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MINISTRY OF
WATER AND IRRIGATION

The National Roadmap for the Institutionalization of Climate Resilient Water and Sanitation Safety Planning in Jordan

2026

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January 2026

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Acronyms and Abbreviations

ACWUA	Arab Countries Water Utilities Association
CRWSP	Climate Resilient Water Safety Planning
CRWSSP	Climate Resilient Water and Sanitation Safety Planning
CRSSP	Climate Resilient Sanitation Safety Planning
JS286	Jordanian Standard 286/2015 on Water/Drinking Water
JVA	Jordan Valley Authority
KPIs	Key Performance Indicators
Miyahuna	Miyahuna Water Company
MoA	Ministry of Agriculture
MoH	Ministry of Health
MWI	Ministry of Water and Irrigation
NRW	Non-Revenue Water
SOPs	Standard Operating Procedures
SSP	Sanitation Safety Planning
UNICEF	United Nations Children's Fund
WAJ	Water Authority of Jordan
WHO	World Health Organisation
WSP	Water Safety Planning
WSS	Water Supply Systems
WWTP	Wastewater Treatment Plant

Glossary

Safe water management	the use of a comprehensive risk assessment and risk management approach that encompasses all steps in the water supply from catch ment to consumer to ensure the safety of drinking-water.[1]
Risk	is the probability of an adverse effect in an organism, system or (sub) population caused under specified circumstances by exposure to an agent.[2]
Risk assessment	is a process intended to calculate or estimate the risk to a given target organism, system or (sub)population, including the identification of uncertainties, following exposure to a particular agent, taking into account the inherent characteristics of the agent of concern as well as the characteristics of the specific target system.[3]
Risk management	is the process of weighing policy alternatives in consultation with all interested parties, considering risk assessment and other factors relevant for the protection of health, and selecting appropriate prevention and control options.[4]

1 WHO (2009; updated 2012). Water safety plan manual: step-by-step risk management for drinking-water suppliers.

2 WHO (2002). Principles for the Assessment of Risks to Human Health from Exposure to Chemicals.

3 WHO (2004). Harmonization Project Document No. 1: IPCS Risk Assessment Terminology. Geneva.

4 WHO (2004). Harmonization Project Document No. 1: IPCS Risk Assessment Terminology. Geneva.

Executive Summary

The National Roadmap for the Institutionalization of Climate Resilient Water and Sanitation Safety Planning in Jordan is developed under the project entitled: "Institutionalization of Climate-Resilient Water and Sanitation Safety and Security Planning", hereafter referred to as "the project." The project is carried out by the Arab Countries Water Utilities Association (ACWUA), with the support of the United Nations Children's Fund (UNICEF), funded by Government of Netherlands under the PROSPECTS programme. Its main aim is to integrate Climate Resilient Water and Sanitation Safety Planning (CRWSSP) into Jordan's national water institutions as a way to prioritize interventions within the water sector, including for most vulnerable communities and address climate change impacts on water supply and environmental sanitation systems. Accordingly, the roadmap was prepared in close collaboration with, and under the stewardship of, the Ministry of Water and Irrigation (MWI), the Water Authority of Jordan (WAJ) and its operating companies. It addresses two central questions: *why* the phased transition from voluntary to mandatory adoption of CRWSSP approach is necessary, and *how* risk assessment and risk management of CRWSSP can be embedded into the routine operations of water service providers in Jordan as indicated in the Jordan National Water Strategy, and recommended by the World Health Organization (WHO) among other international organizations.

This roadmap builds on the findings of the assessment titled 'Enabling Environment and Institutional Assessment and the Proposed Institutional Setup and Its Rationale' which was developed earlier, and referred to hereafter as "the assessment". The assessment presents an analysis of the existing enabling environment, including the institutional arrangements and the identified need to establish dedicated units within water utilities responsible for the development and implementation of water and sanitation safety plans, as well as corresponding units within WAJ to perform internal auditing and oversight of plan implementation. This roadmap sets out the specific actions to enable a phased transition from voluntary to mandatory adoption of water and sanitation safety planning approaches and defines the indicative timeframe for their gradual implementation.

At the operational level, this document defines a set of risk prioritisation matrices to be used by administrative units[5] established under WAJ and the water utilities in preparation for Climate-Resilient Water Safety Planning (CRWSP) and Climate-Resilient Sanitation Safety Planning (CRSSP) implementation. These matrices aim to prioritize water and sanitation systems within each utility in order to identify those most in need of risk assessment and risk management. These matrices were developed through a series of stakeholder consultations during which the main actors from the water utilities, WAJ, and the Ministry of Water and Irrigation (MWI), jointly discussed and agreed on the prioritisation criteria and their corresponding weights, ensuring national-level consistency in selecting water and sanitation systems for initial implementation. In addition, the roadmap was validated and endorsed at technical level.

5 See the "Climate-Resilient Water and Sanitation Safety and Security Planning Institutional Setup" report by ACWUA (2025).

Introduction

Jordan's water sector is under increasing strain from the combined impacts of climate change, rapid population growth, and accelerating urbanisation. The country depends heavily on groundwater to meet the increasingly competing domestic, industrial, and agricultural water demands. However, decades of excessive abstraction have led to declining groundwater levels across all major aquifers, resulting in persistent water quality challenges. Moreover, the intermittent Water Supply System (WSS) and ageing tertiary distribution networks pose significant risks of contamination during periods when the system is not pressurised. Contamination often results from human activities, particularly wastewater generation in areas lacking adequate sewerage network and services systems. These factors highlight the critical need for resilient water management and enhanced Water Safety Planning (WSP), including water reclamation and reuse. As a matter of fact, protecting water quality and ensuring the sustainability of water resources requires safe management of reclaimed water, which offers a reliable, year-round alternative to freshwater. Reclaimed water supports agricultural production while alleviating pressure on scarce groundwater and surface water sources. When managed safely through Sanitation Safety Planning (SSP) for instance, it enhances soil productivity, maintains crop quality, and reduces risks associated with pathogens, antimicrobial-resistant microorganisms, and chemical contaminants. This will consequently strengthen Jordan's long-term water security and climate resilience strategies and reduce cultivation reliance on freshwater resources.

Protecting water quality depends not only on effective water and wastewater management, but also on the resilience and integrity of the entire water and wastewater systems, ideally managed at the watershed level. Risk assessment and risk management at this scale provide a comprehensive framework for identifying, analysing, and mitigating threats that may affect water quality, water availability, ecosystems, and human health. As watersheds integrate all upstream activities including agricultural practices, industrial discharges, urban runoff, wastewater releases, land-use changes, and natural hazards, risks must be evaluated holistically across the entire catchment as well as all related activities. This requires assessing contamination sources, hydrological dynamics, communities and infrastructure vulnerabilities, and the potential impacts of climate change, particularly droughts and extreme floods events. Once risks are identified and assessed, risk management focuses on designing and implementing targeted interventions such as pollution source control measures, land-use regulations, nature-based solutions, enhanced monitoring systems, and strengthened coordination mechanisms among stakeholders. Managing risks at watershed scale ensures that decisions are aligned with ecosystem processes, enhances resilience, promotes integrated protection of water from source to end user, and protection of end-products and direct exposed groups to health risks.

Notwithstanding the importance of risk assessment and risk management for safeguarding water quality, the approach continues to face several interrelated challenges that complicate decision-making and long-term planning as shown in Figure 1. Watersheds often extend across multiple administrative boundaries, requiring strong inter-institutional coordination that is frequently difficult to achieve. Hydrological systems are complex and dynamic, influenced by climate change, land-use practices, and seasonal variability, which makes data collection and predictive modelling particularly demanding. Many basins lack continuous and reliable monitoring data, thereby limiting the accuracy of risk evaluations. Different stakeholder uses of agriculture, industry, domestic water supply, and environmental protection can create conflicts. Financial and technical constraints further hinder

the implementation of mitigation measures, while political, social, and regulatory factors may slow the pace of reform. Together, these challenges highlight the need for integrated planning, improved data systems, and stronger institutional cooperation to ensure effective watershed risk assessment and risk management.

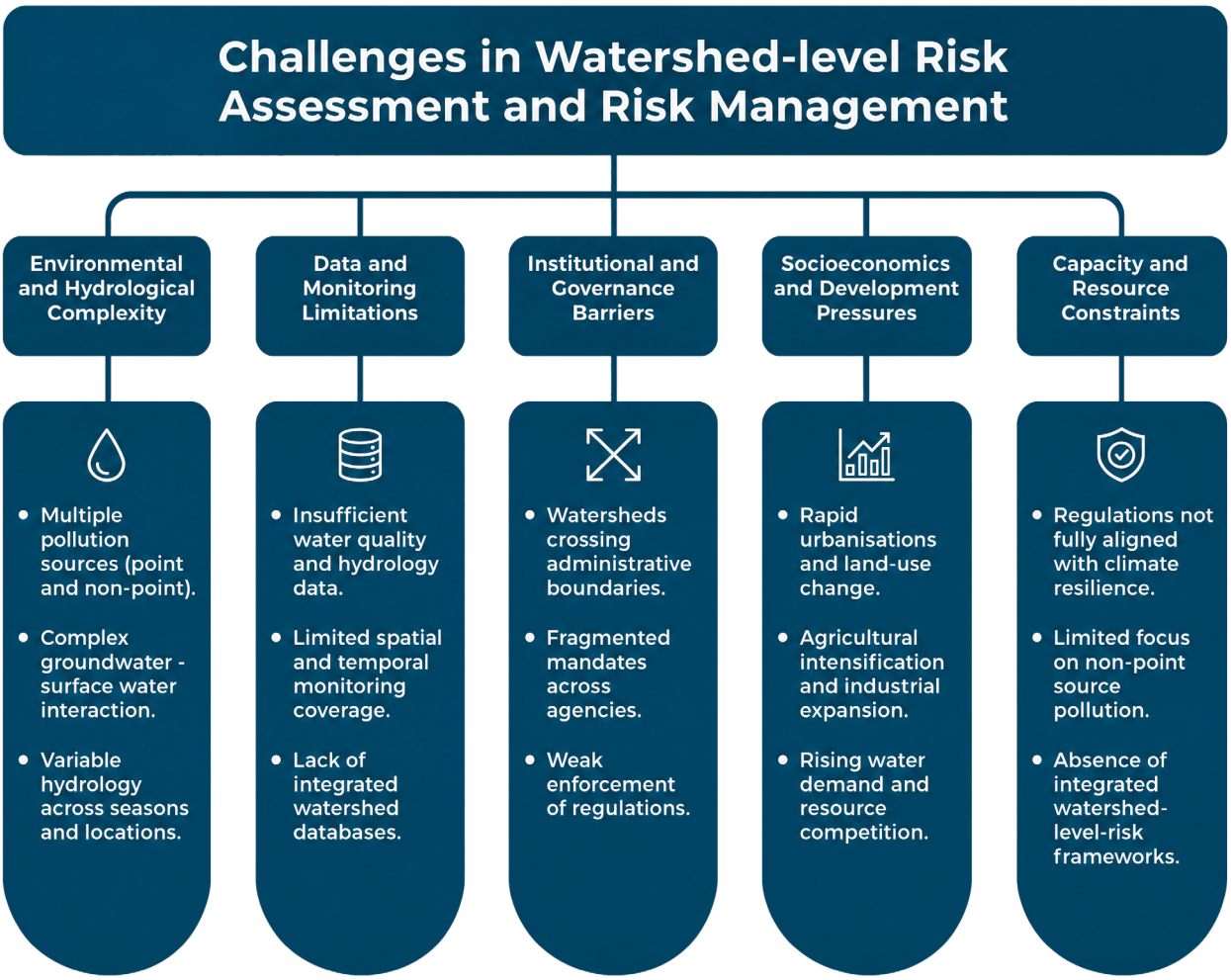


Figure 1. Challenges in watershed-level risk assessment and risk management.

Recognising that Jordan must address these challenges, it is crucial for the country to adopt proactive management approaches grounded in the risk assessment and risk management approach, as demonstrated in Figure 2. The approach promotes the development of shared surveillance systems, the creation of unified policies and strategies, the establishment of multi-sectoral taskforces, and increasing investments in integrated solutions. To prevent water pollution, risk assessment and risk management approach can be implemented by adopting WSP and SSP frameworks developed by WHO.

These frameworks provide a systematic methodology for risk assessment and risk management across the entire water supply and sanitation chains, taking into account all activities in the watershed. The frameworks also address the impacts of climate change through the Climate Resilient Water Safety Planning (CRWSP) and the Climate Resilient Sanitation Safety Planning (CRSSP).

WSSs managed under the CRWSP framework and sanitation systems managed under the CRSSP are properly maintained and continue to operate effectively compared to similar systems lacking such approaches To ensure safe and reliable fit-for-purpose water delivery, CRWSP and CRSSP require operational control measures, smart and real time systems to oversee parameters of concern, and continuous control of water, cultivated products and food.



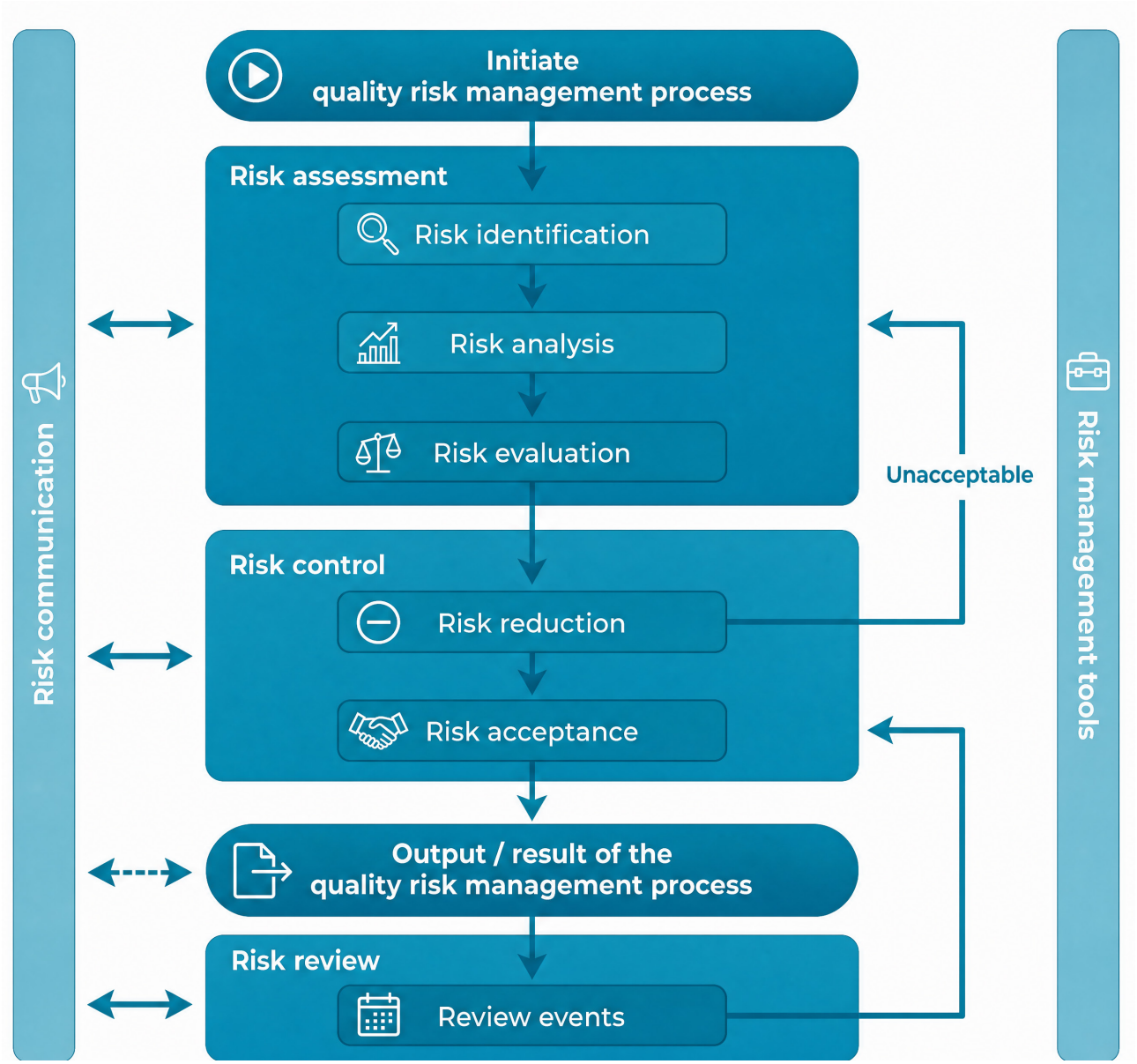


Figure 2. Risk assessment and risk management approach of the WHO https://www.who.int/docs/default-source/medicines/norms-and-standards/guidelines/production/trs981-annex2-who-quality-risk-management.pdf

Jordan's legislative, institutional, and regulatory systems have consistently achieved high drinking water compliance rates exceeding 99% for microbiological standards. Legislators so far have also ensured 67% coverage of sanitation services and water reclamation for controlled agricultural use. However, sustaining these achievements will require wider adoption of the CRWSP and CRSSP preventive approaches, particularly considering the extreme weather events experienced over the past decade.

The National Water Strategy 2023-2040 strongly encourages WAJ and the water utilities to adopt a risk management approach (Chapter 4, page 46). It explicitly states that: "given the increased challenges on water quality that is impacted by climate change, WAJ and the water utilities will implement the CRWSP as a regulatory requirement as per the national preventive water quality management framework". Although WSP was first piloted in Jordan nearly two decades ago, it was never fully adopted or integrated into the routine operations of the water sector. A significant shift began with the assessment which proposed the establishment of dedicated structures within WAJ and the water utilities to ensure the long-term sustainability of planning and implementation processes. The proposed administrative units (a directorate and two sections) within WAJ have already been formally approved under Ministerial Decree No. 3/34/3940 dated November 11, 2025. The approval of the established units at the AWC can be found under the decree number 5/278 dated 10/2/2026, while approval in Miyahuna and YWC is anticipated in the near future. The proposed units emerged from the aforementioned baseline assessment that evaluates the need for institutionalising water and sanitation safety planning in Jordan. It is important to note that the success of this roadmap will rely on the active participation of all stakeholders across the water supply and sanitation service chains, supported by effective communication strategies and well-coordinated efforts.

Roadmap Vision

To ensure safe, reliable, and sustainable water and sanitation services for all people living in Jordan by embedding climate resilience and proactive risk management into national water and wastewater systems and water utility practices.

Roadmap Objective

Jordan aspires to build a water sector that anticipates and adapts to climate-related hazards through integrated planning and strengthened institutional capacities. Through coordinated actions across the government, promoting inclusive management and directing strategic investments, this roadmap aims to employ the risk assessment and risk management approach and secure water resources. **The roadmap's objective is to enable the water utilities to implement CRWSSP, achieving coverage of 100% for the drinking water systems and at least 50% of wastewater systems by 2040.**

PART 1

Part I - Phased Transformation from Reactive to Proactive Water and Sanitation Quality Management

Water quality management in Jordan relies heavily on end-product testing. This testing approach places a considerable strain on the sector and does not fully guarantee control over the safety and the quality of drinking water or reclaimed water. It therefore offers little room for anticipatory action before risks escalate into public health incidents, extensive environmental degradation, significant economic losses in the agricultural sector, and erosion of public trust in water services, limiting the ability to take timely, preventive intervention, limiting the ability to take timely, preventive intervention. Additionally, water supply in Jordan is intermittent and consumers typically receive water once per week or less, depending on the area of service. This poses a burden to water quality management due to the risk of contaminants entering the aging water network when it is not pressurised. Challenges related to water quality can arise in spite of more than 99% compliance with the Jordanian standard 286/2015 on Water/Drinking water (JS 286) due to the following factors:

1. Classic "faecal indicators" have different sensitivity to disinfection and environmental conditions than of viral or protozoan pathogens. The indicator might disappear with disinfection, but the water still contains other disinfection resistant pathogens.

2. Disease outbreaks are sometimes reported in the absence of faecal indicators.

3. Microbial testing has limited early-warning capability since drinking water is typically distributed and consumed before the results are available.

4. Tested water volumes are rarely statistically representative; each sample represents only a singular result that cannot be generalised statistically.

5. There is a limited capability to detect short-term fluctuations in water quality.

6. Responding to any incident has been reactive rather than proactive or preventive.

Wastewater Treatment Plants (WWTPs) in Jordan present additional challenges because most of these plants employ biological treatment technologies, which by nature cannot guarantee fully consistent performance around the clock. Biological treatment systems are living ecosystems, and their efficiency is influenced by a range of external and operational factors. Weather fluctuations, such as extreme heat or cold, can slow or accelerate microbial activity, while sudden changes in influent quality, hydraulic loading, or the presence of toxic substances can disrupt the treatment balance. Additionally, the type of biological technology used whether activated sludge, trickling filters, or lagoons has its own operational sensitivities and limitations. Given these inherent fluctuations, achieving continuous compliance with effluent standards is challenging. For this reason, strong and proactive safety planning becomes essential, particularly where human health and environmental

protection are critical. This kind of planning ensures that risks are systematically identified, barriers are in place to manage variability, and reclaimed water can be used safely and reliably throughout the year.

CRWSP and CRSSP frameworks, introduced by WHO, are designed to ensure safe delivery of drinking water and safe treatment and reuse of wastewater. CRWSP covers the full drinking water supply system (catchment, treatment, storage, distribution up until household storage), while CRSSP encompasses the full sanitation chain (from Toilet to Table). Together, these frameworks provide an integrated approach that covers the complete cycle of water safety and sanitation management, from catchment protection and raw water licensing, through treatment and distribution, to wastewater collection, treatment, and safe reuse in agriculture, ensuring not only safe drinking water but also safe food at the consumer's table as shown in Figure 3. It is worth noting that CRSSP must include populations not served by a sewerage network and that these plans must consider and encourage decentralised wastewater treatment systems to ensure safely managed water resources. Moreover, the CRWSP must also cover water supplied by tankers to households, whether to compensate for water shortages or to serve unconnected populations.

Assignment and development agreements between WAJ and the water utilities will establish performance indicators to ensure water safety from raw water sources through treatment, storage, transmission, and distribution. Similarly, performance indicators will ensure safe wastewater collection, transmission, treatment and reuse, including the supporting infrastructure such as filters, distribution system, and storage ponds at farm level.

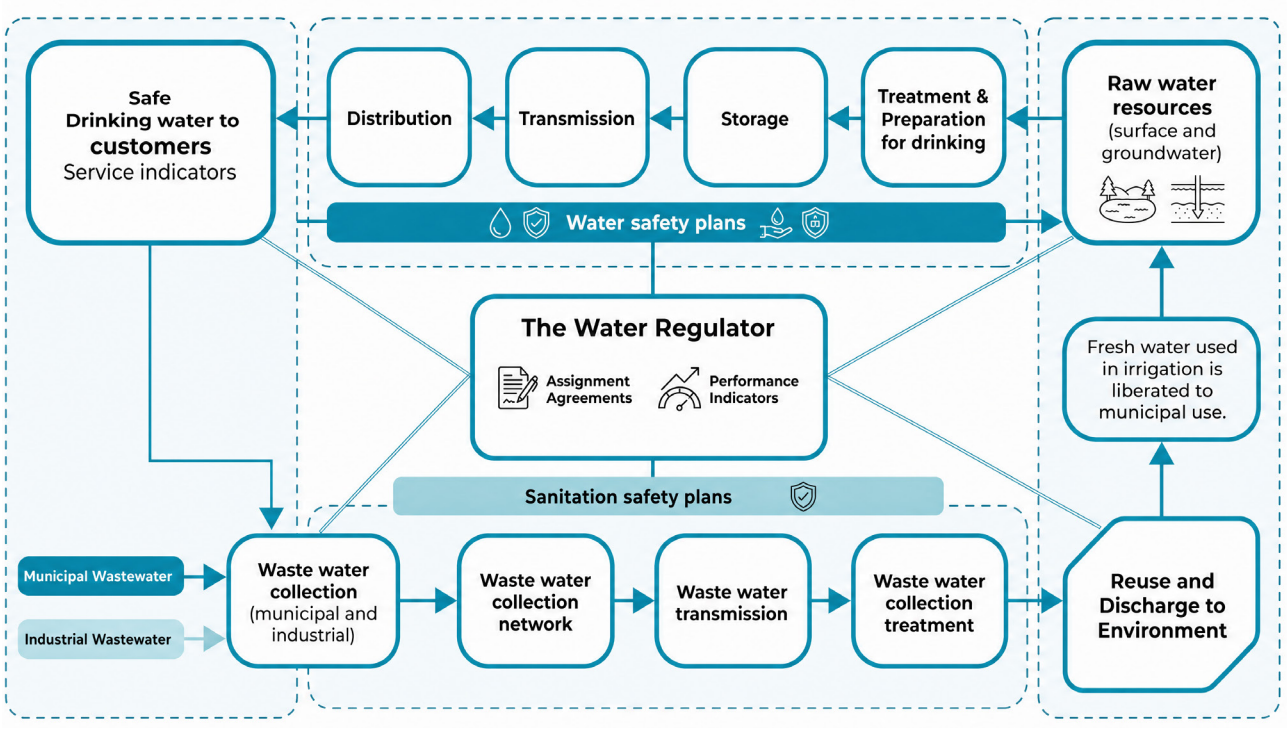


Figure 3. The water supply chain from Catchment to Consumer and from Toilet to Table.

A gradual transformation from a reactive approach focused on managing water quality complaints and incidents to a proactive approach in water quality management is summarised in Table 1 below. The table suggests transformation steps to ensure public and environmental health by shifting from a problem-driven (post-harm) approach to a risk identification and a risk management approach. Key transformation tools include legal framework revisions, strengthening institutional arrangements, capacity building, and the development of the national roadmap to guide the transformation process as already indicated by the institutional assessment. A phased transition is recommended, beginning with a voluntary, incentive-based approach (e.g., additional budget allocation for utilities that implement risk management, reduced inspection frequency, and publishing utility performance as a kind of reputational incentive) and gradually evolving into a mandatory regulatory framework. Capacity building will be essential throughout the process, enabling the regulatory bodies to review, audit, monitor, and enforce the CRWSP and CRSSP developed by the water utilities and operators who will be required to develop their operational monitoring system to ensure compliance and continuous improvement.



Table 1. Transformation tools from reactive to preventive water and wastewater quality management: main elements of the road map.

Reactive approach	Proactive (preventive) approach	Required transformation tools
» Responds after contamination occurs. » Reacts to laboratory test results and complaints.	» Identifies and manages risks before they impact water and/or produce quality issues. » Is resilient to climate change.	» Enforce adoption of the planning and implementation tools as recommended by WHO. » Institutionalise CRWSP and CRSSP as per the Enabling Environment and Institutional Assessment report.[6] » Build the capacity of all professional tiers in all relevant institutions. » On the job training while implementing demonstration sites.
» Delays response due to limitations in testing methods.	» Establishes continuous monitoring, auditing and long-term planning.	
» Focuses on incident-driven interventions.	» Focuses on resilience, sustainability and risk prevention. » Is understood and implemented by all concerned national authorities.	
» Exhibits fragmented management.	» Enables integrated and inclusive management at watershed level.	*In the short term:* » Plan and implement CRWSP and CRSSP in a separate mode. This entails addressing each concept individually rather than adopting an integrated approach. *In the long term:* » Plan and implement CRWSP at watershed level. » Establish clear communication and coordination plans for short- and long-term planning.

6 See the "Enabling Environment and Institutional Assessment and the Proposed Institutional Setup and Its Rationale", or deliverable 1 of this project.

1.1 Steps to move from Voluntary to Compulsory CRWSP and CRSSP

The following steps shown in Figure 4 are grouped in three stages and describe the interventions necessary to move from voluntary to compulsory CRWSP and CRSSP adoption. Stage 2 runs parallel to stage 1, while stage three describes what is needed at operational and cross sectoral level. A recommended timeline for implementation across WAJ and the water utilities is then suggested.

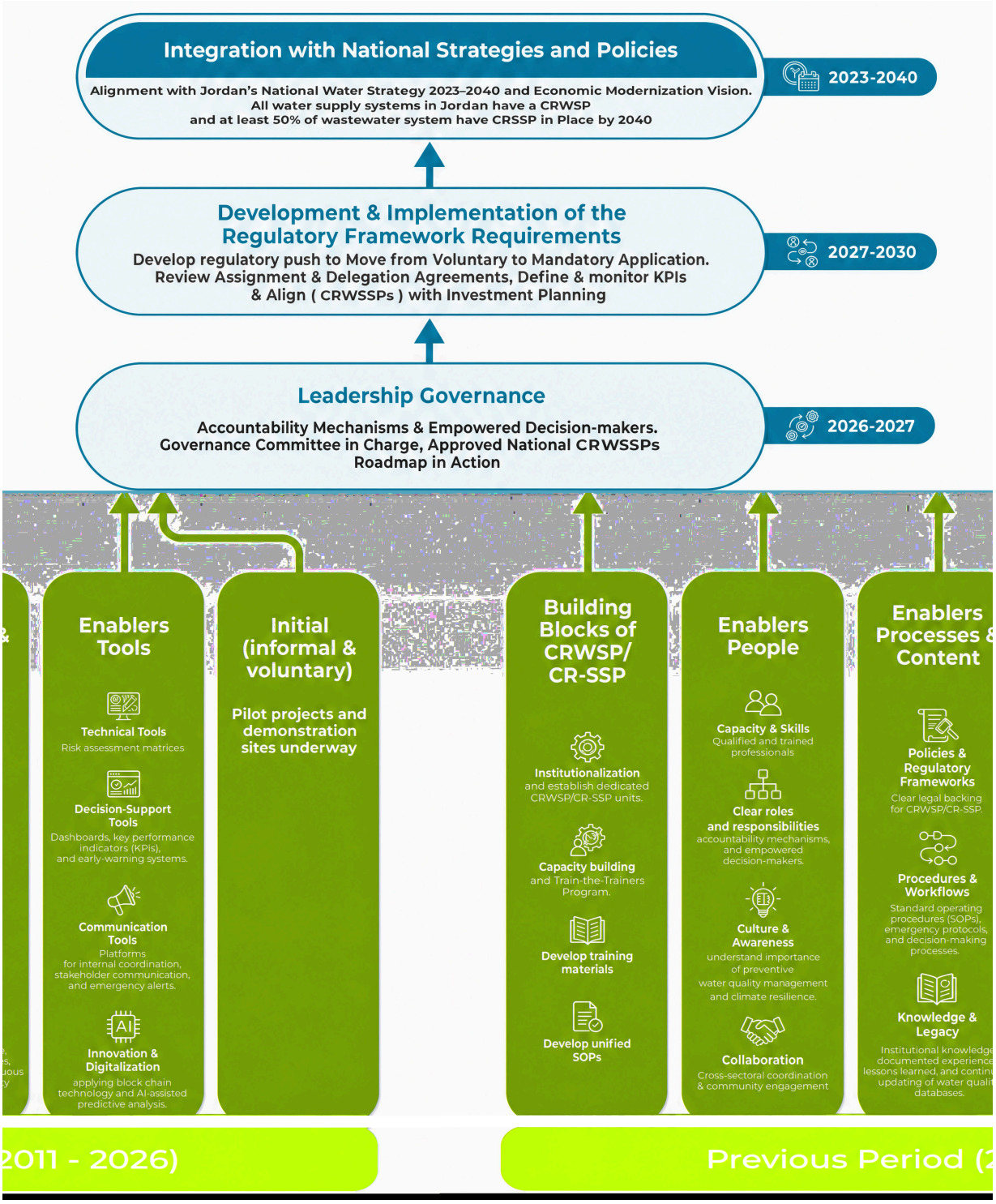


Figure 4. Transition from voluntary to compulsory CRWSP and CRSSP

a. Strengthen institutional arrangements: establish dedicated units for CRWSP and CRSSP

As previously mentioned, and based on the assessment, the establishment of dedicated units responsible for risk assessment and risk management across both the water supply and sanitation chains is recommended. In line with this recommendation, WAJ has recently created new units under the Laboratories and Quality Affairs Directorate by renaming the Quality Directorate to 'Water and Wastewater Quality and Safety Directorate', and incorporating a newly established CR-SSP section, and a merger of the WSP and Watershed Protection sections, to be as follows:

1. Water and Wastewater Quality and Safety Directorate

    A. Watershed Protection and Climate Resilient Water Safety Sections

    B. Climate Resilient Wastewater Safety Planning Section[7]

This consolidation was formalised by the Ministerial Decision 3/34/3940 dated November 11, 2025. These units will be responsible for reviewing CRWSPs and CRSSPs submitted by the water utilities, monitoring their implementation, and serving as internal auditors. As previously discussed, the assessment further proposes the establishment of additional units within the water utilities along with the establishment of the Governance Committee[8] comprising members from utilities, WAJ, JVA, and MWI[9] to support the establishment and operationalisation of these units. Furthermore, a gender-balanced participation policy was already established at WAJ and the water utilities to enhance decision-making and accountability. Diverse teams bring broader perspectives, increase insights, and improve problem-solving. Gender inclusion policy within the established units supports equity and ensures that planning processes do not unintentionally exclude or disadvantage certain people.



7 See the "Climate-Resilient Water and Sanitation Safety and Secuirty Planning Institutional Setup"report by ACWUA (2025)

8 The Governance Committee will be chaired by the Secretary General of WAJ. It will include representatives from MWI, and the executive directors of the water utilities. The Committee will ensure effective oversight, strategic alignment, and institutional coordination to oversee reviews and approvals.

9 MWI supports the governance committee by coordinating several key directorates to ensure the success of CR-WSSSPs. These units provide strategic planning, demand management, alignment with donor and regional initiatives, drought risk integration, and environmental and climate considerations. Together, they ensure CR-WSSSPs are comprehensive, forward-looking, and aligned with national and international priorities.

b. Obtain cabinet approval for the new structure

Although formal cabinet approval of the organisational structure proposed in the assessment is not strictly required for the newly established units to operate effectively, securing this approval would significantly enhance their long-term sustainability. WAJ's organisational structure has undergone frequent revisions in recent years, and high-level endorsement would provide stability, institutional legitimacy, and continuity for these units regardless of administrative or leadership changes. Cabinet approval would also help ensure that the units' mandates are protected, their roles are clearly recognised across government entities, and the resources needed for ongoing risk assessment and risk management activities are more reliably maintained.

c. Define and monitor Key Performance Indicators (KPIs)

Defining KPIs for the CRWSP and CRSSP dedicated units established under WAJ and the water utilities will provide quantifiable metrics that allow these organisations to track and monitor how well they are performing with respect to the development and implementation of the plans. The KPIs can be used by the water utilities to prioritise investments and allocate resources supporting evidence-based decision-making. Similarly, WAJ can use the KPIs to create a clear basis for reporting on the performance of the water utilities regarding water and sanitation safety planning and improving their accountability and transparency, which ultimately enhances trust and demonstrates progress towards national targets. The KPIs will enable WAJ and the water utilities to carry out long-term strategic planning for expanding the systems covered by the CRWSP and CRSSP, while also helping demonstrate implementation results which supports access to donor funding. According to Table 2, the KPIs shall be finalized by the year 2027, and shall be proposed based on a consultation and approved by the governance committee as per the conducted institutional assessment.

d. Align with investment plans and water and wastewater master plans

Embedding CRWSP and CRSSP into the water utilities' investment and master plans will enable them to secure funding in advance for anticipatory actions, risk mitigation activities, infrastructure demanded upgrades, monitoring systems, and early warning mechanisms. This will shift financial planning away from crisis management toward prevention. Donors are more likely to provide funding when they see structured, risk-based investment planning that demonstrates foresight and accountability. This will also promote stronger and more coordinated partnerships across the sector, as the improved ability to plan and seek funding will create a more favourable climate for private sector engagement and investments as well.

e. Incorporate CRWSP and CRSSP into water utilities' strategies

The integration of CRWSP and CRSSP requirements within the water utilities' strategic plans will result in risk management becoming an institutional responsibility and not an optional or temporary action. This integration will ensure that risks are anticipated and predicted, reducing incidents of contamination, and improving resilience to climate shocks. It will also ensure that senior management becomes formally responsible for the development and implementation of the plans, which facilitates resource allocation.

f. Revise the Assignment and Development agreements between WAJ and the water utilities

Revisiting and amending the delegation and formal assignment agreements drawn between WAJ and the water utilities is the most consequential and decisive measure required to formally integrate and enforce risk management across all water utilities. This would allow for the explicit incorporation of risk assessment and risk management obligations and KPIs into the existing assignment agreements, thereby establishing clear accountability for water utilities in how these risks are identified, managed, and monitored over time.

Thus far, the feasibility of amending the existing assignment agreements between WAJ and Miyahuna was discussed, while consultations with the two other water utilities will follow. These discussions indicate that the proposed contractual modifications are feasible, but that their success depends largely on securing strong political commitment at the ministerial level. With clear high-level support, these contractual changes could institutionalise the risk management process, ensuring consistent implementation across water utilities and enhancing long-term sector resilience.

As a base toward changing the agreements, the concerned unit may develop an internal MOU, approved by the Minister, to formalize the adaptation of CR-WSSSP within the utilities, under the oversight of the WAJ. This MOU will serve as a foundation for revising and updating the delegation and assignment agreements between the Water Authority of Jordan (WAJ) and the utilities under its oversight

g. Develop unified Standard Operating Procedures (SOPs) for the newly established CRWSP and CRSSP units

Clear SOPs are essential for strengthening the newly established units' performance because they ensure consistent, standardised, and efficient execution of tasks related to CRWSP and CRSSP. By clearly defining roles, responsibilities, and workflows, SOPs will reduce errors, enhance accountability, and support compliance with the Jordanian Standards on drinking water (JS286:2015) and reclaimed domestic wastewater (JS893:2021). They also preserve institutional knowledge, streamline training, and facilitate effective auditing and monitoring. SOPs also play a critical role in reducing operational and safety risks, improving emergency response, and providing a strong foundation for digitalisation and continuous improvement. Through this project, the core set of Standard Operating Procedures (SOPs) for WAJ and its Utilities key departments have successfully established, which are now finalized and considered as a reference for any needed improvments. As a subsequent phase, more specific SOPs will be developed for each utility, taking into account the unique internal contextual factors of each. These SOPs will not only enhance operational efficiency but will also reflect the roles of supervisory and operational functions within each utility and WAJ, ensuring that all entities benefit from the foundational procedures developed at the base level.

h. Engage Ministry of Agriculture (MoA) and Jordan Valley Authority (JVA)

The JVA plays a central role in the water sector through its mandate to enhance the efficiency of agricultural water use, design and implement irrigation projects, and operate all dams and water-harvesting structures. MoA has the main role of regulating the agricultural sector. Given these

responsibilities and that the agricultural sector is the main consumer of half of fresh water in addition to the reclaimed water (more than 95% is consumed by agriculture across Jordan), MoA and JVA are key stakeholders in both CRWSP and CRSSP processes.

Their involvement is essential not only for implementing the developed plans but also for actively contributing to their formulation, particularly where reclaimed water is used for irrigation. To ensure effective collaboration and long-term sustainability, structured and well-defined coordination and communication plans should be established. This will facilitate coordination between JVA, water utilities, and other relevant institutions, enabling smooth information flow, clear alignment of roles and responsibilities, and consistent engagement throughout the planning and implementation stages.



i. Conduct capacity building and piloting exercises

Capacity building of the relevant operational and technical staff of WAJ and water utilities, as well as relevant GOJ personnel (e.g. Ministry of Health (MOH), MWI, JVA) who are involved in the process of CRSSP formulation, when combined with practical piloting exercises, is considered fundamental for strengthening competencies in developing and implementing CRWSP and CRSSP. These approaches allow the participants to learn by doing, which is essential for fully understanding and internalising the concepts of risk assessment and risk management. When conducting piloting exercises, it is advisable to begin with relatively simple sanitation or water supply chains, or catchments with limited contamination sources. This allows practitioners to focus on mastering the methodology without being overwhelmed by complex system dynamics.

Notably, several capacity-building activities have already been undertaken including hands-on piloting in Syrian refugee camps, where teams were able to apply the CRWSP and CRSSP frameworks in a real-world context. Building on this experience and other previous experiences, capacity building activities need to be expanded to align with the operational priorities and interests of the water utilities. Moreover, Training of Trainers was conducted to ensure continuous national capacity development, enabling replication and scaling, while expanding the pool of skilled professionals across sectors and institutions. These progressive, structured capacity-building efforts are expected

to enhance institutional readiness and support long-term adoption of risk-based management practices. Noteworthy, capacity building is needed at all organisational hierarchy levels to ensure common understanding of the process.

j. Develop CRWSSP communication and coordination plans

Developing clear and structured coordination and communication plans is a fundamental element of effective and climate-resilient water and sanitation safety planning. Water supply and sanitation chain systems rely on a wide network of institutions, including MWI, MOH, MoEnv, MOA, WAJ, JVA, water utilities, municipalities, and water users' associations. Each of these actors plays a distinct role, and the safety of the entire system depends on their ability to work together seamlessly. A well-defined coordination plan ensures that responsibilities are understood, communication channels are established, and decision-making processes are transparent. This reduces the risk of duplication, delays, or gaps in action, especially when responding to hazards or operational challenges.

In situations such as water contamination events, treatment failures, sewer overflows resulting from climate-induced shocks like floods, coordinated action becomes even more critical. A communication plan enables rapid information sharing and anticipatory action so that operational teams, decision-makers, and external stakeholders receive timely alerts and guidance. This will facilitate quick correction actions and support consistent messaging. Beyond emergency response, coordination and communication processes support the overall effectiveness of the CRWSP and CRSSP risk management cycle. They help ensure that risks identified during assessment are acted upon, the monitoring results are shared with the right individuals, and that agencies collaborate in maintaining safety throughout the water supply and sanitation chains. This intersectoral cooperation strengthens the One Health approach by linking water, environment, and public health perspectives.

Additionally, a well-structured communication builds trust and transparency with communities and reinforces accountability among institutions. It also creates a framework for documenting actions, reporting performance, and learning from experience, allowing systems to adapt and improve over time. In this way, coordination and communication plans do not simply support the planning process, they are key drivers for resilience, ensuring that technical measures are backed by strong institutional collaboration and a shared commitment to protecting public health.

Gender inclusion strengthens communication and stakeholder engagement. Ensuring the meaningful participation and representation of women enhances community outreach, supports awareness-raising and behaviour and social change initiatives, and improves risk communication. Inclusive engagement contributes to stronger trust, improved information flow between service providers and communities, and supports earlier detection and identification of emerging risks.

In summary, the herein presented actions reflect a gradual but firm regulatory pathway of transformation, starting with organisational foundations, legal obligations, and clear coordination and communication plans, moving toward policy alignment and financing, and ending with operational enforcement and capacity building. It should be emphasised that future planning is strongly recommended at the watershed level, as it offers a more comprehensive view of the entire water cycle and supports improved safety and security under the bigger umbrella of the One Health approach. However, this approach is not addressed in detail in the present document, as it requires substantially greater coordination and communication than planning conducted within defined administrative areas. Table 2 below summarises the aforementioned steps and their status and presents the timeline of CRWSP and CRSSP roadmap implementation.



Table 2. Timeline for the CRWSP and CRSSP national roadmap.

Action	Status	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1) Establish dedicated units at WAJ and water utilities: Create specialised sections within an agreed organisational structure, endorsed and supported by senior management.	Underway															
2) Develop MOU- accelerate adaptation: Develop internal MOU, approved by the Minister, to formalize the adaptation of CR-WSSSP within the utilities, under the oversight of the WAJ. This MOU will serve as a foundation for revising and updating the delegation and assignment agreements between the Water Authority of Jordan (WAJ) and the utilities under its oversight	Underway															
3) Revise delegation and assignment agreements: Amend the agreements with WAJ to render implementation of CRWSP and CRSSP a binding obligation for all water utilities.	Underway															
4) Cabinet approval for the units established under WAJ and water utilities: Secure official endorsement and approval by the Council of Ministers to formalise the regulatory framework.	Underway															
5) Integrate into corporate strategies and annual action plans: Integrate CRWSP and CRSSP into the water utilities' five-year strategies and corporate annual development plans.	Integrated (partially) for Miyahuna															
6) Align with investment planning: Incorporate CRWSP and CRSSP requirements into investment plans to attract financing from donors and development partners.	Underway															

Table 2. Timeline for the CRWSP and CRSSP national roadmap.

Action	Status	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
7) Engage JVA and MOA: Involve JVA and MOA to ensure alignment with water reuse schemes and safe application and reuse of treated wastewater.	Underway															
8) Define and monitor KPIs: Establish clear KPIs to measure compliance, performance, and continuous improvement.	Underway															
9) Develop unified SOPs: Create SOPs to ensure consistency across water utilities and operators.	Partially developed															
10) Capacity building and pilots: Strengthen institutional and human capacities through structured training programs and pilot projects, providing practical experience and lessons learned before full-scale implementation.	Underway															
11) Develop coordination and communication plans: Demand for communicating required actions with relevant departments within WAJ and water utilities. It is also required to coordinate with other stakeholders to ensure implementation of control measures that are not under the responsibility of WAJ and the water utilities.	Underway															

PART II

Part II - Translating the National Water Strategy into Operational CRWSP and CRSSP Action

2.1 General introduction

The roadmap was developed through a series of consultations at the national and operational levels (see Table 18 in Annex 2 for a detailed list of the consultations). These consultations followed a stepwise approach that began by discussing the required transformation and outlining the roadmap's main features at national and operational levels.

The following step was to identify the actions required to achieve the national-and operational-level transformations and elaborate them more concretely. At the national level, these took the shape of a series of multi-stakeholder consultations that resulted in the set of actions detailed in Part I and summarised in Table 2 above. The objective was to advance these actions towards mandatory risk assessment and risk management for water and wastewater services.

At the operational level, the consultations resulted in the identification of priority systems for CRWSP and CRSSP. During the workshops, participants from water utilities, WAJ, and MWI, identified categories and criteria that are needed to prioritise water and sanitation systems to be considered for the development and implementation of CRWSPs and CRSSPs. The final roadmap has been verified by relevant stakeholders and will be disseminated within the wider sector group.

The following sections will focus on presenting the scaling up criteria defined during the workshops for the CRWSP and CRSSP. The scaling up of CRWSPs is presented in Section 2.2, while CRSSP is addressed in Section 2.3.

2.2 Scaling Up Climate Risk Safety Planning for the Jordanian Water Sector

The multi-stakeholder consultations resulted in the prioritisation and categorisation of two main criteria required for successful CRWSP application within the Jordanian water sector:

1) **Health criteria:** These are related to the history and determination of waterborne diseases (such as diarrhoea and typhoid) as determined by the national health authorities, which hold the mandate for health surveillance and disease classification.

2) **Operational criteria:** These are the criteria that fall under the core responsibility of the Jordanian water operators and will be discussed in this part of the document.

The prioritisation of WSSs for CRWSP development may be based on the extent to which a drinking WSS effectively protects public health. This can be assessed through "service indicators" that are closely linked to health outcomes, namely: water quality, quantity, accessibility, affordability, and continuity of supply, which are all linked to the public satisfaction index. The following is a short description of these indicators:

1) **Water Quality:** A fundamental indicator and determinant of public health, as many diseases are transmitted through contaminated water.

2) **Water Quantity:** A highly critical indicator; insufficient quantities of water may force consumers to resort to alternative sources that are often unsafe, such as tanker water transported from unlicensed sources for drinking. Many diseases are closely linked to the quantity of water supplied. WHO, in a 2012 study conducted in Jordan, determined the minimum water quantity requirement at 40 litres per person per day and noted an increase in diarrhoea cases among children under five years of age when water supply dropped below this threshold.

3) **Accessibility:** The more difficult it is to access water, the greater the risk to health. Improved water sources are expected to provide safe drinking water, unlike unimproved sources. Additionally, households not connected to the public water supply network bear higher costs compared to those connected.

4) **Affordability:** When the cost of water services exceeds citizens' ability to pay, they often resort to unsafe sources such as springs, which pose health risks. This is particularly the case when insufficient amounts of municipal water are pumped to households. Although continuous pumping is not available in most governorates, adherence to a scheduled rotation programme is essential to prevent consumers from resorting to unmonitored water tankers.

5) **Continuity of Supply:** This includes network pressure. Intermittent pumping and lack of pressure can cause contaminants to infiltrate the distribution system through cracks.

A Priority Matrix for scaling up CRWSP was prepared based on these five service indicators (see Table 4). It is worth noting that the matrix prioritises water sources that do not comply with JS286 and lack safe alternative supply resources.

To ensure a consistent, transparent, and nationally guided approach to scaling up CRWSP, the following criteria and scoring methodology will guide the prioritisation of WSSs across Jordan. These criteria are designed to implicitly incorporate the above service indicators while also addressing national vulnerabilities and contextual realities.

2.2.1 Risk Prioritisation Methodology for Scaling Up Climate Resilient Water Safety Planning

The following points represent the multi-stakeholder consultations and stakeholder's feedback as the guiding criteria to prioritise water systems:

a. Class and vulnerability of the raw water source

According to JS286, raw water is classified into three classes according to their microbiological loads. Each class has its requirements for treatment (multiple barrier approach) so that if one barrier fails the other barriers guarantee a safe drinking water supply:

- Class I: *Escherichia coli* (E. coli) less than 20 Most Probable Number (MPN)/100 millilitre (ml) (protected sources)
- Class II: *E. coli* 20 to 2,000 MPN/100 ml
- Class III: *E. coli* 2,000 to 20,000 MPN/100 ml

Class I raw water is a protected source that can be supplied as drinking water after disinfection with appropriate oxidant such as chlorine.

Class II raw water should be treated with one or more of the following methods before final disinfection and distribution as drinking water. The treatment should ensure 4-log removal of viruses and 3-log removal of Cryptosporidium and Giardia:

1. Filtration: Rapid filtration, microfiltration, ultrafiltration and nano filtration.
2. Reverse osmosis.
3. Flocculation and sedimentation followed by sand filtration; or
4. Any other treatment that guarantees the above-mentioned log removals.

Class III raw water requires advanced treatment that would include the treatment methods of Class II raw water plus additional barriers and controls such as Ultraviolet (UV) disinfection or any other method that guarantees 5-log removal of viruses and 3-log removal of Cryptosporidium and Giardia.

All water resources in Jordan are classified and prepared to supply safe water in accordance with the latest revision of the JS286. The MoH conducts frequent surveys and audits of water operator to ensure full compliance with the requirements of this guideline:

Priority in developing the CRWSP scaling up plans within the water utilities, WAJ and the water operators will be given water classes II and III, because they are the most vulnerable to pollution risks, which include industrial discharge and agricultural runoff among others. Priority in CRWSP scaling up plans will also be given to water resources with high exposure to climatic risks (e.g., drought and floods) or transboundary pressures.

b. Vulnerability of the Water Supply System

WSS with aging infrastructure, high Non-Revenue Water (NRW), frequent service disruptions, or poor operational resilience shall be considered as higher risk and given priority in CRWSSP planning. The frequency and type of actual pollution incidents, together with the corrective actions taken, shall be documented to ensure systematic monitoring and continuous improvement.

c. Number of customers served

Per the WHO guidelines, regional best practices, and JS286, WSS serving populations above a minimum threshold shall be classified as high priority. Larger systems, due to their greater potential public health impacts, must be subject to stricter regulatory oversight, mandatory WSP, and regular reporting to the competent authority. The responsible water utilities shall ensure that such systems comply with all applicable requirements, and regulatory bodies shall conduct periodic audits to verify compliance and enforce corrective measures where necessary. The number of individuals directly and indirectly affected by any pollution incident shall be documented and used as a primary criterion for prioritising WSS. Incidents impacting a large population, particularly in densely populated urban centres, shall receive the highest priority for regulatory action, corrective measures, and resource allocation. For instance, a contamination event in Miyahuna's supply network serving Amman would affect hundreds of thousands of consumers, requiring immediate intervention, compared to a smaller rural WSS affecting only a few hundred households.

d. Repeated incidents and customer complaints

WSS with a documented history of pollution incidents, water quality exceedances, or recurring customer complaints should be prioritised. The level of priority shall increase with both the frequency and severity of these events. A register must be maintained to record the occurrence of actual incidents as well as the frequency of operational disruptions caused by water quality issues.

e. Social and economic impact of the pollution incident

WSS serving critical institutions and vulnerable groups (hospitals, schools, nurseries, e camps, shelters, marginalized communities) will be given special consideration. Moreover, the broader social and economic consequences of a pollution incident shall be assessed and incorporated into prioritisation decisions. This includes impacts on vulnerable communities, disruption of livelihoods, loss of productivity, increased healthcare costs, and reputational damage to the water utility. For instance, pollution affecting the Jordan Valley irrigation schemes has both drinking water and agricultural implications, leading to loss of citrus and vegetable crops, reduced farmer income, and regional food security risks. Similarly, contamination of supply in Madaba or Karak, where communities have limited alternative water sources, carries disproportionate social burdens.

f. Diversity of sources and availability of alternatives

WSS relying on a single source of supply with no available alternatives shall be classified as high-risk and given priority in regulatory oversight and contingency planning. Systems with diversified sources shall be considered more resilient and therefore of lower immediate priority. For example, Madaba Governorate depends almost entirely on one drinking WSS from the Hidan well field with limited backup sources. Any contamination or operational failure affecting this well field poses a direct threat to the entire population of that governorate.

Rural or remote areas, that depend on a single water source with no alternative or backup supplies, are highly vulnerable and, therefore, prioritised.

g. Vulnerability to climate change

The degree to which a WSS is exposed to climate-related risks, such as reduced recharge of groundwater aquifers, increased frequency of droughts, or flash flooding, shall be formally assessed and factored into prioritisation. Systems with higher climate vulnerability shall be subject to more stringent preventive measures and monitoring. For example, the Jordan Valley is highly exposed to climate variability, where reduced rainfall and prolonged droughts intensify stress on both drinking water and irrigation supplies.

h. Geological sensitivity of the source area

Water sources located in geologically sensitive areas shall be prioritised due to their increased risk of contamination from natural or anthropogenic activities. Geological vulnerability must be documented through hydrogeological assessments, vulnerability mapping, and source protection zoning. For example, the *Qairawan* Spring in Jerash is highly sensitive, being situated in a karstic formation. Pollution risks are elevated because contaminants can travel rapidly through fractures, limiting natural filtration.

2.2.2 Integrated Risk Prioritisation Across the Water Supply Chain

Table 3 explains the different categories and more detailed components of the scaling up matrix along the supply chain of the drinking water from Catchment to Consumer (C-C) to guide water utilities to develop their scaling up plans within the national CRWSP roadmap.

Table 3. Scaling-up categories along the supply chain and glossary of the components.

Catchment	
Class and vulnerability of the raw water source to pollution	The class as per the microbiological criteria.
Deliberate pollution of water resources and intentional infringements on water resources and related infrastructure	Including planned activities in the catchment and changes in land use.
Vulnerability to Climate Change	Sources with high exposure to climatic risks like reduced recharge of groundwater aquifers, increased frequency of droughts, or flash flooding will be prioritised.
Geological sensitivity of the water source catchment area	Geological vulnerability must be documented through hydrogeological assessments, vulnerability mapping, and source protection zoning.

WSS: Treatment - Storage - Transmission - Distribution	
Vulnerability and condition of the WSS	Aging infrastructure, high operational costs, leaks, frequent service disruptions, poor operational resilience, efficiency and treatment stages.
Diversity of sources and availability of alternatives	Rural or remote areas depending on a single water source with no alternative or backup supplies are highly vulnerable and prioritised.
Vulnerability of the WSS to Climate Change	WSS with high exposure to climatic risks will be prioritised.
Transmission	High NRW repeated incidents and customer complaints.
Distribution: Condition of network, length, age material and competence to the national and international standards	Frequency of incidents of interaction with the sanitation system (overflowing manholes, breaks and wastewater intrusion), leaks, breaks and NRW.
National priority development areas	Linkage to existing national capital investments and rehabilitation projects .
Customers and End Users	
Repeated incidents and customer complaints	The level of priority shall increase with both the frequency and severity of these events. A register must be maintained to record the occurrence of actual incidents as well as the frequency of operational disruptions caused by water quality issues.
Number of customers served or number of people affected by the pollution incident	The number of individuals directly and indirectly affected by any pollution incident shall be documented and used as a primary criterion for prioritising WSS. Incidents impacting a large population, particularly in densely populated urban centres, shall receive the highest priority for regulatory action, corrective measures, and resource allocation.
Social and economic impact of the pollution incidents including vulnerable groups and communities (e.g. refugees, infants and elderly people)	The broader social and economic consequences of a pollution incident shall be assessed and incorporated into prioritisation decisions. This includes impacts on disruption of livelihoods, loss of productivity, increased healthcare costs, and reputational damage to the water utility.

Table 4 illustrates the CRWSP integrated risk prioritisation matrix. It also presents the unified weights established during the stakeholder consultations and illustrates how the different stages of the water supply chain are scored using the prioritisation criteria. Weights are applied to reflect relative importance while impact and frequency are multiplied to determine the risk score. The cumulative weighted score provides an overall risk prioritisation for the system based on the following rules:

- The agreed upon unified **weight range** per category is filled in the weight column.
- The risk score is determined by multiplying **Impact (I) and Frequency (F).**
- The **Weighted Score** is then calculated by multiplying the assigned Weight per component by the Score.
- The total of all scores provides the overall **Risk Prioritisation Score (RPS)** for the WSS.

For the CRWSP system, the impact and the frequency of each criterion is determined. **Impact defines the severity or the consequence of the hazardous event and can be defined as the degree of harm that a hazardous event would cause if it occurred**. A typical impact scale might be:

1 = **Insignificant**: No health impact; minor aesthetic issues (slight taste/odor).

2 = **Minor**: Minor aesthetic failure (e.g., turbidity spike); no illnesses.

3 = **Moderate**: Minor health symptoms (e.g., mild diarrhea); breach of chemical standards (low chlorine).

4 = **Major**: Serious illness; likely waterborne outbreaks.

5 = **Catastrophic**: Loss of life; epidemic (e.g., cholera); toxic contamination.

Frequency indicates the likelihood or probability of occurrence and can be defined as the chance or the rate at which a hazardous event is expected to occur. It reflects how often a risk has been observed or is likely to happen based on system data, historical events, or expert judgment. A typical frequency scale can be as follows:

5 = **Almost Certain**: Expected to occur frequently or constantly.

4 = **Likely**: Happens regularly.

3 = **Possible**: Could happen; not unusual.

2 = **Unlikely**: Rare but possible.

1 = **Rare**: Very unlikely; exceptional.

Table 4. Integrated risk prioritisation matrix for CRWSP.

Stage	Weight (× 100%)	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score = Weight × Score
Catchment	**25-30**				
- Class and vulnerability of the raw water source					
- Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure					
- Vulnerability to Climate Change					
- Geological sensitivity of the catchment area of the water source					
WSS	**45-55**				
- Vulnerability and condition of the WSS					
- Diversity of sources and availability of alternatives					
- Vulnerability of the WSS to climate change					
- Transmission and trunk lines					
- Distribution: Condition of network, length, age, etc.					
- National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context					
Customers and End users	**15-20**				
- Repeated incidents and customer complaints					
- Number of customers served - Number of people affected by the pollution incident					
- Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups					
Risk Prioritisation Score (RPS) =					

**Total weight not to exceed 100%*

Criteria for prioritisation:

RPS 15–25	High priority
RPS 7–14	Medium priority
RPS 1-6	Low priority

Annex 1 provides filled out examples of Table 4 above prepared in cooperation with the stakeholders. As an essential step, starting with a small and relatively simple system is advisable to serve as a practical training ground for applying the methodology and piloting the planning process. With growing expertise, WSSs can then be arranged within a priority matrix based on the agreed criteria presented in this document, ensuring that all systems are eventually covered by CRWSPs. In scaling-up CRWSP implementation, water utilities may take the following points into consideration:

- Rapid risk assessments of systems serving populations greater than 100,000 people.
- Emergency protection for sensitive populations, including hospitals, schools, and refugee camps.
- Interim control measures for high-risk sources, such as drought, floods, and industrial pollution.
- Emergency response protocols and customer complaint hotlines.
- Extend CRWSP coverage to rural and isolated communities.

2.3 Risk Prioritisation Methodology for Scaling up Climate Resilient Sanitation Safety Planning

Driving the CRSSP forward requires Jordan to move from strategy to action. The immediate priorities include strengthening institutional arrangements, piloting CRSSP in high-risk systems, and embedding risk management into water utility operations. The following criteria highlight how national leadership, local operators, regulators, and stakeholders will collaborate to accelerate implementation, protect public health, and build resilience against climate-related challenges to ensure that risk management becomes an essential part of operational practices. They resulted from the first and second stakeholder consultations, as representatives from MWI, WAJ and the water utilities identified them as criteria to prioritise sanitation systems for initial selection for CRSSP development and implementation:



a. Size of WWTP

Large WWTPs pose high-impact risks, while smaller plants present more frequent but localised risks that typically require decentralised monitoring and simpler mitigation measures. Failures in large plants affect large populations and cause widespread environmental contamination. Accordingly, these plants warrant stricter process control, system reliability, and emergency response plans.

b. Applied wastewater treatment technology

Applied treatment technology determines how effectively hazards are reduced and the residual risks that remain. In other words, it dictates the sanitation-related hazards and associated health and environmental risks, or hazard reduction efficiency. Table 5 suggests the CRSSP implications of the different treatment technologies used in Jordan.

Table 5. Implications of different treatment technologies on CRSSP.

Treatment Technology	Typical Use	CRSSP Implications
Activated sludge systems	Urban (**e.g. >5000PE**[10])	Reliable when well-operated, require skilled operators, high energy demand, risky if aeration or sludge handling fails.
Activated sludge systems with sludge treatment	Urban (**e.g. >5000PE**)	In the presence of sludge digesters, risks expand to include those related to operation of anaerobic digesters and gas storage.
Stabilisation ponds/lagoons	Urban	Simple and robust, less dependent on energy supply, risks associated with insufficient retention time or short-circuiting.
Constructed wetlands/ nature-based systems	Decentralised settings	Low-cost and sustainable, performance varies seasonally, requiring adaptive risk management.
Trickling filter	Urban	Needs stable loading and flow, lower treatment efficiency as compared to Activated Sludge systems, vector attraction which results in public health nuisance, demand for proper sludge management, requires additional treatment for safe reuse or discharge.

c. Wastewater flow as compared to design capacity of the WWTP and that of the sewage network design

Regardless of the size of the treatment plant, this criterion is critical as it reflects the degree of system hydraulic stress and the associated risks to performance, environmental quality, and public health. When a system is hydraulically overloaded, treatment processes become less effective, resulting in incomplete wastewater treatment, increased occurrences of overflows or bypasses, and higher pollutant discharges to the environment. Systems operating

10 Population Equivalent.

close to or beyond their design limits (e.g. Ain Al-Basha, Wadi-Shuaib, Madaba) should therefore be prioritised for capacity expansion, rehabilitation or upgrading alongside more detailed risk assessment and monitoring. On the other hand, significantly underloaded systems may indicate inefficient use of infrastructure, resources losses, and demands system optimisation. In fact, this criterion should also be considered in conjunction with the influent characteristics, particularly organic load, since both factors determine the extent of treatment plant overloading. In some cases, systems can be hydraulically overloaded, however, they still function adequately due to underloading with respect to organic contaminants. For instance, the *Fuhais* WWTP is performing well despite performing at its hydraulic loading limit because it is still below its organic load design capacity.

d. Percentage of served population

The percentage of population served by sanitation systems is a key factor in SSP though it might be out of the water utilities' scope of service, particularly in areas with low network coverage. In principle, the percentage of the served population directly affects risk identification, prioritisation, and management. In areas with low service coverage, risks extend beyond the water utilities' managed systems and the SSP teams must identify exposure pathways beyond the water utility's control, such as contamination of surface and groundwater, or contamination of agricultural land resulting from the decentralised sanitation cesspools. In fact, CRSSP may be mostly needed for vulnerable communities lacking resources to manage their decentralised sanitation systems. Conversely, high coverage often reduces direct exposure but shifts the focus to system reliability and treatment efficiency. Moreover, the percentage of the served population affects prioritisation of interventions. For instance, in partially served areas, priority actions may include the expansion of the network coverage and improving faecal sludge collection and treatment while in fully served areas, priorities may focus on ensuring compliance with effluent standards and managing overflow, infiltration, or stormwater interaction, and the safe use of treated wastewater in agriculture. Additionally, monitoring strategies differ in high coverage areas as compared to low coverage areas.

e. Influent water quality

Influent water quality determines the level of risk that the treatment plant has to manage. For instance, the introduction of industrial or agro-industrial wastewater may affect the treatment process and quality of the produced sludge, particularly when illegal discharges to the network are practiced. Variations in influent quality driven by climate change impacts might affect the performance of the treatment plant and effluent quality, and consequently the entire downstream chain. Additionally poor influent control increases the chances and likelihood of treatment failure and the severity of harm if failure occurs. In these cases, the SSP team needs to consider contingency procedures to mitigate the impact of influent water quality variations. In some cases, the treatment plant operates within its hydraulic design capacity, however, it exercises challenges related to influent quality. An example of this is the industrial wastewater resulting from nearby quarries and stone cutting establishments that ends up flowing into the South Amman WWTP, causing damages to its components.

f. Effluent water quality

Effluent quality is the key determinant of treatment performance and risk control. When the effluent is non-compliant with the local treated wastewater quality standards[11]. It signals that existing control measures are insufficient and corrective actions are needed. Effluent quality defines the risk to downstream users such as farmers and consumers. Moreover, effluent quality influences monitoring and verification plans as high variations in effluent quality may necessitate frequent monitoring and support decisions for upgrading the treatment plant or adjusting operational procedures.

g. Status of sanitation infrastructure

The physical condition and operational functionality of sanitation infrastructure including sewer networks, pumping stations, WWTPs, and sludge management facilities directly influence the likelihood of hazardous events and the exposure risks to public health and the environment. Aging, overloaded or damaged infrastructure impose higher risks due to sewer blockages and overflows, infiltration/ inflow of stormwater, breakdown, sludge leakage, wastewater leakage, etc.

Moreover, the status of the sanitation infrastructure will affect the scope and focus of the SSP team. While the focus of the team might be on optimisation of operation processes and reuse management in a well-functioning system with good conditions, it might be emergency containment and minimisation of exposure to hazards when infrastructure is severely degraded. Therefore, the SSP team must adapt monitoring frequency and indicators based on infrastructure vulnerability.

h. Deliberate or unintended damage to sewer networks

When parts of the sewer network are deliberately or unintendedly damaged, e.g., broken pipelines, destroyed or stolen manholes, untreated sewage may escape into the streets, infiltrate groundwater, or flow in natural wadis.[12] This will impose high risk to surrounding communities or exposure groups. Stolen manhole covers pose a serious safety risk, as pedestrians may accidentally fall into open sewer lines. Such physical hazards can lead to severe injuries or even loss of life, especially during flooding events when uncovered manholes are obscured and difficult to detect.

Moreover, many SSP risk control measures rely on a functional infrastructure, and neither operational monitoring becomes reliable nor control measures can operate as designed when damage occurs. In areas with frequent damages to the infrastructure, the SSP team

11 The Jordanian Standards that govern the use of the treated effluent are based on its use. They are:

a. Jordanian Standard JS 893:2006, Water – Reclaimed Domestic Wastewater (latest amendment issued in 2016).

b. Jordanian Standard JS 202:2017, Water – Wastewater Discharge to Surface Water Bodies.

c. Jordanian Standard JS 1189:2006, Water – Industrial Wastewater Discharged to Public Sewerage Networks.

12 A wadi is an Arabic word that denotes a ravine or valley expected to be dry during the dry season. Sometimes, wadi refers to a stream running through such a valley (UNESCWA).

must consider emergency risk management and contingency planning including rapid hazard identification, immediate control actions, emergency communication and coordination between water utility, municipality, and emergency response agencies.

i. Final use of treated effluent and the presence of reuse infrastructure

The final use of the treated effluent directly defines the exposure pathways and therefore the risk profile considered in SSP. For instance, risk of pathogen transfer to crops is a main pathway to consider when agricultural reuse is targeted while the risk of aquifer contamination is the main exposure pathway when groundwater recharge is considered. The intended reuse purpose determines the effluent quality targets and technology selection. It also expands the system boundaries to include storage reservoirs, pumping stations, irrigation pipelines, on-farm distribution systems, and other agricultural practices that are required to produce a safe agricultural product. The final use will determine the expansion of the number and diversity of stakeholders involved in the SSP. Effluent reuse involves multiple actors such as water utilities, farmers or irrigation associations, environmental and agricultural authorities, and public health agencies.

j. Outputs of Water Safety Planning

WSP and SSP are complementary approaches of integrated water and sanitation risk management with the unified objective of protecting public health across the full water cycle. In other words, the outputs of one plan become inputs of the other plan because they are sequential in the water cycle. For instance, one of the key outputs of a WSP is the identification of vulnerable water sources and the hazardous activities or discharges that threaten them. If the WSP identifies wastewater discharges, leaky sewers, or septic overflows as key contamination sources, then the findings would directly feed into SSP as priority risks to be managed. Moreover, WSP outputs provide valuable baseline data for SSP development such as source water quality trends, catchment characteristics and pollution sources, results of microbial or chemical monitoring, and vulnerability maps and hydraulic data.

The risk assessment in WSP and SSP overlap at critical points, particularly at the interface between treated effluent discharge and raw water abstraction. WSP outputs on downstream intakes or aquifer recharge zones helps SSP teams define where treated effluent reuse or discharge must be controlled. On the other hand, SSP outputs on effluent quality and management inform WSP teams about potential upstream contamination risks. In fact, integrating water and sanitation safety planning would enable the best investment decisions with respect to infrastructure investment priorities, land-use planning, emergency response coordination, and inter-institutional and intra-institutional coordination.

2.3.1 Integrated Risk Prioritisation Across the Sanitation Chain

The roadmap introduces an integrated risk prioritisation approach applicable across the sanitation chain to ensure that systems most vulnerable to performance failure, environmental contamination, and public health risks are identified and addressed first. Table 6 below presents the categorisation and prioritisation matrix developed during the roadmap workshops, which combines both health-related and operational criteria into a transparent scoring framework.

By incorporating indicators such as treatment capacity, hydraulic loading, organic load, and exposure of sensitive populations, the matrix enables water utilities and regulators to rank systems consistently and objectively. This will help direct resources to high-risk systems, strengthening resilience and safeguarding public health. Further, the matrix provides a comprehensive description of the criteria used to categorise and prioritise each risk across the sanitation chain.



2.3.2 Categorisation and Prioritisation Matrix

The categorisation of the selected criteria for scaling up CRSSP and the risk prioritisation matrix are presented in Table 6 for each sanitation sub-system, which should ideally be completed by the water utilities. To go through the prioritisation exercise, a weight is first given for each category and criterion. These weights are fixed for all SSP systems under the responsibility of the water utility. For each system, the impact and the frequency of each criterion is then determined. **Impact defines the severity or the consequence of the hazardous event and can be defined as the degree of harm that a hazardous event would cause if it occurred**. For instance, overflow of untreated sewage into a residential area may have a very high impact as it poses serious health and environmental damage while slight odour nuisance at treatment plants poses a low impact as it has a limited public impact. A typical impact scale might be:

1 = **Insignificant** (no health or environmental consequences)

2 = **Minor** (local inconvenience)

3 = **Moderate** (temporary or reversible effect)

4 = **Major** (significant pollution or illness)

5 = **Catastrophic** (widespread health impact or long-term environmental damage)

Frequency indicates the likelihood or probability of occurrence and can be defined as the chance or the rate at which a hazardous event is expected to occur. It reflects how often a risk has been observed or is likely to happen based on system data, historical events, or expert judgment. For instance, sewer overflow during heavy rain every winter has a high frequency while chemical spills (never occurred) have low frequency. A typical frequency scale can be as follows:

1 = **Rare** (once in 10 years or less)

2 = **Unlikely** (once every 5 to 10 years)

3 = **Possible** (once every 1-5 years)

4 = **Likely** (several times per year)

5 = **Very likely/ frequent** (occurs regularly or continuously)

Table 6. Risk prioritisation matrix for the CRSSP upscaling criteria

Stage	Weight (×100%)	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score (Weight × Score)
Catchment (Collection Systems)	**30-35**				
Outputs of Water Safety Planning					
Percentage of Served Population					
Status of Sanitation Infrastructure					
Collection System Type & capacity					
Deliberate of Networks					
Wastewater Treatment	**45-55**				
Wastewater flows as compared to design capacity of the WWTP and the sewage network design capacity					
WWTP Size					
Applied wastewater treatment technology					
Influent water characteristics					
Effluent water characteristics					
Sludge Management					
Technical Sustainable Management (TSM)					
Downstream of WWTP	**15-20**				
Final direct of use of treated effluent and the reuse infrastructure					
Risk Prioritisation Score (RPS) =					

Prioritisation criteria would be:

RPS 15–25	High priority
RPS 7–14	Medium priority
RPS 1-6	Low priority

The project conducted mock exercises to apply the risk prioritisation matrix in locations across Jordan in cooperation with Miyahuna, Aqaba Water Company, and Yarmouk Water Company's teams (see Annex 1). It should be noted that these examples are intended solely for training purposes and do not represent a final determination of the weighting, which must be carried out by each water utility through a broader participatory process involving representatives from the various sections and directorates responsible for service delivery.

In summary, WSS prioritisation step is essential for ensuring that the prioritisation matrix is technically sound and reflects actual vulnerabilities along the water and sanitation systems, operationally practical allowing water utilities to differentiate in a transparent and objective manner between high, medium, and low priority systems. Additionally, this step is essential to align with the national scaling-up vision, enabling water utilities to sequence plans' development in a gradual and feasible and consistent manner.

The scoring outputs across the validated WSS (Annex 1) for instance, showed very clear patterns. WSSs with multiple vulnerabilities received higher RPS scores, confirming the robustness of the matrix. Conversely, WSSs with better infrastructure or greater operational redundancy scored significantly lower. For Miyahuna, the prioritisation outcomes were found to be fully consistent with the water utility's current five-year strategy. Systems that are historically known to be operationally challenging or socially critical ranked as higher priority using the matrix. Moreover, and despite different geographical settings and management practices, water utilities applied the criteria consistently. This confirms that the matrix can serve as a national, harmonised tool. Likewise, the prioritisation matrix now serves as the cornerstone tool for Jordan's phased national CRWSP scaling-up process. It provides a clear mechanism for water utilities to determine where to begin, plan medium-term expansion, and develop long-term full coverage plans toward 2040.



Recommendations

The National Roadmap for the Institutionalization of Climate Resilient Water and Sanitation Safety Planning in Jordan, along with the implementation of the risk prioritisation matrices for scaling up CRWSP and CRSSP, should be formally endorsed through an official governmental decision. This formalization process should include high-level approval, clear designation of institutional responsibilities, and integration into relevant regulatory and policy frameworks to ensure sustainability and accountability. Moreover, the roadmap should be disseminated and validated through structured program to secure ownership across the sector. Engagement should extend beyond water utilities, WAJ, and MWI to include Jordan Valley Authority and the Ministry of Agriculture. Moreover, the critical roles of the Ministry of Health and Ministry of Environment shall also be highlighted during the implementation phase. In fact, establishing an inter-institutional coordination mechanism would further support harmonized implementation and cross-sector alignment.

In parallel, CRWSP and CRSSP requirements should be integrated into national and water utility-level investment plans and master plans to ensure sustainable financing through national budgets, donor support, private sector and appropriate incentive mechanisms. In addition, targeted investments are required to upgrade testing laboratories, strengthen monitoring protocols and requirements, and enhance institutional capacity through comprehensive capacity-building initiatives. The later may include technical training, establishment of professional certification pathways, and applied learning platforms such as living laboratories.

Collectively, these measures will move CRWSP and CRSSP from pilot-based initiatives to fully institutionalized, mandatory components of Jordan's water and sanitation governance framework, ensuring long-term climate resilience, public health protection, and sustainable resource management.



References

(1) *National Framework for Drinking Water Quality Management in Jordan. Developed by the Water Governance Activity funded by the former USAID in 2024*

(2) *The Assignment Agreements between the Water Authority of Jordan and the Water Utilities.*

(3) *World Health Organization (2017). Guidelines for Drinking-water Quality, 4th Edition, incorporating 1st Addendum.*

(4) *Jordanian Standard 286/2015 on Water/Drinking Water, Jordan Standards and Metrology Organization, Amman, Jordan (2015).*

(5) *National Water Strategy 2023–2040. Ministry of Water and Irrigation (2023).*

(6) *Water Safety Plan Manual: Step-by-step risk management for drinking-water suppliers, World Health Organization (2009 & 2023).*

(7) *WHO (2017a). Climate-resilient water safety plans: managing health risks associated with climate variability and change. Section 5.1 includes specific information on the type of climate-related expertise that can provide ad hoc support to WSP teams.*

(8) *WHO (2019). A guide to equitable water safety planning: ensuring no one is left behind. Section 1a describes how to ensure meaningful participation of women and disadvantaged groups in the WSP process.*

(9) *Enabling Environment and Institutional Assessment Report, prepar*
Water Utilities Association (ACWUA) and reviewed and approved b



Annexes

Annex 1. List of consultations conducted under the project to translate the National Water Strategy into the operational level

Table 7. Workshops conducted to validate the roadmap moving towards the operational level.

Activity	Time	Remarks
1. Conduct stakeholder consultations	First workshop: September 3, 2025 Second workshop: September 25, 2025 Third workshop: October 22, 2025	The first workshop marked the initial formal review and feedback of the assessment report and roadmap by key stakeholders from WAJ, MWI, and the water utilities. In the second and third workshops, the stakeholders discussed and agreed upon range categories and criteria to prioritise water and sanitation systems of weight per category.
2. Draft the national roadmap	Multiple meetings during September 3- 30, 2025	Drafting the roadmap starts
3. Validate the roadmap established categories and criteria	Validation Workshop: October 1-30,2025	Establish consensus between water utilities on prioritisation criteria
4. Finalise and disseminate the national roadmap	Dissemination Workshop January 2026	Roadmap disseminated

Annex 2. List of Exercises Conducted

Tables 8, 9, 10 and 11 below are exercises that Miyahuna's team completed with the support of the project for the *Shraia'a* Spring WSS, Ras Al Ain WSS - Amman Centre, Zara Ma'en WSS, and the Madaba WWTP. These examples are intended solely for training purposes and do not represent a final determination of the weighting.

Table 8. Risk prioritisation score - Shraia'a WSS - Miyahuna

Stage	Weight (×100%)	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight × Score
Catchment	**25-30**				
- Class and vulnerability of the raw water source	**9**	**4**	**4**	**16**	**1.44**
- Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**6**	**3**	**2**	**6**	**0.36**
- Vulnerability to Climate Change	**8**	**3**	**1**	**3**	**0.24**
- Geological sensitivity of the catchment area of the source water	**7**	**3**	**3**	**9**	**0.63**
WSS: Treatment – Storage - Transmission – Distribution	**45-55**				
- Vulnerability and condition of the WSS	**9**	**4**	**2**	**8**	**0.72**
- Diversity of sources and availability of alternatives	**9**	**3**	**2**	**6**	**0.54**
- Vulnerability of the WSS to climate change	**8**	**2**	**1**	**2**	**0.16**
- Transmission and trunk lines	**7**	**3**	**4**	**12**	**0.84**
- Distribution: Condition of network, length, age	**9**	**3**	**3**	**9**	**0.81**
- National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**8**	**4**	**2**	**8**	**0.64**
Customers and End Users	**15-20**				
- Repeated incidents and customer complaints	**7**	**5**	**2**	**10**	**0.70**
- Number of customers served - Number of people affected by the pollution incident	**8**	**4**	**2**	**8**	**0.64**
- Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**5**	**4**	**2**	**8**	**0.40**
Risk Prioritisation Score (RPS*) =			**8.12**		

**RPS = The total of Weighted Scores *0.1*

Table 9: Risk prioritisation score - Ras AL Ain WSS- Amman Centre - Miyahuna

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**25-30**				
- Class and vulnerability of the raw water source	**10**	**4**	**2**	**8**	**0.80**
- Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**7**	**3**	**2**	**6**	**0.42**
- Vulnerability to Climate Change	**6**	**3**	**1**	**3**	**0.18**
- Geological sensitivity of the catchment area of the source water	**7**	**3**	**2**	**6**	**0.42**
Water Supply System: Treatment – Storage - Transmission - distribution	**45-55**				
- Vulnerability and condition of the WSS	**8**	**3**	**1**	**3**	**0.24**
- Diversity of sources and availability of alternatives	**10**	**4**	**1**	**4**	**0.40**
- Vulnerability of the WSS to climate change	**6**	**2**	**1**	**2**	**0.12**
- Transmission and trunk lines	**6**	**2**	**1**	**2**	**0.12**
- Distribution: Condition of network, length, age	**8**	**3**	**1**	**3**	**0.24**
- National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**7**	**3**	**2**	**6**	**0.42**
Customers and End users	**15-20**				
- Repeated incidents and customer complaints	**6**	**4**	**1**	**4**	**0.24**
- Number of customers served - Number of people affected by the pollution incident	**8**	**4**	**2**	**8**	**0.64**
- Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**6**	**4**	**2**	**8**	**0.48**
Risk Prioritisation Score (RPS) = 4.72					

**RPS = The total of Weighted Scores *0.1*

Table 10: Risk prioritisation score - Zara Ma'en WSS- Miyahuna

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**25-30**				
- Class and vulnerability of the raw water source	**9**	**3**	**1**	**3**	**0.27**
- Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**6**	**3**	**2**	**6**	**0.36**
- Vulnerability to Climate Change	**8**	**4**	**2**	**8**	**0.64**
- Geological sensitivity of the catchment area of the source water	**7**	**3**	**1**	**3**	**0.21**
Water Supply System: Treatment – Storage - Transmission - distribution	**45-55**				
- Vulnerability and condition of the WSS	**9**	**3**	**1**	**3**	**0.27**
- Diversity of sources and availability of alternatives	**9**	**2**	**3**	**6**	**0.54**
- Vulnerability of the WSS to climate change	**8**	**2**	**1**	**2**	**0.16**
- Transmission and trunk lines	**7**	**4**	**1**	**4**	**0.28**
- Distribution: Condition of network, length, age	**9**	**3**	**1**	**3**	**0.27**
- National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**8**	**3**	**2**	**6**	**0.48**
Customers and End users	**15-20**				
- Repeated incidents and customer complaints	**7**	**5**	**1**	**5**	**0.35**
- Number of customers served - Number of people affected by the pollution incident	**8**	**5**	**1**	**5**	**0.40**
- Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**5**	**5**	**1**	**5**	**0.25**
Risk Prioritisation Score (RPS) = 4.48					

**RPS = The total of Weighted Scores *0.1*

Table 11. Categorisation and prioritisation matrix in the Madaba WWTP.

Stage	Weight (×100%)	Impact (I) (1-5)	Frequency (F) (1-5)	Score = I × F	Weighted Score = Weight×Score
Catchment (Collection Systems)	**30%**				
Outputs of Water Safety Planning	**6%**	**5**	**2**	**10**	**0.60**
Percentage of Served Population	**6%**	**3**	**5**	**15**	**0.90**
Status of Sanitation Infrastructure	**6%**	**4**	**5**	**20**	**1.20**
Collection System Type & capacity	**6%**	**5**	**5**	**25**	**1.5**
Deliberate of Networks	**6%**	**4**	**2**	**8**	**0.48**
Wastewater Treatment	**50 %**				
Wastewater flows as compared to design capacity of the WWTP and the sewage network design capacity	**10%**	**3**	**2**	**6**	**0.60**
WWTP Size	**6%**	**3**	**3**	**9**	**0.54**
Applied wastewater treatment technology	**6%**	**4**	**2**	**8**	**0.48**
Influent water characteristics	**7%**	**3**	**2**	**6**	**0.42**
Effluent water characteristics	**10%**	**4**	**2**	**8**	**0.80**
Sludge Management	**6%**	**4**	**1**	**4**	**0.24**
Technical Sustainable Management (TSM)	**5%**	**3**	**3**	**9**	**0.45**
Downstream of WWTP	**20%**				
Final direct of use of treated effluent and the reuse infrastructure	**10%**	**5**	**5**	**25**	**2.5**
Final indirect of use of treated effluent and the reuse infrastructure	**10%**	**5**	**1**	**5**	**0.50**
Risk Prioritisation Score (RPS*) = 11.2					

RPS = The total of Weighted Score.

Tables 12, 13 and 14 below are exercises that Aqaba Water Company's team completed with the support of the project for the WSS of Ghour Safi, Ein Sarah, and Mujib Dam in the south of Jordan. These examples are intended solely for training purposes and do not represent a final determination of the weighting.

Table 12: Risk prioritisation score - Ghour Safi WSS- Karak

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**30%**				
-Class and vulnerability of the raw water source	**0.09**	**4**	**3**	**12**	**1.08**
-Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**0.06**	**2**	**1**	**2**	**0.12**
-Vulnerability to Climate Change	**0.07**	**4**	**3**	**12**	**0.84**
-Geological sensitivity of the catchment area of the source water	**0.08**	**4**	**3**	**12**	**0.96**
Water Supply System: Treatment – Storage - Transmission - distribution	**50%**				
-Vulnerability and condition of the WSS	**0.1**	**4**	**4**	**16**	**1.6**
-Diversity of sources and availability of alternatives	**0.07**	**5**	**5**	**25**	**1.75**
-Vulnerability of the WSS to climate change	**0.08**	**4**	**3**	**12**	**0.96**
-Transmission and trunk lines	**0.07**	**3**	**2**	**6**	**0.42**
-Distribution: Condition of network, length, age	**0.1**	**3**	**2**	**6**	**0.6**
-National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**0.08**	**1**	**1**	**1**	**0.08**
Customers and End users	**20%**				
-Repeated incidents and customer complaints	**0.06**	**3**	**3**	**9**	**0.54**
-Number of customers served - Number of people affected by the pollution incident	**0.07**	**3**	**3**	**9**	**0.63**
-Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**0.07**	**3**	**2**	**6**	**0.42**
Risk Prioritisation Score (RPS) = 10					

**RPS = The total of Weighted Scores *0.1*

Table 13: Risk prioritisation score - Ein Sarah WSS- Karak

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**30%**				
-Class and vulnerability of the raw water source	**0.09**	**4**	**3**	**12**	**1.08**
-Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**0.06**	**2**	**1**	**2**	**0.12**
-Vulnerability to Climate Change	**0.07**	**4**	**3**	**12**	**0.84**
-Geological sensitivity of the catchment area of the source water	**0.08**	**3**	**2**	**6**	**0.48**
Water Supply System: Treatment – Storage - Transmission - distribution	**50%**				
-Vulnerability and condition of the WSS	**0.1**	**4**	**3**	**12**	**1.2**
-Diversity of sources and availability of alternatives	**0.07**	**5**	**5**	**25**	**1.75**
-Vulnerability of the WSS to climate change	**0.08**	**4**	**3**	**12**	**0.96**
-Transmission and trunk lines	**0.07**	**3**	**2**	**6**	**0.42**
-Distribution: Condition of network, length, age	**0.1**	**3**	**2**	**6**	**0.6**
-National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**0.08**	**1**	**1**	**1**	**0.08**
Customers and End users	**20%**				
-Repeated incidents and customer complaints	**0.06**	**3**	**3**	**9**	**0.54**
-Number of customers served - Number of people affected by the pollution incident	**0.07**	**3**	**2**	**6**	**0.42**
-Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**0.07**	**3**	**2**	**6**	**0.42**
Risk Prioritisation Score (RPS) =8.91					

**RPS = The total of Weighted Scores *0.1*

Table 14: Risk prioritisation score - Mujib Dam WSS- Karak

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**30%**				
-Class and vulnerability of the raw water source	**0.09**	**4**	**3**	**12**	**1.08**
-Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**0.06**	**2**	**1**	**2**	**0.12**
-Vulnerability to Climate Change	**0.07**	**3**	**2**	**6**	**0.42**
-Geological sensitivity of the catchment area of the source water	**0.08**	**3**	**2**	**6**	**0.48**
Water Supply System: Treatment – Storage - Transmission - distribution	**50%**				
-Vulnerability and condition of the WSS	**0.1**	**4**	**4**	**16**	**1.6**
-Diversity of sources and availability of alternatives	**0.07**	**1**	**1**	**1**	**0.07**
-Vulnerability of the WSS to climate change	**0.08**	**4**	**2**	**8**	**0.64**
-Transmission and trunk lines	**0.07**	**3**	**4**	**12**	**0.84**
-Distribution: Condition of network, length, age	**0.1**	**3**	**3**	**9**	**0.9**
-National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**0.08**	**2**	**2**	**4**	**0.32**
Customers and End users	**20%**				
-Repeated incidents and customer complaints	**0.06**	**3**	**4**	**12**	**0.72**
-Number of customers served - Number of people affected by the pollution incident	**0.07**	**3**	**3**	**9**	**0.63**
-Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**0.07**	**4**	**3**	**12**	**0.84**
Risk Prioritisation Score (RPS) = 8.66					

**RPS = The total of Weighted Scores *0.1*

Tables 15, 16, 17 and 18 below are exercises that Yarmouk Water Company's team completed with the support of the project for the WSS of Tannour, Qairwan, Shawahed, and Ramtha, in the north of Jordan. These examples are intended solely for training purposes and do not represent a final determination of the weighting.

Table 15: Risk prioritisation score- Tannour WSS- Yarmouk

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**30%**				
- Class and vulnerability of the raw water source	**0.09**	**5**	**4**	**20**	**1.8**
- Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**0.66**	**5**	**4**	**20**	**1.2**
- Vulnerability to Climate Change	**0.07**	**4**	**3**	**12**	**0.84**
- Geological sensitivity of the catchment area of the source water	**0.08**	**4**	**3**	**12**	**0.96**
Water Supply System: Treatment – Storage - Transmission - distribution	**50%**				
- Vulnerability and condition of the WSS	**0.1**	**5**	**4**	**20**	**2.0**
- Diversity of sources and availability of alternatives	**0.07**	**5**	**3**	**15**	**1.05**
- Vulnerability of the WSS to climate change	**0.08**	**5**	**3**	**15**	**1.2**
- Transmission and trunk lines	**0.07**	**4**	**3**	**12**	**0.84**
- Distribution: Condition of network, length, age	**0.1**	**4**	**3**	**12**	**1.2**

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
- National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**0.08**	**4**	**3**	**12**	**0.96**
Customers and End users	**20%**				
- Repeated incidents and customer complaints	**0.06**	**4**	**3**	**12**	**0.72**
- Number of customers served - Number of people affected by the pollution incident	**0.07**	**5**	**4**	**20**	**1.4**
- Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**0.07**	**4**	**4**	**16**	**1.12**
Risk Prioritisation Score (RPS) =15.29					

**RPS = The total of Weighted Scores *0.1*

Table 16: Risk prioritisation score- Qairwan WSS- Yarmouk

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**28%**				
- Class and vulnerability of the raw water source	**0.07**	**4**	**2**	**8**	**0.56**
- Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**0.05**	**4**	**2**	**8**	**0.4**
- Vulnerability to Climate Change	**0.08**	**4**	**3**	**12**	**0.96**
- Geological sensitivity of the catchment area of the source water	**0.08**	**4**	**3**	**12**	**0.96**
Water Supply System: Treatment – Storage - Transmission - distribution	**52%**				
- Vulnerability and condition of the WSS	**0.1**	**5**	**3**	**15**	**1.5**
- Diversity of sources and availability of alternatives	**0.07**	**4**	**3**	**12**	**0.84**
- Vulnerability of the WSS to climate change	**0.08**	**4**	**3**	**12**	**0.96**
- Transmission and trunk lines	**0.08**	**4**	**2**	**8**	**0.64**
- Distribution: Condition of network, length, age	**0.11**	**4**	**2**	**8**	**0.88**
- National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**0.08**	**4**	**2**	**8**	**0.64**
Customers and End users	**20%**				
- Repeated incidents and customer complaints	**0.06**	**4**	**1**	**4**	**0.24**
- Number of customers served - Number of people affected by the pollution incident	**0.07**	**5**	**4**	**20**	**1.4**
- Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**0.07**	**4**	**2**	**8**	**0.56**
Risk Prioritisation Score (RPS) =10.54					

**RPS = The total of Weighted Scores *0.1*

Table 17: Risk prioritisation score- Shawahed WSS- Yarmouk

Stage	Weight 100%)*	Impact (I) (1–5)	Frequency (F) (1–5)	Score = I × F	Weighted Score Weight x Score
Catchment	**28%**				
- Class and vulnerability of the raw water source	**0.07**	**4**	**4**	**16**	**1.12**
- Deliberate pollution of water resources and intentional attacks on water resources and related infrastructure	**0.05**	**5**	**4**	**20**	**1**
- Vulnerability to Climate Change	**0.08**	**4**	**3**	**12**	**0.96**
- Geological sensitivity of the catchment area of the source water	**0.08**	**4**	**4**	**16**	**1.28**
Water Supply System: Treatment – Storage - Transmission - distribution	**52%**				
- Vulnerability and condition of the WSS	**0.1**	**5**	**3**	**15**	**1.5**
- Diversity of sources and availability of alternatives	**0.07**	**4**	**4**	**16**	**1.12**
- Vulnerability of the WSS to climate change	**0.08**	**4**	**3**	**12**	**0.96**
- Transmission and trunk lines	**0.08**	**4**	**3**	**12**	**0.96**
- Distribution: Condition of network, length, age	**0.11**	**4**	**3**	**12**	**1.32**
- National priority development areas and linkage to existing capital investment and rehabilitation projects within the national priority context	**0.08**	**4**	**3**	**12**	**0.96**
Customers and End users	**20%**				
- Repeated incidents and customer complaints	**0.06**	**4**	**3**	**12**	**0.72**
- Number of customers served - Number of people affected by the pollution incident	**0.07**	**5**	**4**	**20**	**1.4**
- Social and economic impact of the pollution incident including impacts on refugees and vulnerable groups	**0.07**	**4**	**3**	**12**	**0.84**
Risk Prioritisation Score (RPS) =14.14					

**RPS = The total of Weighted Scores *0.1*

Table 18. Categorisation and prioritisation matrix (System chosen: Ramtha WWTP)

Stage	Weight 100%	Impact (I) (1-5)	Frequency (F) (1-5)	Score = I * F	Weighted Score = Weight* Score
Catchment (Collection Systems)	**30%**				
Outputs of Waste Water Safety Planning	**4%**	**5**	**2**	**10**	**0.4**
Percentage of Served Population	**6%**	**3**	**3**	**9**	**0.54**
Status of Sanitation Infrastructure	**7%**	**5**	**4**	**20**	**1.4**
Collection System Type & capacity	**7%**	**5**	**3**	**15**	**1.05**
Deliberate of Networks	**6%**	**4**	**2**	**8**	**0.48**
Wastewater Treatment	**50 %**				
Wastewater flows as compared to design capacity of the wastewater treatment plant and the sewage network design capacity	**10%**	**5**	**2**	**10**	**1.0**
Size of Wastewater treatment plant	**6%**	**4**	**2**	**8**	**0.48**
Applied wastewater treatment technology	**8%**	**4**	**2**	**8**	**0.64**
Influent water characteristics	**8%**	**4**	**2**	**8**	**0.64**
Effluent water characteristics	**9%**	**5**	**1**	**5**	**0.45**
Sludge Management	**6%**	**4**	**2**	**4**	**0.24**
Technical Sustainable Management (TSM)	**3%**	**3**	**3**	**9**	**0.27**
Downstream of WWTP	**20%**				
Final direct of use of treated effluent and the reuse infrastructure	**10%**	**5**	**3**	**15**	**1.5**
Final Indirect of use of treated effluent and the reuse infrastructure	**10%**	**5**	**5**	**25**	**2.5**
Risk Prioritisation Score (RPS) =11.59					

**RPS = The total of Weighted Scores *0.1*

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