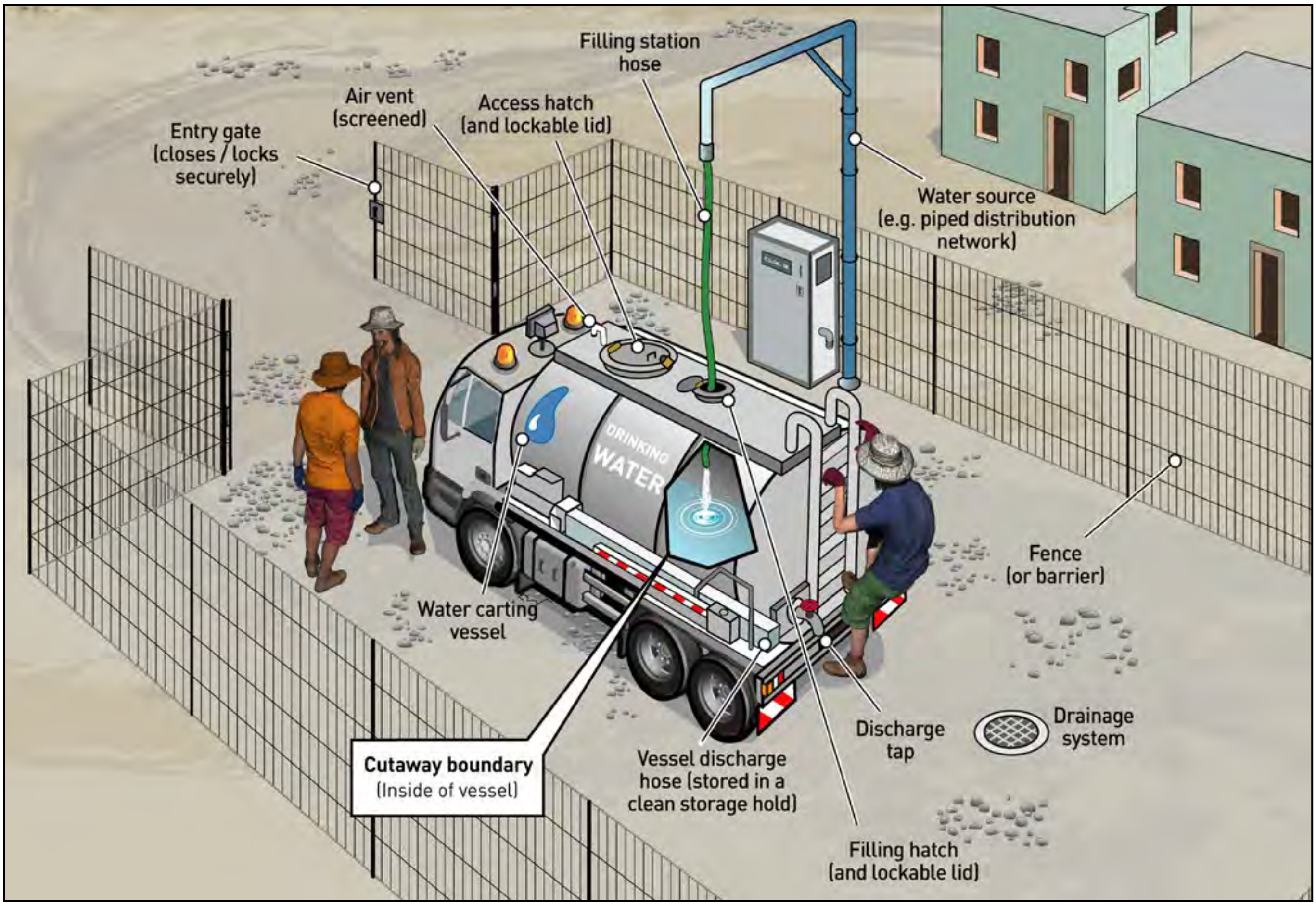

Figure 1. A common filling station and water cart vessel in a sanitary condition

[a] Also referred to as a water truck or water tanker.
[b] For guidance on adequate chlorine disinfection, refer to the *Management advice sheet.*

Typical risk factors associated with filling stations and water carts are presented in the corresponding *Sanitary inspection form.*

Filling stations and water carts typically include the following main components.

Filling station

- **Water source:** Typically provided from a piped distribution network, or from surface water or groundwater sources (e.g. river, borehole, spring). The source water should be treated/disinfected as required to ensure it is safe for human consumption.
- **Filling station hose:** Delivers drinking-water from the filling station to a water cart vessel. The filling station hose (or pipe) should be used for drinking-water only. When not in use, the filling hose should be stored in a sanitary manner (e.g. raised off the ground, capped end).
- **Drainage system:** Directs water away from the filling station area to a drainage system. The drainage system should slope down from the filling area. This prevents water ponding and stagnating, which could contaminate the filling area.
- **Fence or barrier:** A physical barrier to prevent animals or unauthorized people from accessing the filling station and contaminating or damaging the components. The fence or barrier should have an entry point (e.g. a gate) that can be closed tightly and latched shut/locked.

Water cart

- **Water cart vessel:** Stores the drinking-water from the filling station before delivery to the user. Vessels are typically made from high density polyethylene (HDPE), polyvinylchloride (PVC) or stainless steel. The vessel should be used to transport drinking-water only, and this should be clearly marked on the vessel in the local language(s).

  The vessel should have a sump (not shown in Figure 1) that allows the vessel to be emptied for cleaning and maintenance. The sump should be located at the lowest point of the vessel floor to ensure the vessel can be drained completely.
- **Vessel filling hatch:** Allows drinking-water from the filling station to be delivered to the water cart vessel. The filling hatch should have a lid that is tightly fitting and lockable to stop contaminants from entering the vessel (e.g. insects, dust), and to stop unauthorized access by people.
- **Vessel inspection hatch:** Allows access to the vessel for inspection or operations and maintenance. The inspection hatch should have a lid that is tightly fitting and lockable to stop contaminants from entering the vessel, and to stop unauthorized access by people. *Note* – in some cases, the inspection hatch may also act as a filling hatch.
- **Vessel discharge tap:** Allows water to be discharged from the vessel (via a discharge hose) in a sanitary way and with minimal spillage or wastage. The tap should be raised off the floor-level of the vessel to minimize the risk of withdrawing sediment from the bottom of the vessel during use. The tap also allows easy collection of water quality samples for analysis.
- **Vessel discharge hose:** Delivers drinking-water from the vessel tap to a point of delivery (e.g. household storage tank). The discharge hose should be used for drinking-water only. When not in use, the hose should be stored in a sanitary manner (e.g. a dedicated clean, dry storage hold, off the ground, capped ends).
- **Vessel air vent:** Allows ventilation in the vessel. The air vent should be facing downwards and have a vermin- and dust-proof screen to stop contaminants entering the vessel.

Additional considerations

Before a new vessel is used to store or transport drinking-water, cleaning and disinfection is required (e.g. with chlorine).[c] Ideally, water quality testing should then be conducted before the vessel is commissioned to confirm the water is safe for consumption. Periodic disinfection of the vessel and testing may also be required (e.g. after maintenance).

When purchasing new water carting vessels or rehabilitating old ones, any materials used (e.g. vessel material, hoses, taps, valves, fittings) should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme).

[c] For guidance on disinfecting water storage tanks, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013).

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Filling station with water cart

This management advice sheet provides guidance for the safe management of a drinking-water filling station and water cart, which supports the sanitary inspection of a water supply.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the filling station and water cart in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained caretaker or operator (e.g. simple maintenance tasks such as cleaning the filling station area, cleaning the water cart vessel). Larger repairs and maintenance tasks (e.g. repairing the water cart vessel) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

Use of multiple water sources for the filling station or water cart may be needed to help ensure an adequate quantity of drinking-water to meet user needs. Adequate treatment/disinfection are required before consuming the drinking-water if any of the water sources are vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling during transport, or by the user in the home.

The condition of the filling station components and water cart vessel should be inspected routinely to help prevent contaminants entering the water supply. Any damage or faults should be repaired immediately (e.g. damaged hoses, broken fence, leaking vessel, damaged air vent screen). Hoses, taps and related fittings (e.g. clamps, nozzles) should be clean and stored in a sanitary way to protect them from contamination (e.g. in a clean and dry dedicated storage hold, off the ground, capped ends).

Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. inspecting the water cart vessel, cleaning and disinfection of the vessel). These should be followed by trained individuals so the work is carried out safely and the vessel is not contaminated during the work.

Where chlorine disinfection is practised, water cart operators should have access to a chlorine testing kit. Operators should test the free chlorine residual concentration of the vessel water before leaving the filling station, and as required, before delivery to the user, and record the results (e.g. in a log book). As needed, batch chlorine disinfection of the vessel should be carried out to ensure that adequate chlorination is achieved (with all related activities conducted by trained operators according to SOPs).[a] Chemicals (e.g. chlorine) or testing reagents should be used before their expiry date and stored appropriately according to manufacturer's instructions.

[a] Where chlorine disinfection is practised, the free chlorine residual concentration should be at least 0.2 mg/L at the point of use. This means that the free chlorine residual concentration in the water cart vessel should be higher (e.g. at least 0.5 mg/L at pH less than 8 after at least 30 minutes contact time) - this can allow for chlorine decay during delivery, and subsequent storage and handling at the household level. Note that chlorine effectiveness is impacted by several factors including turbidity, pH and temperature. Chlorine doses or contact times will need to be adjusted to ensure adequate chlorine residual concentrations based on the local context. The free chlorine residual concentration in the water should also consider user acceptability. For more information, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

The water cart vessel should be used for drinking-water only - no other liquids, including water of lesser quality, should be stored in the vessel. The vessel should be periodically cleaned and disinfected according to SOPs.[b]

The duration of time the water is stored in the vessel and the weather conditions (e.g. very hot conditions), can affect water quality in terms of the microbiological safety or taste and odour issues. If the water is chlorinated and stored in the vessel for long periods without use (e.g. more than several days), the free chlorine residual concentration of the stored water should minimally be tested to ensure it is adequate before it is delivered to users.[a]

To ensure users can be contacted if contamination is detected, water cart operators should maintain a record of the full details of each water delivery.[c]

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Before each filling/ delivery	*Filling station* • Check the filling hose is clean. Clean and disinfect it (e.g. with chlorine) as needed. *Water cart* • Check the discharge hose and tap are clean. Clean and disinfect them (e.g. with chlorine) as needed. • Where chlorination is practised, check the free chlorine residual concentration in the vessel. Optimize the chlorine concentration either upstream (e.g. at a water treatment plant) or within the vessel as needed.[a,b]
Daily to weekly	*Filling station* • Check and clean the filling station area, including the filling hose. Store the hose in a sanitary way (e.g. off the ground, fully drained). • Check that the drainage system is clear and functioning. Remove debris or repair as needed. • Check that the fence or barrier is in good condition and that the entry point (e.g. gate) can be closed securely and latched shut/locked. Repair as needed. *Water cart* • Check and clean the discharge hose and tap. Store the hose in a sanitary way (e.g. off the ground in a storage hold, fully drained). • Check that the air vent is in place and in good condition, with a protective vermin- and dust-proof screen securely fitted. Repair or replace damaged parts. • Check that the inside of the vessel is clean (e.g. free from animals, faecal material, sediment accumulation). Clean and disinfect (e.g. with chlorine) as needed.[b]
Monthly to every three months	*Filling station* • Check the filling station hose (or pipe) is in good condition. Repair or replace the hose as needed, then clean and disinfect it (e.g. with chlorine). *Water cart* • Check the discharge tap is in good condition. Repair or replace the tap as needed, then clean and disinfect it. • Check the discharge hose and storage hold are in good condition. Repair or replace damaged components as needed. • Check the vessel for signs of damage or failure. Repair as needed. • Drain the water cart vessel, remove sediment and clean the internal vessel walls (e.g. using a brush and clean water), and then disinfect the vessel (e.g. with chlorine).[b] *Note* – this should also be done as the need arises if the vessel is contaminated (e.g. if vermin is found inside the vessel).
As the need arises[d]	• Repair or replace filling station or water cart components. • Perform maintenance tasks (e.g. tap maintenance). • Monitor water distribution to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[b] For guidance on O&M, including safely cleaning and disinfecting water cart vessels, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers and Delivering safe water by tanker (WHO & WEDC, 2013). Cleaning and disinfecting the vessel is required following a contamination event (e.g. presence of animals in the vessel; *E. coli* detection). *Note* – in water scarce areas, consult with local health authorities before draining a water cart vessel to ensure that the risk to water quality justifies the loss of water. Alternative water supply arrangements may then be needed to ensure that users have sufficient water quantity to meet domestic needs.

[c] This may include: driver's name; date of vessel filling; name of the filling station; free chlorine residual of the water at the filling station, in the vessel and at the point of delivery to the user; date of delivery, name, address and contact details of each user receiving a delivery, and the quantity of water they received; cleaning and maintenance record for the water cart.

[d] See Table 2 for potential issues that could trigger these activities.

General notes

- The suggested frequencies in Table 1 represent a minimum requirement and may need to be increased depending on the local context. A suitable O&M schedule should be made for each filling station and water cart supply chain including who is responsible for performing the work. Completion of activities as part of an O&M schedule should be recorded, with additional detail on any issues identified and corrective actions undertaken.
- Only persons with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be taken if entering the water cart vessel (e.g. inspection, maintenance etc.) or handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections and water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form.* Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, local rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a filling station and water cart, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
Filling station		
1	The filling station hose (or pipe) is dirty, or stored in an unsanitary way, which could allow contaminants to enter the water cart vessel.	• If the hose is dirty, clean and disinfect it (e.g. with chlorine). • If there is no dedicated sanitary storage place for the hose, install a storage space for it (e.g. a hook raised off the ground, capped end). • Communicate the importance of routine cleaning/maintenance, and returning the hose to the dedicated storage place after each use. Consider installing information signs at the filling point to remind users of the risk.
2	The drainage system is inadequate (e.g. absent, damaged or blocked drain), which could result in stagnant water contaminating the filling area.	• If a drainage system is absent, dig a temporary channel to divert water away from the water filling area. Construct a permanent solution as soon as possible. • If a drainage system is not working correctly, consider whether maintenance is needed (e.g. repair, cleaning), or if deepening, widening or extending is required.

Question	Problem identified	Corrective actions to consider
3	The fence or barrier around the filling station is missing or inadequate, which could allow animals or unauthorized people to contaminate the filling area or damage the filling station components.	• If absent, construct a robust fence or barrier with a lockable gate that closes securely. • If a fence or barrier is present but inadequate to prevent access, repair or replace it. • If the entry point (e.g. gate) to the filling station area is damaged and/or does not close securely, repair or replace it.
4	There are sources of pollution (e.g. open defecation, animals, rubbish, commercial activity, open drains) around the filling station that could contaminate the water filling area.	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the filling area in a clean condition. • Consult with local authorities and users to consider: o appropriate actions to relocate or eliminate the source of pollution o other actions to minimize the issue from occurring again (e.g. awareness raising, signage, enforcement measures).
Water cart		
5	The water cart vessel has been used to store liquids other than drinking-water, which could contaminate the vessel.	• Stop the practice of storing other liquids in the vessel immediately. • Clean and disinfect the vessel (e.g. with chlorine),[b] or replace the vessel if deemed necessary (e.g. if the vessel has previously stored animal or human waste, chemicals, petroleum products). • Communicate to operators the importance of storing only drinking-water in the vessel. Consider installing information signs on the vessel to remind operators of the risk.
6	There are signs of contaminants in the vessel (e.g. animals, faeces, sediment build-up) that could present a serious risk to water quality.	• Remove the contaminants immediately if possible. • Consider what immediate actions should be taken to minimize the risk to public health. • Drain, clean and disinfect the vessel (e.g. with chlorine).[b] • Consider appropriate measures to minimize the risk of contamination entering the vessel from this source in the future (e.g. locking the inspection hatch lid when not in use).
7	The inspection or filling hatch lid is missing (or open, unlocked), or it is in poor condition (e.g. deep cracks, severely corroded, does not fit tightly when closed), which could allow contaminants to enter the vessel.	• If the hatch lid is missing, or it is in poor condition, provide a temporary seal (e.g. impermeable plastic sheeting) over the hatch to minimize the entry of contaminants. Repair or replace the hatch and/or lid as soon as possible. • If the hatch lid is open or unlocked, communicate the importance of closing and locking the lid securely when it is not in use.
8	The vessel is cracked or leaking, which could allow contaminants to enter the vessel, or result in water loss.	• If the vessel is cracked or leaking, engage local craftspeople to repair or replace the vessel as required. Then clean and disinfect the vessel (e.g. with chlorine).[b]

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
9	The vessel discharge hose is dirty, or stored in an unsanitary way, which could allow contaminants to enter the water cart vessel.	• If the hose is dirty, clean and disinfect it (e.g. with chlorine). • If there is no dedicated sanitary storage place for the hose, install a storage space for it (e.g. a dedicated clean, dry storage hold, off the ground, capped ends). • Communicate to operators the importance of routine cleaning/ maintenance, and returning the hose to the dedicated storage place after each use. Consider installing information signs on the water cart to remind operators of the risk.
10	The air vents are poorly designed (e.g. facing upwards) or unprotected (e.g. without a vermin- or dust-proof screen), which could allow contaminants to enter the vessel.	• If the air vents are facing upwards, modify the vents so they face downwards. • If the air vent screens are absent, cover the vents with vermin- and dust-proof screens. • If the air vent screens are damaged (or have wide gaps), replace with functioning screens.
11	The vessel discharge tap is dirty or in poor condition (e.g. damaged, corroded, leaking), which could allow contaminants into the water during delivery, or result in water loss.	• If the vessel tap is unclean, clean and disinfect it (e.g. with chlorine). • If the tap is in poor condition, repair or replace it as needed, then clean and disinfect it. • Communicate the importance of routine cleaning/maintenance to the operators.
12	The water in the vessel is not adequately disinfected.[a]	• Develop the necessary SOPs and provide operator training on adequate disinfection practices (including on the use of free chlorine residual test kits where chlorination is practised, and turbidity and pH where possible). • Ensure adequate provision is made to procure chlorine (or an appropriate alternative means of disinfection), along with water quality testing equipment and consumables for monitoring. • Ensure disinfection is practised correctly and consistently, and is optimized through routine monitoring and water quality testing.
General		
13	The filling station and water cart is excluded from routine maintenance and quality control programmes.	• Develop and implement an appropriate routine maintenance and quality control programme, liaising with relevant authorities if appropriate. • Where needed, ensure adequate provision is made for water quality testing equipment and consumables, alongside appropriate SOPs and training for operators.

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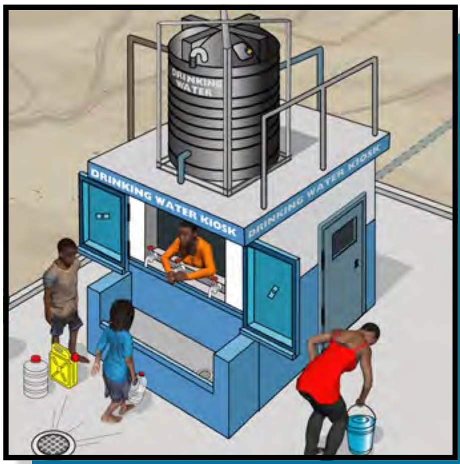

12

Sanitary inspection package

Kiosk

Kiosk

A. GENERAL INFORMATION

A.1. Kiosk information

Kiosk location (e.g. village, town, community, parish, district, province, state)

Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)	
Name of entity responsible for the management of the kiosk (e.g. name of water utility, private operator, community group)	
Source of kiosk water[a] Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Piped distribution network ❑ Other. Describe (e.g. direct from borehole, river, water cart):

Service type Tick (✓) the appropriate box(es)	❑ Operator in attendance ❑ Automated (e.g. self- service with automated payment)	**Service (opening) times**	.... hours per day .... days per week
Average volume of water distributed from the kiosk per week (including units)		**Storage tank volume** (including units)	

Storage tank material Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Ductile iron (DI) ❑ High density polyethylene (HDPE) ❑ Polyvinylchloride (PVC) ❑ Ferro-cement ❑ Concrete ❑ Other. Describe:
Tap material Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Brass ❑ Stainless steel ❑ Other. Describe:

A.2. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.3. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**	**Sample identification code**	**Other information**
No (go to A.4)	Yes			

Parameter tested	*E. coli*[b]		*or* Thermotolerant (faecal) coliforms[b]		Additional parameter		Additional parameter		Additional parameter	
Results and units	Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

A.4. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

Location	Is the water treated?			If **Yes,** describe (e.g. type of treatment, chlorine dose, frequency of dosing, if known)[c]
Before the kiosk (e.g. at a water treatment plant)	❑ Unsure	❑ No	❑ Yes	
At the kiosk (e.g. on-site water treatment)	❑ Unsure	❑ No	❑ Yes	
Downstream of the kiosk (e.g. household water treatment)	❑ Unsure	❑ No	❑ Yes	

[a] Carry out individual sanitary inspections for any sources of water that supply the kiosk (e.g. borehole, surface water, water cart, piped distribution network), and for household practices, using the corresponding sanitary inspection packages.

[b] The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as increased disinfection before or at the kiosk, additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

[c] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested and the result recorded in Section A.3. Where possible, turbidity and pH should also be measured. For guidance on adequate chlorine disinfection, see the *Management advice sheet.*

General note

- This form is intended for use on a single kiosk. Where there are multiple kiosks to be inspected, additional forms will be needed. Kiosks may be inspected on a rotational basis where there are too many to cover during each inspection.

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the kiosk. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the kiosk being inspected.
3. Tick the **No** box if the question does apply to the kiosk being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

Figure 1. Typical risk factors associated with a kiosk

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
1	**Has the kiosk storage tank been used to store liquids other than drinking-water?** Contaminants could enter the water if liquids other than drinking-water have been stored in the tank. This could include water of lesser quality, as well as human/animal waste, chemicals or fuels.	❑	❑	❑	
2	**Is the storage tank cover (or roof) absent or in poor condition?** Contaminants could enter the storage tank if the cover is absent. This could also happen if the cover is damaged (e.g. broken, missing sections, deep cracks). This is particularly likely after rain.	❑	❑	❑	
3	**Is the storage tank inspection hatch lid missing or in poor condition?** Contaminants could enter the storage tank (e.g. from the entry of contaminated water following rain, animals) if the inspection hatch lid is missing (or open, unlocked). This could also happen if the lid is damaged (e.g. deep cracks, severely corroded, does not fit tightly when closed).	❑	❑	❑	
4	**Does the overflow pipe lack adequate protection from vermin?** Contaminants could enter the storage tank (e.g. from insects, rodents, birds) if the overflow pipe is not covered with a vermin-proof screen (e.g. mesh, gauze).	❑	❑	❑	
5	**Are the air vents poorly designed so that contaminants could enter the storage tank?** Contaminants could enter the storage tank if the air vents are facing upwards, or are not covered with a vermin-proof screen.	❑	❑	❑	
6	**Are the storage tank walls cracked or leaking?** Contaminants could enter the storage tank if the walls are damaged (e.g. with deep cracks). A leaking tank could also result in stagnant water contaminating the kiosk area, as well as water loss.	❑	❑	❑	
7	**Are there signs of contaminants inside the storage tank?** The presence of animals or faeces inside the storage tank is a serious risk to the safety of the drinking-water, and indicates that harmful microorganisms are present. Sediments may also contain harmful microorganisms and other contaminants (such as metals) that can affect the safety or acceptability of the water.	❑	❑	❑	

Sanitary inspection questions		NA	No	Yes	If Yes, what corrective action is needed?
8	**Is the kiosk tap dirty or in poor condition?** Contaminants could enter the water if the kiosk tap is dirty. This could also happen if the tap is damaged (e.g. broken, severely corroded) or leaking. A leaking tap could result in stagnant water contaminating the area, and water loss.	❑	❑	❑	
9	**Is drainage inadequate, which could allow water to accumulate in the kiosk area?** Stagnant water could contaminate the collection area if there is no drainage system in place. This could also happen if the drainage system is damaged or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water during the inspection may indicate poor drainage.	❑	❑	❑	
10	**Can sources of pollution be seen in the water collection area (e.g. open defecation, animals, rubbish, commercial activity, open drains)?** The presence of animals or faeces on the ground close to the water collection area poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household, agricultural, industrial) could be washed into the area during rain and contaminate the water during collection.	❑	❑	❑	
11	**Is the kiosk excluded from routine maintenance and quality control programmes?**[d] Failure of the responsible management entity to routinely inspect, maintain and monitor the quality of water at the kiosk may result in unsafe drinking-water being supplied.	❑	❑	❑	
12	**Does the kiosk water lack adequate disinfection?**[c,d] Failure to adequately disinfect water with chlorine (or provide an alternative means of disinfection, such as ultraviolet [UV] light or ozone) can result in unsafe drinking-water being supplied.	❑	❑	❑	
	Total number of Yes responses				

[d] Risk factor is not illustrated in Figure 1. To answer this question, interview the caretaker, operator or management entity as appropriate. Check activity log books for confirmation. Provide further information in Section C to support your answer if necessary.

C. ADDITIONAL DETAILS

Include any additional risk factors,[e] recommendations, observations or remarks from users of the kiosk (e.g. problems with the taste, odour or appearance of the water, water source reliability). Attach additional sheets and photographs if needed.

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[e] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: _______________________

Organization: _______________________

Designation/title of inspector: _______________________

Signature: _______________________ Date: __________

Name of water supply representative: _______________________

Contact number (if available): _______________________

Signature (if available): _______________________ Date: __________

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Kiosk

This technical fact sheet provides background information on a drinking-water kiosk, which supports the sanitary inspection of a drinking-water supply.

A kiosk provides drinking-water to users. A typical kiosk supply chain includes a water source (e.g. from a piped distribution network), a storage tank and a collection point for users to fill water collection vessels (e.g. a jerry can). Kiosks may treat the water on-site, or provide water that has already been treated (e.g. connected to a piped distribution network where the water has been treated at a water treatment plant).

Kiosks provide an interim approach to drinking-water supply where water services, particularly piped supplies, are inadequate to meet all needs of users. Kiosks are commonly found in urban and peri-urban settings, as well as other areas that lack adequate service coverage (e.g. informal settlements, rural areas).

Kiosk water should be appropriately treated/disinfected (e.g. with chlorine), and stored in a sanitary way before delivery to users (i.e. in a clean storage tank that is protected from contamination, with clean taps and fittings). If chlorine disinfection is practised, there should be an adequate free chlorine residual concentration to help protect the water from harmful microorganisms during household transport, storage and handling.[a]

Figure 1 shows a common type of drinking-water kiosk that is supplied by a piped distribution network and has an on-site storage tank. This figure shows a typical design. Other designs can also provide safe drinking-water.

The water collection area should be built so it is accessible for all users.[b]

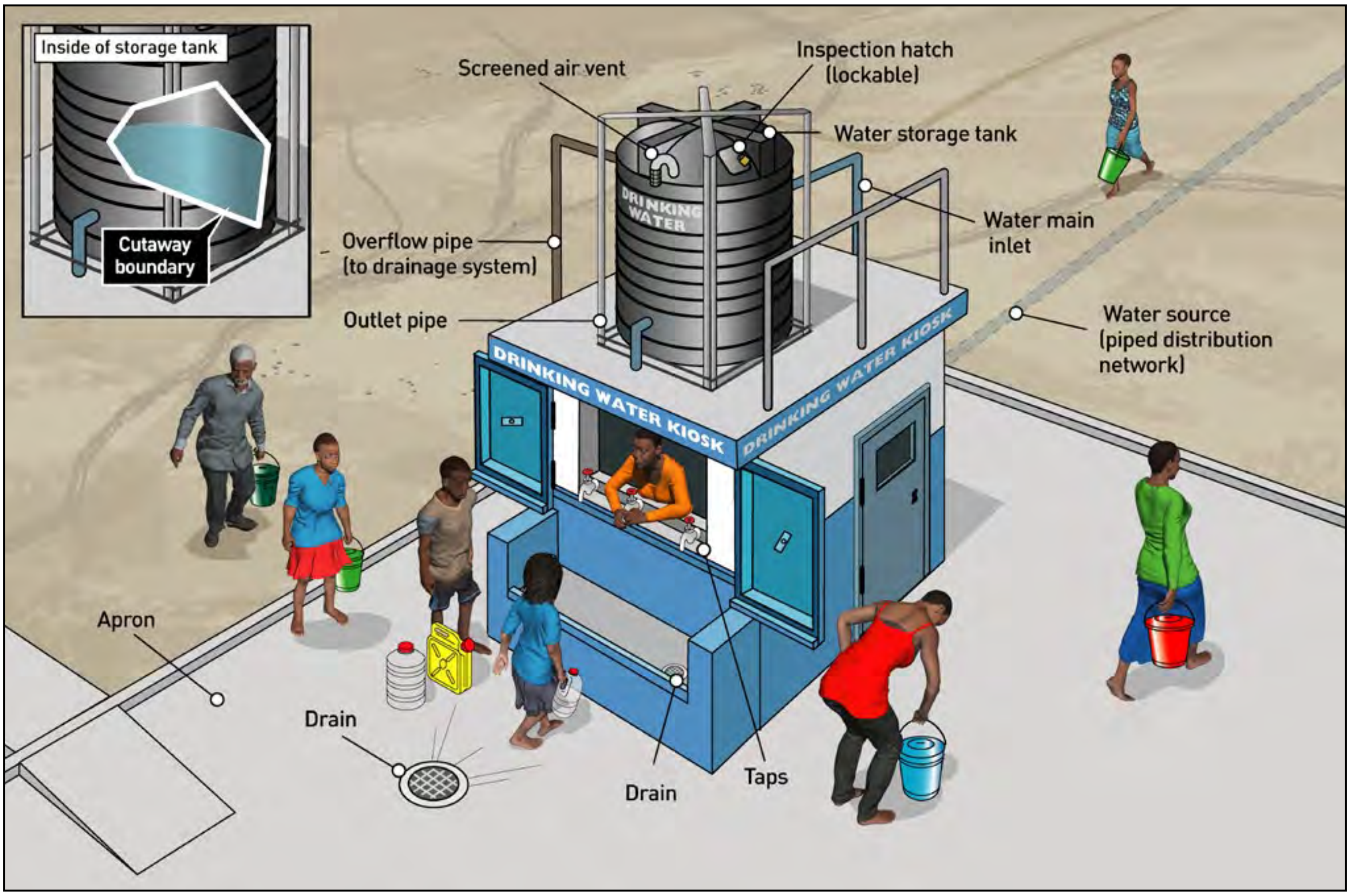

Figure 1. A common drinking-water kiosk in a sanitary condition

[a] For guidance on adequate chlorine disinfection, refer to the *Management advice sheet.*

[b] For guidance on designing accessible facilities, refer to Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility (Jones & Reed, 2005).

Typical risk factors associated with kiosks are presented in the corresponding *Sanitary inspection form.*

Kiosks typically include the following main components.

- **Water source:** Typically provided from a piped distribution network, or from surface water or groundwater sources (e.g. river, borehole, spring). The source water should be treated/disinfected as required to ensure it is safe for human consumption.
- **Water main inlet:** Pipe that delivers drinking-water into the water storage tank (e.g. from a piped distribution network).
- **Water storage tank:** Stores water at the kiosk prior to collection by users. The storage tank can provide a buffer to help ensure the continuity of supply (e.g. during intermittent supply in piped distribution networks). Storage tanks are commonly made from high density polyethylene (HDPE), polyvinylchloride (PVC), ferro-cement, metal or concrete. The tank should be covered and sealed to stop contaminants entering the storage tank. The tank should have a sump (not shown in Figure 1) to allow cleaning and maintenance. The sump should be located at the lowest point of the tank floor to ensure the tank can be drained completely.
- **Storage tank inspection hatch:** Allows access to the storage tank for inspection or operations and maintenance. The inspection hatch should have a lid that is tightly fitting and lockable to stop contaminants from entering the tank, and to stop unauthorized access by people. *Note* – the inspection hatch may also act as a filling point if water is supplied to the storage tank by a water cart.
- **Storage tank air vent:** Allows ventilation in the storage tank. The air vent should be facing downwards and have a vermin-proof screen to stop contaminants entering the tank.
- **Kiosk tap:** Allows users to collect water from the kiosk in a sanitary way, minimizing water wastage or spillage. The tap also allows easy collection of water quality samples for analysis.
- **Storage tank overflow pipe:** Directs excess water from the storage tank to a drainage system. This stops the tank overflowing in an uncontrolled way, which could contaminate the kiosk area or damage components. The overflow pipe should be facing downwards and have a vermin-proof screen (e.g. gauze or mesh) to prevent contaminants entering the storage tank. Water from the overflow pipe should not erode the ground beneath the tank, as this could contaminate the kiosk area or damage its components. This could also result in water loss.
- **Apron:** A reinforced stone, brick or concrete floor built around the kiosk to drain water away from the collection area. The apron should slope down from the collection area to a drainage system. The apron also provides a standing area for users when collecting water.
- **Drainage system:** Directs water away from the kiosk to a drainage area or soakaway. The drainage system should slope down from the kiosk. This prevents water ponding and stagnating, which could contaminate the collection area.

Additional considerations

After a new kiosk is constructed, cleaning and disinfection of the components is required (e.g. with chlorine).[c] Ideally, water quality testing should then be conducted before the kiosk is commissioned to confirm the water is safe for consumption. Periodic disinfection of the system and testing may also be required (e.g. after maintenance).

When constructing new kiosks or rehabilitating old ones, all materials used should be safe for contact with drinking-water (e.g. using materials approved through an appropriate certification scheme, including for lead-free or low-lead materials).

Kiosks may use advanced on-site drinking-water treatment technologies (e.g. packaged units with membrane filtration, ultraviolet light disinfection). Risk factors for these technologies should be determined in consultation with the appropriate technical advice and considering the manufacturer's guidance.

[c] For guidance on disinfecting water storage tanks, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013).

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Kiosk

This management advice sheet provides guidance for the safe management of a drinking-water kiosk, which supports the sanitary inspection of a drinking-water supply.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the kiosk in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a trained user, caretaker or operator (e.g. simple tasks such as cleaning kiosk area, checking the free chlorine residual concentration, cleaning the storage tank). Larger repairs and maintenance tasks (e.g. repairing the storage tank) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

The condition of the kiosk components should be inspected routinely to help prevent contaminants entering the water supply. Any damage or faults should be repaired immediately (e.g. damaged storage tank inspection hatch, leaking tap). Standard operating procedures (SOPs) should be developed for important O&M tasks (e.g. inspecting the storage tank). These should be followed by trained individuals so the work is carried out safely and the water supply is not contaminated during the work.

The kiosk storage tank should only contain drinking-water – no other liquids, including water of lesser quality, should be stored in the tank. The storage tank should be periodically cleaned and disinfected according to SOPs.[a] Taps and related fittings should be maintained in a sanitary way.

Use of multiple water sources for the kiosk may be required to ensure an adequate quantity of drinking-water to meet user needs. Adequate treatment/disinfection are required before consuming the drinking-water if any of the water sources are vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home.

Where chlorine disinfection is practised, operators should have access to a chlorine testing kit. Operators should make sure there is an adequate free chlorine residual concentration throughout the tank by monitoring at regular intervals (see Table 1) and the results recorded (e.g. in a log book). As needed, batch chlorine disinfection of the storage tank water should be carried out to ensure that adequate chlorination is achieved (with all related activities conducted by trained operators according to SOPs).[b] Chemicals (e.g. chlorine) or testing reagents should be used before their expiry date and stored appropriately according to manufacturer's instructions.

Kiosk operators should be trained to advise users on safe drinking-water collection practices (e.g. if a user comes to the kiosk with an unsafe drinking-water collection vessel).

For kiosks supplied by a water carting vessel, the kiosk operator should keep a log book to record the full details of each delivery, including: delivery date; driver's name; vehicle registration number; the water source(s) location; the volume of water received; and the free chlorine residual concentration in the water carting vessel prior to filling the kiosk storage tank.

Ideally, kiosk operators should be registered and/or licenced with the relevant authority who has responsibility for overseeing that training is provided and safe drinking-water management practices are being applied.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check and clean the kiosk facility, including the taps. Remove any polluting materials (e.g. faeces, rubbish). • Where chlorination is practised, check that free chlorine residual concentration at the kiosk tap is adequate. Optimize the chlorine concentration before or within the water storage tank as needed (e.g. by increasing the chlorine dose at a water treatment plant, batch dosing the storage tank).[b] • Check that the taps are working. Repair or replace taps as needed, then clean and disinfect them (e.g. with chlorine). • Check that the storage tank air vent and overflow pipe are in good condition. Ensure that protective vermin-proof screens are securely fitted and in good condition. Repair or replace damaged parts. • Check that the inspection hatch lid is in place and in good condition, and is closed and locked securely. Repair or replace damaged parts, and lock as needed. • Check that the inside of the storage tank is clean (e.g. free from animals, faeces, sediment build-up). Drain the tank as needed, then clean and disinfect it.[a] • Check that the drainage system is clear and functioning. Remove debris or repair as needed.
Monthly to every three months	• Inspect the storage tank (and the tank support base if present) for signs of damage or failure. Repair or replace as needed.
As the need arises[c]	• Drain the storage tank, remove sediment and clean the internal tank walls (e.g. using a brush and clean water), and then disinfect the storage tank (e.g. with chlorine).[a] • Monitor water distribution to identify changes (e.g. during periods of drought). • Ensure procurement of any materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[a] For guidance on O&M, including safely cleaning and disinfecting water storage tanks, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013). This activity is required following a contamination event (e.g. presence of animals in the storage tank; *E. coli* detection). *Note* – in water scarce areas, consult with local health authorities before draining a storage tank to make sure that the risk to water quality justifies the loss of water. Alternative water supply arrangements may then be needed to ensure that users have sufficient water quantity to meet domestic needs.

[b] Where chlorine disinfection is practised, the free chlorine residual concentration should be at least 0.2 mg/L at the point of use. This means that the free chlorine residual concentration at the kiosk should be higher (e.g. at least 0.5 mg/L at pH less than 8 after at least 30 minutes contact time) - this can allow for chlorine decay during user transport, and subsequent storage and handling at the household level. Note that chlorine effectiveness is impacted by several factors including turbidity, pH and temperature. Chlorine doses or contact times will need to be adjusted to ensure adequate chlorine residual concentrations based on the local context. The free chlorine residual concentration in the water should also consider user acceptability. For more information, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

[c] See Table 2 for potential problems that could trigger these activities.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each site, including who is responsible for performing the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when entering a storage tank for inspection or maintenance. Safety risks such as storage tank collapse or asphyxiation should be appropriately managed. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form.* Where relevant, corrective actions should be completed by trained individuals according to SOPs. Where needed, develop awareness raising and education programmes, and if necessary, rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a drinking-water kiosk, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
1	The kiosk storage tank has been used to store liquids other than drinking-water, which could contaminate the water supply.	• Stop the practice of storing other liquids in the tank immediately. • Drain, clean and disinfect the tank (e.g. with chlorine),[a] or replace the tank if deemed necessary (e.g. if the tank has previously stored animal or human waste, chemicals, petroleum products). • Communicate the importance of only using the tank for drinking-water purposes.
2	The storage tank is inadequately covered, which could allow contaminants to enter the tank.	• Provide a temporary cover (e.g. impermeable plastic sheeting) to minimize contaminants entering the storage tank. Install or repair the tank cover tank as soon as possible. • Drain, clean and disinfect the tank (e.g. with chlorine).[a]
3	The storage tank inspection hatch lid is missing (or open, unlocked), or it is in poor condition (e.g. deep cracks, severely corroded, does not fit tightly when closed), which could allow contaminants to enter the tank (e.g. via run-off, animals).	• If the inspection hatch lid is absent or in poor condition, provide a temporary cover (e.g. impermeable plastic sheeting) over the inspection hatch to minimize the entry of contaminants. Repair or replace the hatch and/or lid as soon as possible. • If the inspection hatch lid is open or unlocked, communicate the importance of closing and locking the lid securely when not in use.
4	The overflow pipe is inadequately protected (e.g. with a screen) which could allow vermin to enter the storage tank and contaminate the water.	• If the overflow pipe is unprotected, cover the pipe with a vermin-proof screen (e.g. gauze or mesh). • If the overflow pipe screen is damaged (e.g. ripped, broken) or has wide gaps, replace with a functioning vermin-proof screen.
5	The air vents are poorly designed (e.g. facing upwards) or unprotected (e.g. no vermin-proof screen), which could allow contaminants to enter the storage tank.	• If the air vents are facing upwards, modify the vents so they face downwards. • If the air vent screens are absent, cover the vents with vermin-proof screens. • If the air vent screens are damaged or have wide gaps, replace with functioning vermin-proof screens.
6	The storage tank walls are cracked or leaking, which could allow contaminants to enter the tank, or result in water loss.	• If the storage tank is cracked or leaking, engage local craftspeople to repair or replace the storage tank as needed. • Clean and disinfect the storage tank (e.g. with chlorine).[a]

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
7	There are signs of contaminants in the storage tank (e.g. animals, faeces, sediment build-up) that could present a serious risk to water quality.	• Remove the contaminants immediately if possible. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to treat the water before consumption). • Drain, clean and disinfect the storage tank.[a] • Consider appropriate measures to minimize the risk of contamination entering the storage tank from this source in the future (e.g. install a storage tank cover if not present, lock inspection hatch lid).
8	The kiosk tap is dirty or in poor condition (e.g. damaged, corroded, leaking), which could allow contaminants to enter the water during collection, or result in water loss.	• If the tap is dirty, clean and disinfect the tap (e.g. with chlorine). • If the tap is in poor condition, repair or replace the tap as needed, then clean and disinfect the tap. • Communicate the importance of routine cleaning/maintenance to the operators.
9	The drainage is inadequate (e.g. absent, damaged or blocked drain), which could result in stagnant water contaminating the kiosk area.	• If a drainage system is absent, dig a temporary drainage channel to divert water away from the kiosk area. Construct a permanent solution as soon as possible. • If the drainage system is not working, consider whether maintenance is needed (e.g. repair, cleaning), or if deepening, widening or extending is required.

10	There are sources of pollution (e.g. open defecation, animals, rubbish, commercial activity, open drains) around the kiosk that could contaminate the water collection area.	• Where practical, remove the pollution (e.g. remove animal faeces, rubbish). Communicate the importance of maintaining the kiosk area in a clean condition.
		• Consult with local authorities and users to consider:
		  ◦ appropriate actions to relocate or eliminate the source of pollution
		  ◦ other actions to minimize the issue from occurring again (e.g. awareness raising, signage, enforcement measures).

11	The kiosk is excluded from routine maintenance and quality control programmes.	• Develop and implement an appropriate routine maintenance and quality control programme, liaising with the relevant authorities if appropriate. • Where needed, ensure adequate provision is made for water quality testing equipment and consumables, alongside appropriate SOPs and training for operators.
12	The kiosk water is not adequately disinfected.[b]	• Develop the necessary SOPs and provide operator training on adequate disinfection practices (including on the use of free chlorine residual test kits where chlorination is practised, and turbidity and pH where possible). • Ensure adequate provision is made to procure chlorine (or an appropriate alternative means of disinfection), along with water quality testing equipment and consumables for monitoring. • Ensure disinfection is practised correctly and consistently, and is optimized through routine monitoring and water quality testing.

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13

Sanitary inspection package

Household practices

Household practices

Collection, storage and treatment

A. GENERAL INFORMATION

A.1. Household information

Household location (e.g. household name or number, village, town, community, parish, district, province, state)	
Additional location information State the reference system and units, if using coordinates (e.g. national grid reference coordinates, GPS coordinates)	
Number of people living in this household	
Source of household drinking-water[a] Tick (✓) the appropriate box(es) and provide further information where applicable	❑ Dug well ❑ Spring ❑ Tubewell ❑ Rainwater ❑ Borehole ❑ Kiosk ❑ Tapstand ❑ Water carter ❑ Other. Describe:

A.2. Weather conditions during the 48 hours before inspection

Circle the temperature and precipitation options below to indicate the main conditions during the 48 hours before the inspection. More than one option may be circled if conditions changed during this time. Record additional information in Section C if needed.

Temperature	<0 °C	0–15 °C	16–30 °C	>30 °C
Precipitation	Snow	Heavy rain	Rain	Dry

A.3. Water quality sample information

Record details of any water quality samples taken during the inspection. Include information for any parameters tested. Add **NA** if information is not applicable. Record additional information in Section C if needed.

Sample taken? Circle **No** or **Yes**		**Sampling location**		**Sample identification code**		**Other information**					
No (go to A.4)	Yes										
Parameter tested		*E. coli*[b]	*or*	Thermotolerant (faecal) coliforms[b]		Additional parameter		Additional parameter		Additional parameter	
Results and units		Results	Units	Results	Units	Results	Units	Results	Units	Results	Units

a Carry out individual sanitary inspections for any water sources that supply the household using the corresponding sanitary inspection packages.

b The presence of *E. coli* (or thermotolerant [faecal] coliforms) suggests recent faecal contamination. If detected, further action is needed, such as additional sampling and investigation of potential sources of contamination, and/or household water treatment advisories (e.g. boil water notice). *Note* – thermotolerant (faecal) coliforms are distinct from "total coliforms", where total coliforms do not necessarily indicate recent faecal contamination.

General note

- This form is intended for use on a household. Where there are multiple households to be inspected, additional forms will be needed. Households may be inspected on a rotational basis where there are too many to cover during each inspection.

A.4. Water treatment

Tick (✓) the appropriate box(es) and provide additional information as needed.

❑ **No treatment applied.**

❑ **Treatment applied before the household.** Describe (e.g. at a central water treatment plant or kiosk, and the type of treatment if known).

❑ **Treatment applied at the household.** Tick (✓) the appropriate box(es) and provide additional information as needed.

❑ Boiling	❑ Pasteurization	❑ Solar disinfection	❑ Chlorination[c]	❑ Ultraviolet (UV) disinfection
❑ Membrane filtration	❑ Sand filtration	❑ Ceramic filtration	❑ Arsenic removal filtration	❑ Fluoride removal filtration

❑ Other. Describe:

[c] Where chlorine is applied, the free chlorine residual concentration in the drinking-water should be tested during the inspection and the result recorded in Section A.3. Where possible, turbidity and pH should also be measured. For more information, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

B. SANITARY INSPECTION

IMPORTANT: Read the following notes before completing the sanitary inspection

1. Tick (✓) the appropriate box for each question. For guidance, refer to the numbered risk factors in Figure 1; the numbers in the figure are linked to the questions. Record any additional risk factors present in Section C. Refer also to the *Technical fact sheet* for information on the individual components of the household water supply. *Note* – the questions in this section are example risk factors only, which can be used as a starting point for adapting the form to the local context.
2. Tick the **NA** (not applicable) box if the question ***does not apply*** to the household being inspected. For example, if the household does not use an intermediate and/or final storage container.
3. Tick the **No** box if the question does apply to the household being inspected, but the risk factor ***is not present***.
4. Tick the **Yes** box if the risk factor ***is present***. For important situations that require attention, record the corrective actions to be taken in the last column. These notes can be used to develop a detailed improvement plan, documenting what will be done, who will do it, by when it will be done and what resources are required. For guidance, refer to the *Management advice sheet*. Where possible, address the most serious risk factors first, considering low-cost or no-cost improvements that can be made immediately.
5. If a question cannot be answered because access to a component is not possible, tick the **Yes** box. Record these issues in Section C for further investigation.

Figure 1. Typical risk factors associated with household (A) collection (transportation), (B, C) intermediate storage, and (D) final storage (after household water treatment, if practised)

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
Collection container					
1	**Is the collection container dirty or in poor condition?** Contaminants could enter the water if the container is dirty. This could also happen if the container is damaged (e.g. cracked, corroded) or leaking. A leaking container could also result in water loss.	❑	❑	❑	
2	**Does the collection container lack a cover?** Contaminants could enter the water if the container has no cover in place (e.g. cap, lid). This could also happen if the cover is not tightly fitting when it is closed.	❑	❑	❑	
3	**Is the collection container stored in a place where it could become contaminated?** Contaminants could enter the water if the container is stored in a dirty place when it is not in use (e.g. in a wet area, on the ground), or in a place that can be easily accessed by children or animals.	❑	❑	❑	
4	**Has the collection container been used to store liquids other than drinking-water?** Contaminants could enter the water if liquids other than drinking-water have been stored in the collection container. This could include containers that have stored water of poorer quality, as well as containers that have stored milk, chemicals, oils or fuels.	❑	❑	❑	
Intermediate storage container					
5	**Is the intermediate storage container dirty or in poor condition?** Contaminants could enter the water if the container is dirty. This could also happen if the container is damaged (e.g. cracked, corroded) or leaking. A leaking container could result in stagnant water contaminating the collection area, and water loss.	❑	❑	❑	
6	**Does the intermediate storage container lack a cover?** Contaminants could enter the water if there is no cover (or lid) in place. This could also happen if the cover is not tightly fitting when it is closed.	❑	❑	❑	
7	**Has the intermediate storage container been used to store liquids other than drinking-water?** Contaminants could enter the water if liquids other than drinking-water have been stored in the container. This could include containers that have stored water of poorer quality, as well as containers that have stored human/animal waste, chemicals, oils or fuels.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
8	**Are there any signs of contaminants inside the intermediate storage container?** The presence of animals or faeces inside the container is a serious risk to the safety of the drinking-water, and indicates that harmful microorganisms are present. Sediments may also contain harmful microorganisms and other contaminants (such as metals) that can affect the safety or acceptability of the water.	❑	❑	❑	
9	**Is the tap or utensil dirty or in poor condition?** Contaminants could enter the water if a dirty tap or utensil (e.g. bucket, pot, ladle) is used to transfer water from the intermediate storage container to the final storage container. This could also happen if the tap is damaged (e.g. broken, severely corroded) or leaking. A leaking tap could result in stagnant water contaminating the collection area, and water loss.	❑	❑	❑	
10	**Is the intermediate storage container used for household activities other than storing drinking-water?** Contaminants could enter the container if activities such as handwashing, bathing or laundry are carried out within the container.	❑	❑	❑	
11	**Is the drainage inadequate, which could allow water to accumulate in the collection area?** Stagnant water could contaminate the collection area if there is no drainage in place, or if the drainage system is not working or blocked (e.g. from leaves, sediment). This is especially likely after rain. *Note* – the presence of pooled water during the inspection may indicate poor drainage.	❑	❑	❑	
12	**Can sources of pollution be seen around the intermediate storage container (e.g. open defecation, open drains, animals, drinking troughs for livestock, rubbish)?** The presence of animals or faeces on the ground close to the collection area poses a serious risk to the safety of the drinking-water. Contaminants from other waste (e.g. household wastewater, grey water, rubbish) could be washed into the area during rain and contaminate the water during collection.	❑	❑	❑	

	Sanitary inspection questions	NA	No	Yes	If Yes, what corrective action is needed?
Final storage container					
13	**Is the final storage container dirty or in poor condition?** Contaminants could enter the water if the container is dirty. This could also happen if the container is damaged (e.g. cracked, severely corroded) or leaking. A leaking container could result in stagnant water contaminating the area, and water loss.	❑	❑	❑	
14	**Does the final storage container lack a cover?** Contaminants could enter the container if there is no cover in place (e.g. cap, lid). This could also happen if the cover is not tightly fitting when it is closed.	❑	❑	❑	
15	**Has the final storage container been used to store liquids other than drinking-water?** Contaminants could enter the water if liquids other than drinking-water have been stored in the container. This could include containers that have stored water of poorer quality, as well as containers that have stored milk, chemicals, oils or fuels.	❑	❑	❑	
16	**Is the final storage container stored in a place where it could become contaminated?** Contaminants could enter the water if the container is stored in a dirty place (e.g. in a wet area, on the ground), or in a place that can be easily accessed by children or animals.	❑	❑	❑	
17	**Is the tap or utensil dirty or in poor condition?** Contaminants could enter the water if a dirty tap or utensil (e.g. bucket, pot, ladle) is used to take water from the final storage container. This could also happen if the tap is damaged (e.g. broken, severely corroded) or leaking. A leaking tap could result in stagnant water contaminating the area, and water loss.	❑	❑	❑	
Household water treatment					
18	**Is household water treatment not practised, or practised incorrectly?**[d,e] If household treatment is not practised, harmful contaminants may not be removed from the drinking-water. If household treatment is practised incorrectly, contaminants may not be removed from, or could even be introduced into, the drinking-water.	❑	❑	❑	
	Total number of Yes responses				

[d] Tick **NA** (not applicable) if the household water is sourced from a safely managed drinking-water supply, and is considered to be safe for consumption without household water treatment i.e. if the water comes from an improved water source (e.g. piped connection, boreholes or tubewells, protected dug wells, protected springs, rainwater collection), which is located on premises, available when needed and free of faecal and priority chemical contamination.

[e] Where possible, ask the household to demonstrate the household treatment process during the inspection. Examples of incorrect household treatment practices may include: incorrect chlorine disinfection (e.g. adding an insufficient concentration of chlorine, not allowing sufficient chlorine contact time);[c] not bringing the water to a rolling boil; adding an insufficient concentration of chemical coagulants; using expired treatment chemicals (e.g. chlorine tablets, flocculants). *Note* – examples of inappropriate household level treatment include: straining water through a cloth, letting the water stand and settle.

C. ADDITIONAL DETAILS

Include any additional remarks (e.g. collection, intermediate and final storage container volume and construction material), risk factors,[f] recommendations or observations (e.g. problems with the taste, odour or appearance of the water). Attach additional sheets and photographs if needed.

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[f] These risk factors should be considered for future inclusion in Section B.

D. INSPECTION DETAILS

Name of inspector: ____________________________

Organization: ____________________________

Designation/title of inspector: ____________________________

Signature: ____________________ Date: __________

Name of household representative: ____________________________

Contact number (if available): ____________________________

Signature (if available): ____________________ Date: __________

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World Health Organization

Household practices
Collection, storage and treatment

This technical fact sheet provides background information on household practices, which supports the sanitary inspection of a household drinking-water supply.

Household water treatment and safe storage is an important interim solution to help ensure safe drinking-water.

For households that are not connected to a piped distribution network, a typical household drinking-water supply includes collection from the water source (e.g. dug well, kiosk, tapstand), intermediate storage at the household (e.g. bulk storage container), and final storage (e.g. after household water treatment, if practised). In such settings, household water treatment is required where users rely on untreated water sources that are vulnerable to contamination, or where water may become contaminated through unhygienic household collection, storage and handling practices.[a]

Figure 1 shows a common type of household drinking-water supply where there is no connection to a piped distribution network. This figure shows a typical configuration. Other configurations can also provide safe drinking-water.

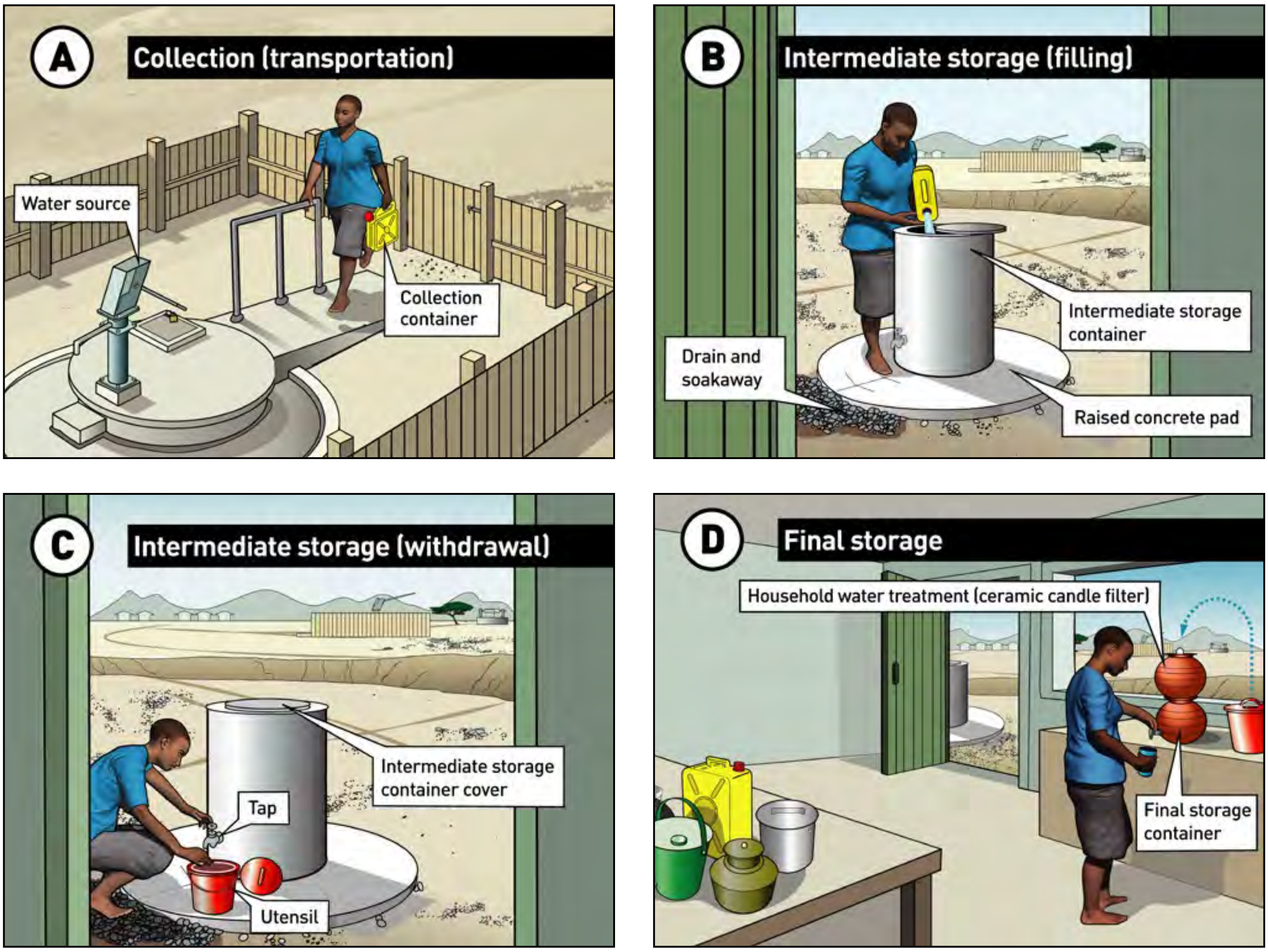

Figure 1. A common household drinking-water supply chain consisting of (A) collection (transportation), (B, C) intermediate storage, and (D) final storage (after household water treatment, if practised)

[a] Households that are connected to a piped distribution network may also require household water treatment and storage. This may be due to a number of reasons, including water quality issues associated with inadequate treatment at a central water treatment plant, the vulnerability of the distribution network to contamination, intermittent water supply, or frequent unplanned water supply outages.

Typical risk factors associated with household supply chains are presented in the corresponding *Sanitary inspection form.*

Household supply chains typically include the following main components.

- **Water source:** The source of water for the household (e.g. river, borehole, spring, kiosk, tapstand).

- **Collection container:** Allows water to be collected from the water source and transported to the home (e.g. in a jerry can). Collection containers are typically 3–30 L capacity and can be made from steel, high density polyethylene (HDPE) or polyethylene terephthalate (PET). Collection containers should be covered (e.g. with a tightly fitting lid that closes securely).

- **Intermediate storage container:** Allows larger quantities of water to be stored for household use (e.g. >100 L).[b] The container may be filled by the collection container, or by a water carter. Intermediate storage containers are typically made from HDPE, polyvinyl chloride (PVC), ferro-cement, metal or concrete. The container should be covered (e.g. with a tightly fitting cover or lid that closes securely) and ideally raised off the ground (e.g. either on a **raised concrete pad** or elevated stand). The inside of the container should be easy to access for inspection and maintenance.

  Adequate drainage should be in place around the container (e.g. **drain**, **soakaway**) to prevent water from ponding and stagnating (e.g. after spillages), which could contaminate the collection area.

- **Final storage container:** Used to store smaller quantities of water for day-to-day use (e.g. 1–30 L). The container may be filled from the intermediate storage container (or directly by the collection container if there is no intermediate storage in place). In some settings, the final storage container will contain water that has been treated by the household (see below). The final storage container should be covered (e.g. with a tightly fitting cover or lid that closes securely).

- **Tap or utensil:** Allows users to take water from containers in a sanitary way with minimal wastage or spillage. A tap should be used where possible, provided it can be easily cleaned and maintained. If a ladle is used as a utensil to take water from the container, it should have a long handle. This will help to avoid contaminants from the user's hand making direct contact with the drinking-water. Utensils should be stored in a sanitary manner when not in use (e.g. stored in a clean, dry storage area that is raised off the ground).

- **Household water treatment:** For water supplies that are vulnerable to contamination, the household should treat the drinking-water before consumption. Examples include clarification (e.g. chemical flocculant), filtration (e.g. ceramic candle) and disinfection (e.g. via chlorination, boiling, solar disinfection).[c]

  Turbidity reduces the effectiveness of disinfection, so turbid waters should be treated through a combination of methods, such as flocculation and/or filtration followed by disinfection.

  In addition, water containing harmful chemicals (e.g. arsenic, fluoride, manganese) can be successfully treated by household water treatment methods, although treatment technologies for these chemicals are generally expensive.

  Brackish or saline water sources, or sources containing agricultural or industrial chemicals, typically cannot be treated at the household level. In such cases, alternative sources of safe drinking-water should be used.

Additional considerations

Drinking-water containers (Figure 2) should have an opening that is large enough to allow thorough cleaning (e.g. with detergent) and disinfection (e.g. with chlorine). Hollow handles should be avoided, as they are hard to clean effectively. The container material should be opaque (i.e. avoiding transparent materials that allow light through) to minimize the risks from algal growth.[d]

[b] For larger intermediate storage tanks (e.g. rooftop storage tanks for buildings), refer to *Sanitary inspection package: rainwater collection and storage*, which can be adapted for this purpose.

[c] For guidance on common household water treatment technologies, refer to *Compendium of drinking-water systems and technologies from source to consumer* (WHO, in preparation).

[d] For more information on the design of drinking-water containers, refer to Domestic water containers: an engineer's guide (WEDC, 2011).

Any materials used should be safe for contact with drinking-water (e.g. using certified schemes where these are in place). Before a new container is used, cleaning and disinfection is required (e.g. with chlorine).[e]

When selecting appropriate household water treatment options, the quality of the source water should be considered, as well as its variability (e.g. how the water quality changes from season to season). Appropriate household treatment strategies should be chosen in consultation with the local health authorities. Ideally, certified household treatment technologies should be used, for example, technologies approved by a national evaluation scheme, or in the absence of a national scheme, using the WHO's *International scheme to evaluate household water treatment technologies*.[f]

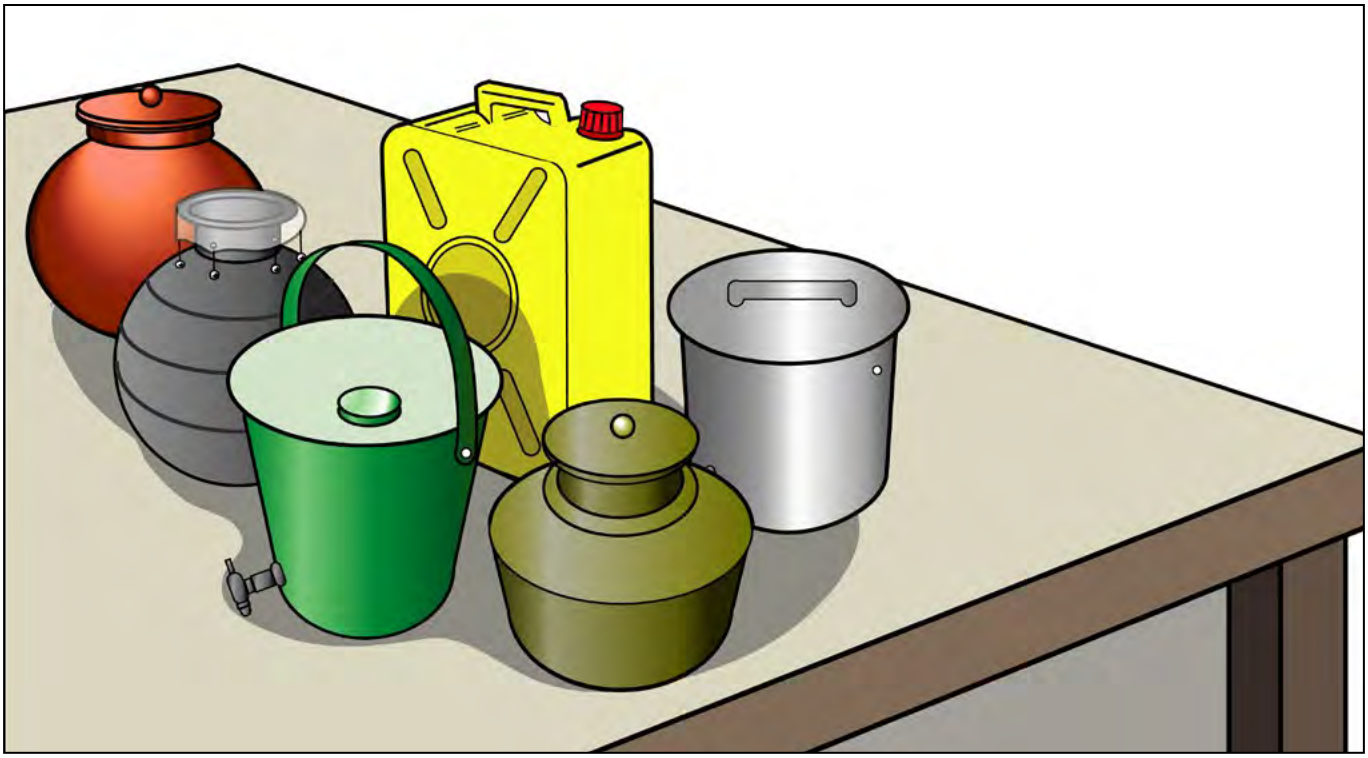

Figure 2. Examples of common drinking-water containers

[e] For guidance on disinfecting water storage tanks, which may be adapted to containers, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013).

[f] For a list of household water treatment technologies evaluated by WHO, visit: https://www.who.int/tools/international-scheme-to-evaluate-household-water-treatment-technologies/products-evaluated.

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World Health Organization

Household practices
Collection, storage and treatment

This management advice sheet provides guidance for the safe management of household drinking-water, which supports the sanitary inspection of a household water supply.

Guidance for typical operations and maintenance (O&M) activities is provided in Table 1, including suggested frequencies for each activity. These activities are important for keeping the household water supply in good working condition and protecting drinking-water quality.

Table 2 lists potential problems that may be identified during a sanitary inspection, and provides basic corrective actions to consider for each problem.

This management advice sheet can also support routine management and monitoring practices, which are required to help ensure the ongoing safety of the household water supply.

A. OPERATIONS AND MAINTENANCE

Basic O&M can usually be carried out by a member of the household (e.g. simple maintenance tasks such as cleaning drinking-water containers). Larger repairs and maintenance tasks (e.g. repairing an intermediate storage container) may need skilled labour which can be provided by local craftspeople, or with support from outside of the local area.

Drinking-water is often contaminated between collection and consumption. Care should be taken to collect, store and handle drinking-water in a sanitary way, using appropriate containers that are clean and protected from contamination. Drinking-water containers should only be used for drinking-water - no other liquids, including water of lesser quality, should be stored in the containers. Regular cleaning and disinfection of drinking-water containers is required (e.g. using detergent, chlorine).[a] Taps and related fittings should be cleaned and maintained regularly. Utensils, such as scoops or ladles, should be cleaned regularly and stored in a sanitary way when not in use (e.g. in a dedicated clean and dry storage area, raised off the ground).

The duration of time the water is stored and the weather conditions (e.g. very hot conditions), can affect water quality in terms of its safety, as well as its acceptability (e.g. taste and odour issues). If water is stored in containers for long periods of time without use (e.g. more than several days), and chlorination is practised, the free chlorine residual concentration of the stored water should minimally be tested to ensure it is adequate before consumption.[b] Drinking-water containers should be stored away from direct sunlight to minimize the risks from algal growth (or from chemicals leaching into the water from the container material in the case of certain plastics).

Use of multiple water sources for the household may be required to ensure an adequate quantity of drinking-water to meet user needs. Adequate treatment/disinfection are required before consuming the drinking-water if any of the water sources are vulnerable to contamination, or if the water could be contaminated due to unhygienic storage and handling by the user during transport or in the home. Where household treatment is required, this should be applied correctly and consistently, following the manufacturer's guidance, and seeking help from the local health authorities as needed. Ideally, the inspector should be knowledgeable in the proper procedures for using each household treatment technology, given that each technology requires specific procedures.

[a] Guidance for O&M, including safely cleaning and disinfecting water storage tanks, may be found in Technical notes on drinking-water, sanitation and hygiene in emergencies: cleaning and disinfecting water storage tanks and tankers (WHO & WEDC, 2013). This guidance may be adapted to containers. *Note* – in water scarce areas, consult with local health authorities before draining the intermediate storage container to make sure that the risk to water quality justifies the loss of water. If drained, alternative water supply arrangements may be needed to ensure that the household has sufficient water quantity to meet domestic needs.

[b] For more information on adequate chlorination, refer to Technical notes on drinking-water, sanitation and hygiene in emergencies: measuring chlorine levels in water supplies (WHO & WEDC, 2013).

To minimize the risk of drinking-water contamination from user handling, the household should ensure safe sanitation and hygiene practices at all times. Effective handwashing is particularly important before handling drinking-water.

Table 1. Guidance for developing an operations and maintenance schedule

Frequency	Activity
Daily to weekly	• Check, clean and disinfect the collection container and final storage container (e.g. with chlorine).[a] Cover securely and store in a sanitary place (e.g. clean and dry area, off the ground). • Check that the intermediate storage container is covered securely. Cover the container as needed. • Check and clean the area around the intermediate storage container. Remove any polluting materials (e.g. faeces, rubbish). • Check that the drain and soakaway around the intermediate storage container are clear and in good condition. Remove debris or repair as needed. • Check, clean and disinfect any utensils/taps used to withdraw water from the containers. Store utensils in a sanitary place (e.g. clean and dry area, off the ground).
Weekly to monthly	• Check that the inside of the intermediate storage container is clean (e.g. free from animals, faeces, sediment build-up). Drain as needed, then clean and disinfect the container (e.g. with chlorine).[a] • Check each container for damage or failure. Repair or replace as needed. • Where practised, check that household water treatment equipment is in good working order, and that reagents (e.g. chlorine, flocculants) are stored correctly and are within the expiry date.
Annually	• Drain, clean and disinfect the intermediate storage container (e.g. with chlorine).[a]
As the need arises[c]	• Perform maintenance tasks (e.g. tap maintenance). • Monitor water use to identify changes (e.g. during periods of drought). • Ensure that any new materials in contact with drinking-water and water treatment chemicals (where used) are safe for drinking-water use.

[c] See Table 2 for potential issues that could trigger these activities.

General notes

- The suggested frequencies in Table 1 are a minimum recommendation. The frequency of activities may need to be increased depending on the local context. A suitable O&M schedule should be made for each household, including who is responsible for the work. Completion of activities as per the O&M schedule should be recorded, including additional details for any problems identified and corrective actions undertaken.
- Only people with relevant training and skills should undertake the activities in Table 1. Appropriate safety measures should be in place when entering a storage tank for inspection or maintenance. Care should be taken when handling disinfection products.
- For guidance on appropriate frequencies for monitoring (e.g. sanitary inspections, water quality testing), refer to Guidelines for drinking-water quality: small water supplies (WHO, 2024).

B. PROBLEMS AND CORRECTIVE ACTIONS

Each problem in Table 2 is linked to the same question number in Section B of the *Sanitary inspection form*. Where relevant, corrective actions should be completed by trained individuals (according to standard operating procedures where appropriate). Where needed, develop awareness raising and education programmes, and if necessary, rules or regulations, to support safe drinking-water management in the context of the guidance provided in Table 2.

If problems are identified that represent an immediate threat to drinking-water safety (e.g. likely presence of faecal contamination in the water supply, positive *E. coli* detection), consider what immediate actions should be taken to minimize the risk to public health (e.g. advise users to seek an alternative safe drinking-water source, disinfect the water at the point of use).

Table 2. Common problems associated with a household water supply, and suggested corrective actions

Question	Problem identified	Corrective actions to consider
Collection container		
1	The collection container is dirty or in poor condition, which could allow contaminants to enter the water during collection/transportation.	• If the container is dirty, clean and disinfect it (e.g. with chlorine).[a] • If the container is cracked or leaking, replace it. • Communicate to the household the importance of routine cleaning/maintenance of the container.
2	The collection container does not have a tightly fitting cover (e.g. cap, lid) that closes securely, which could allow contaminants to enter the water.	• Find a replacement cover that is clean and fits securely. • If a replacement cover cannot be sourced, replace the container ensuring it has a securely fitting cover.
3	The collection container is stored in a place where it may become contaminated.	• If the container is dirty, clean and disinfect it (e.g. with chlorine).[a] • If there is no dedicated clean storage place for the container, install a storage space (e.g. a shelf raised off the ground). • Communicate to the household the importance of storing the container in the dedicated storage place after each use.
4	The collection container has been used to store liquids other than drinking-water, which may contaminate the water.	• Stop the practice of storing other liquids in the container immediately. • Clean and disinfect the container (e.g. with chlorine),[a] or replace the container if deemed necessary (e.g. if the container has previously stored chemicals, petroleum products). • Communicate to the household the importance of only using the container for drinking-water purposes.
Intermediate storage container		
5	The intermediate storage container is dirty or in poor condition, which could allow contaminants to enter the water during storage.	• If the container is dirty, drain, clean and disinfect it (e.g. with chlorine).[a] • If the container is cracked or leaking, repair or replace it. • Communicate to the household the importance of routine cleaning/maintenance of the container.
6	The intermediate storage container does not have a tightly fitting cover (or lid) that closes securely, which could allow contaminants to enter the water during storage.	• If the cover (or lid) is absent or damaged, find a replacement that fits securely. • If a replacement cover cannot be sourced, replace the container ensuring it has a securely fitting cover.
7	The intermediate storage container has been used to store liquids other than drinking-water, which could allow contaminants to enter the water during storage.	• Stop the practice of storing other liquids in the container immediately. • Clean and disinfect the container (e.g. with chlorine),[a] or replace the container if deemed necessary (e.g. if the container has previously stored animal or human waste, chemicals, petroleum products). • Communicate to the household the importance of using the container for only drinking-water purposes.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
8	There are signs of contaminants in the intermediate storage container (e.g. animals, faeces, sediment build-up), which could present a serious risk to water quality.	• Remove the contaminants immediately if possible. • Consider what immediate actions should be taken to minimize the risk to public health (e.g. advise the household to boil the water if treatment is not currently practised). • Drain, clean and disinfect the container (e.g. with chlorine).[a] • Consider appropriate measures to minimize the risk of contamination entering the container from this source in the future (e.g. install a cover, fence the container area).
9	The intermediate storage container tap or utensil is dirty or in poor condition, which could allow contaminants to enter the water during collection.	• If the tap or utensil is dirty, clean and disinfect it (e.g. with chlorine). • If the tap or utensil is in poor condition, repair or replace it as needed. • Communicate to the household the importance of routine cleaning/maintenance to minimize the risk of contamination.
10	The intermediate storage container is used for household activities other than drinking-water storage (e.g. washing or bathing is carried out within the container), which could allow contaminants to enter the water.	• Stop all other activities within the container. • Drain, clean and disinfect (e.g. with chlorine) the container.[a] • Source a separate container for the other activities. • Communicate to the household the importance of using the intermediate storage container for only drinking-water purposes.
11	The drainage is inadequate (e.g. absent, damaged or blocked drainage channel or soakaway), which could result in stagnant water contaminating the collection area.	• If a drainage channel or soakaway is absent, dig a temporary channel to divert water away from the collection area. Construct a permanent solution as soon as possible. • If a drainage channel or soakaway is not working, consider whether maintenance is needed (e.g. repair, cleaning), or if deepening, widening or extending is required.
12	There are signs of pollution (e.g. open defecation, open drains, animals, drinking troughs for livestock, rubbish) around the intermediate storage container, which could allow contaminants to enter the water.	• Remove the pollution (e.g. remove animal faeces, rubbish). • Consider what actions may be appropriate to relocate or eliminate the source of pollution. • Communicate to the household the importance of keeping the collection area clean.
Final storage container		
13	The final storage container is dirty or in poor condition, which could allow contaminants to enter the water during storage.	• If the container is dirty, clean and disinfect it (e.g. with chlorine).[a] • If the container is cracked or leaking, repair or replace it. • Communicate to the household the importance of routine cleaning/maintenance of the container.
14	The final storage container does not have a tightly fitting cover (or lid) that closes securely, which could allow contaminants to enter the water during storage.	• If the cover (or lid) is absent or damaged, find a replacement that fits securely. • If a replacement cover cannot be sourced, replace the container ensuring it has a securely fitting cover.

Table 2. ...continued

Question	Problem identified	Corrective actions to consider
15	The final storage container has been used to store liquids other than drinking-water, which could contaminate the water during storage.	• Stop the practice of storing other liquids in the container immediately. • Clean and disinfect the container (e.g. with chlorine),[a] or replace the container if deemed necessary (e.g. if the container has previously stored chemicals, petroleum products). • Communicate to the household the importance of using the container for only drinking-water purposes.
16	The final storage container is stored in a place where it may become contaminated.	• If the container is dirty, clean and disinfect it (e.g. with chlorine).[a] • If there is no dedicated sanitary storage place for the container, install a storage space (e.g. a dry, clean shelf raised off the ground). • Communicate to the household the importance of storing the container in the dedicated storage place after each use.
17	The final storage container tap or utensil is dirty or in poor condition, which could allow contaminants to enter the water during collection.	• If the tap or utensil is dirty, clean and disinfect it (e.g. with chlorine). • If the tap or utensil is in poor condition, repair or replace it as needed, then clean and disinfect it. • Communicate to the household the importance of routine cleaning/maintenance to minimize the risk of contamination.
Household water treatment		
18	Household water treatment is not practised, or is practised incorrectly, which could fail to remove, or introduce, harmful contaminants.	• If household water treatment is required,[d] seek support from local health authorities to help ensure that appropriate treatment technologies are selected, and that household water treatment is practised correctly and consistently. • Review manufacturer's guidance to ensure that household water treatment practice, and maintenance of the treatment unit, is carried out correctly. Ensure also that any chemical reagents (e.g. flocculant, chlorine) are stored correctly and are used within their expiry date.

[d] Household treatment is not required if the household water is sourced from a safely managed drinking-water supply, and is considered to be safe for consumption i.e. sourced from an improved water source (e.g. piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater collection), which is located on premises, available when needed and free of faecal and priority chemical contamination.

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Annex 1
Approach to content development and declarations of interest

The need for updating the World Health Organization's (WHO's) 1997 *Guidelines for drinking-water quality. Volume 3: surveillance and control of community supplies*[1] was identified by the WHO Drinking-water Quality Committee at the *Guidelines for drinking-water quality* expert meeting in Singapore (2008). An expert Working Group was established in 2014 to oversee the update, including the sanitary inspection forms which are covered in this publication.[2] The Working Group was composed of small water supply experts and experienced practitioners, including in the areas of drinking-water supply management, public health surveillance and regulation.

To inform the update of the sanitary inspection forms, WHO commissioned a study in 2015 on the evidence base and experiences on sanitary inspections. This study, led by University of Surrey, United Kingdom of Great Britain and Northern Ireland, consisted of a series of semi-structured expert and practitioner interviews and a systematic literature review. The study was undertaken to identify experiences, benefits and challenges of sanitary inspections, as well as risk factors associated with each technology/scenario for which there was an existing WHO sanitary inspection form. The findings of this evaluation were prepared as an internal report to WHO in 2015 and the findings from the expert interviews were published in the peer-reviewed literature.[3]

These findings were discussed at a WHO-led international technical meeting on updating WHO's small supplies Guidelines in Guildford, the United Kingdom (2015). Participants included researchers at the University of Surrey, the Working Group, and other experts. The outcomes from this meeting included a recommended list of water supply technologies/scenarios to develop sanitary inspection forms for, and a proposed "package" for each of these. In addition to the sanitary inspection form, it was agreed that a technical fact sheet and a management advice sheet would also be developed for each water supply technology/scenario, to ensure greater alignment with the water safety planning approach. These elements were further developed based on expert consultation in 2017, as well as the outcomes from a WHO technical meeting in Chișinău, Republic of Moldova (2017), which included the Working Group and other experts.

Four prototype sanitary inspection packages were then developed, led by the University of Surrey in coordination with WHO. The risk factor questions in the new sanitary inspection forms were based on existing WHO sanitary inspection forms, the evidence base generated in the 2015 report, and Working Group and additional expert and practitioner feedback. The four prototype packages were subject to additional review, updated, and then piloted in 2018. Piloting consisted of expert desk-based review and practitioner application in the field in 18 countries, across all six WHO regions.[4] The outcomes from this global piloting resulted in updates to the four protype packages.

Further sanitary inspection packages were subsequently developed by the University of Surrey in coordination with WHO, and reviewed by the Working Group and additional experts, including the University of North Carolina, United States of America, and updated. These packages were subject to piloting in 2021 in 21 countries across all six WHO regions.[5] The pilots included expert desk-based review and practitioner application in the field.

1 Guidelines for drinking-water quality. Volume 3: surveillance and control of community supplies. 2nd edition. Geneva: World Health Organization; 1997.

2 This publication on sanitary inspection packages complements the Guidelines for drinking-water quality: small water supplies. Geneva: World Health Organization; 2024. Together, the *Guidelines for drinking-water quality: small water supplies* and this publication update and supersede the 1997 Guideline.

3 Pond K, King R, Herschan J, Malcolm R, McKeown RM, Schmoll O. Improving risk assessments by sanitary inspection for small drinking-water supplies– qualitative evidence. Resources. 2020;9(6):71. doi.org/10.3390/resources9060071.

4 Afghanistan, Australia, Burkina Faso, Canada, Ethiopia, India, Indonesia, Republic of Korea, Myanmar, New Zealand, Papua New Guinea, Serbia, Sri Lanka, Switzerland, United Republic of Tanzania, the United Kingdom, the USA, Viet Nam.

5 Australia, Bangladesh, Burkina Faso, Cambodia, Ethiopia, Ghana, Honduras, Iceland, Indonesia, Jordan, Kenya, Mali, Nepal, Niger, Serbia, South Africa, the United Kingdom, the USA, Uganda, Vanuatu, Zimbabwe.

Throughout this development process, the materials were discussed at – and further developed based on the outcomes from – dedicated workshops with practitioners at several international conferences, including WASH Futures in Brisbane, Australia (2018) and the 41st (Nakuru, Kenya; 2018) and 42nd (virtual, 2021) Water Engineering and Development Centre International WASH Conferences.

All of the sanitary inspection packages were updated based on the 2021 piloting experiences, and finalized between 2022 and 2023.

Before the key expert meetings mentioned above, and for the small system Guidelines work more broadly, all Working Group members, and the lead researcher at the University of Surrey, submitted declarations of interest to WHO. These were to disclose any potential conflicts of interest that might affect, or might reasonably be perceived to affect, their objectivity and independence in relation to the subject matter of the guidance. WHO reviewed each of the declarations and concluded that none could give rise to a potential or reasonably perceived conflict of interest related to the subjects discussed at the meetings or covered by the guidance.

Annex 2

Summary of key changes to the sanitary inspection packages

The sanitary inspection packages presented in this publication are updates of the sanitary inspection forms with an accompanying illustration that were published in the *Guidelines for drinking-water quality. Volume 3: surveillance and control of community supplies.*[1] These packages were developed based on the methodology described in Annex 1.

The key changes made during this revision process are summarized in the table below.

Table A2.1 Key changes made to the sanitary inspection packages (where each package comprises the form, technical fact sheet and management advice sheet)

Item	Key changes made
Water supply technologies/ scenarios covered	New and/or stand-alone packages have been developed for: a. piped distribution – storage tank b. piped distribution – network c. piped distribution – tapstand d. kiosk e. household practices. ***Notes*** • Packages a–c are new stand-alone packages that have been developed based on the 1997 sanitary inspection form for "piped distribution". • The new package for household practices (e) includes elements relating to household tanks from the 1997 form for "filling stations, tanker truckers and household tanks". • The 1997 form for "open dug well" was not updated in this publication; references to the importance of using improved sources where possible have been added to the covered dug well packages. • The 1997 form for "water treatment plant" was not updated in this publication because of the site-specific nature of the type of information captured in this form. With these updates, this publication includes 13 sanitary inspection packages, compared to 11 sanitary inspection forms in the 1997 Guidelines.[1]

[1] Guidelines for drinking-water quality. Volume 3: surveillance and control of community supplies. 2nd edition. Geneva: World Health Organization; 1997.

Table A2.1 continued Key changes made to the sanitary inspection packages (where each package comprises the form, technical fact sheet and management advice sheet)

<table>
<tr><th>Item</th><th>Key changes made</th></tr>
<tr><td>Sanitary inspection form</td><td>Section 1

Includes the option to capture more detailed general information (including basic information relating to climate change impacts and water availability) that can inform a risk assessment and support the development/maintenance of a small supply inventory. It also includes an option to record more comprehensive information on water quality testing.

Section 2

Includes:
updated questions (i.e. risk factors) based on scientific evidence and expert opinion; each question includes explanatory text to aid with answering and support consistency among individuals completing the form;
consideration of water quantity issues, which have been highlighted where relevant;
updated illustration depicting the risk factors;
addition of a “what action is needed?” column to prompt corrective actions to manage identified risk factors, and to better align with the water safety plan approach; and
removal of quantitative risk ranking (for example, low, intermediate, high and very high risk) based solely on a tally of equally weighted risk factors (removed to avoid potential misrepresentation of site risks, for example, if only one or two risk factors are identified, they may pose a significant risk to water safety, such that a risk ranking of “low” for the site is not appropriate).</td></tr>
<tr><td>Technical fact sheet (new)</td><td>Provides basic technical information to support the completion of the sanitary inspection form.
Includes illustrations depicting the water supply in a “sanitary condition”, which can be compared with the illustration in the sanitary inspection form to help identify risk factors.</td></tr>
<tr><td>Management advice sheet (new)</td><td>Provides general guidance to support the ongoing safe management of the water supply through basic operations, maintenance and monitoring, in line with water safety planning principles.
Includes simple problem-solving advice (i.e. possible corrective actions) to address risk factors included in the sanitary inspection form.</td></tr>
</table>

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