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ACTION PLAN ON MACROPLASTIC POLLUTION MONITORING IN THE NILE BASIN

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Document Sheet

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TABLE OF CONTENTS

LIST OF FIGURES	III
LIST OF TABLES	III
ACKNOWLEDGMENTS	V
LIST OF ACRONYMS AND ABBREVIATION	VI
DEFINITIONS	VII
SUMMARY	VIII
1 INTRODUCTION	1
1.1 The project	1
1.2 Why is an Action Plan needed?	2
2 BACKGROUND AND SCOPE OF THE ACTION PLAN	2
2.1 Rationale	3
2.2 Alignment of macroplastic monitoring with NBI objectives on water quality and environmental monitoring	4
2.3 Methodological approach of the Action plan	6
3 STRATEGIC VISION OF THE ACTION PLAN AND OBJECTIVES OF THE ACTIONS PLAN	7
4 THE GUIDING PRINCIPLES OF THE ACTION PLAN	8
4.1 Focus on simple methods	9
4.2 Generate synergies with water quality and hydrological monitoring	10
4.3 Promote Participation, institutionalize and empower citizen engagement	10
4.4 Learning Through Pilot Implementation of the Monitoring Programme	11
4.5 Prioritize Data Management and Timely Data Flows Alongside Data Collection	12
4.6 Strengthen Institutional Capacity for Long-Term Monitoring Success	13
5 IMPLEMENTATION OF THE ACTION PLAN FOR MACROPLASTIC MONITORING IN THE NILE BASIN (2025–2030)	13
5.1 General recommendations based on the guiding principles	13
5.2 Stakeholder engagement	15
5.3 Action Items and Timeline	16
5.4 Financial Resources	26
6 RISK ASSESSMENT AND MANAGEMENT	30
7 REFERENCES:	33
ANNEX	34
A1. Global Method use for macroplastic monitoring	34
A 2. Selection of monitoring location and times	34
A 3. Citizen Science for Water Quality Monitoring and SDG Indicator 6.3.2 reporting	37
A 4. Data Licensing Options	38
A5 Pilot Sites proposed during the Workshop	39

List of Figures

Figure 1: Hierarchical design of plastic monitoring programmes as proposed in the unep guidelines for monitoring plastics in rivers and lakes (UNEP 2021)	4
Figure 2: Overview on the guiding principles of the action plan.....	9
Figure 3: Key stakeholder groups for a macroplastic monitoring programme	16
Figure 4: Overview on the three phases of the action plan	16
Figure 5: Matrix to assess to risk based on likelihood	30
Figure a 1: Relative frequency of macroplastic monitoring method applications	34
Figure a 2: Map of the proposed water quality monitoring stations in the Nile Basin	36

List of Tables

Table 1: Proposed action items objective 1: to design a standardized and basin-wide monitoring approach for macroplastic in rivers and lakes, embedded within existing water quality and hydrological monitoring systems of the Nile basin, to ensure coherence, efficiency, and mutual reinforcement of monitoring efforts	18
Table 2: Proposed action items objective 2: to implement and sustain macroplastic monitoring at selected sites in the Nile basin, using a phased approach that includes pilot testing and scale-up.	19
Table 3: Proposed action items objective 3: to develop and operationalize data management for macroplastic monitoring, ensuring data quality, accessibility, and integration with existing Nile basin information platforms	20
Table 4: Proposed action items objective 4: to engage citizen scientists, communities, and civil society in macroplastic monitoring, expanding spatial and temporal coverage and fostering environmental awareness and stewardship	20
Table 5: Gantt chart of the action plan	21
Table 6: Estimated annual operating costs per site for field measurements carried out by institutional staff	28
Table 7: Estimated annual operating costs data management, outreach, data synthesis	28
Table 8: Estimated annual costs citizen science engagement	28
Table 9: Estimated costs for the pilot phase (2 years)	29
Table 10: Estimated annual costs full scale monitoring	29
Table 11: Initial version of a risk register for the action plan. This register should be reviewed and updated as part of the action plan evaluation	31

Table a 1. Scheme supporting the selection of monitoring sites. Additional criteria can be added.

Note that in practice, criteria will never be met completely. 36

Table a 2 .Proposed pilot monitoring sites as outcome of an exercise during the kisumu workshop

39

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List of acronyms and abbreviation

BMUKN	Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany)
GEMS/Water	Global Environment Monitoring System for Water
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Cooperation)
LVBC	Lake Victoria Basin Commission
NBD	Nile Basin Discourse
NCCR	Nile Cooperation for Climate Resilience Project
NBI	Nile Basin Initiative
NGO	Non-Governmental Organization
SDG	Sustainable Development Goal
UAV	Unmanned Aerial Vehicle
UN	United Nations
UNEP	United Nations Environment Programme
WASSMO	Pan-African Water and Sanitation Sector Monitoring and Reporting System
WRUA	Water Resource User Associations

Definitions

Citizen Science: is the practice of engaging non-professional volunteers or community members in scientific research and data collection. It helps gather large-scale or local data that might be difficult for scientists or authorities alone to obtain, while raising public awareness and involvement in environmental monitoring.

Macroplastic: Plastic particles, fragments or items larger than 5 millimetres in size. This includes recognizable plastic debris such as plastic bags, bottles, food packaging, and fishing gear.

Monitoring: The systematic collection of environmental data at regular intervals over extended time periods to detect patterns and trends of pollution and inform management decisions.

Summary

Plastic pollution in freshwater systems poses a growing threat to ecosystem health, public wellbeing, and livelihoods—both globally and in the Nile Basin. This Action Plan focuses on macroplastic, which are more visible, easier to monitor, and actionable compared to microplastics. It presents a tangible framework for establishing a basin-wide macroplastic monitoring programme over a five-year period, aligned with the strategic objectives of the Nile Basin Initiative (NBI).

The Action Plan is grounded in a set of guiding principles that emphasize feasibility, inclusivity, and sustainability. It proposes low-cost, field-tested methods suitable for both expert personnel and citizen science groups. The Action Plan suggests to promote the integration of citizen science approaches leveraging the public awareness and engagement in plastic pollution. The integration of citizen science requires structured guidance, training, and visibility feedback mechanisms to ensure data quality and sustained participation. The Action Plan emphasizes that data management – submission, hosting, quality control, evaluation and publication is as important as the monitoring itself to promote the basis for informed decisions. Clear protocols for data ownership, access, and sharing are proposed to ensure transparency and usability of monitoring data. To launch the programme effectively, pilot implementation is proposed at selected sites across different countries. These pilots will refine protocols, test data systems, and build practical experience. Lessons learned will inform full-scale implementation and regional coordination.

Though NBI will need to mobilize additional financial resources, the Action Plan proposes several immediate Action Items to initiate a pilot monitoring programme which can be started with minimal additional resources when aligned with ongoing water quality and hydrological monitoring programmes.

1 Introduction

The exponential growth of plastic production since the 1950s and inadequate waste management have resulted in the accumulation of plastic debris, from macroplastic objects to nanometre-sized particles, in the environment. The marine environment is a major sink for plastic debris, most of which is generated on land and transported from coasts and by rivers. The widespread occurrence of plastics in soils, lakes, rivers and the marine environment, combined with its longevity, makes it a global environmental threat (MacLeod et al. 2021).

While rivers are considered a major transport pathway for plastic from land to the marine environment, increased observational data indicate that substantial amounts of plastic debris accumulate in and around rivers and on land. This creates a legacy of plastic pollution, even if the primary leakage of mismanaged plastic waste has ended.

Reducing plastic pollution in both the marine and terrestrial environment requires a holistic approach addressing the different phases of product life cycles. This includes product design that uses less plastic, the reduction of single-use items, especially packaging, and design for recyclability. A key factor in reducing plastic leakage into the environment is improving waste management, including collection, sorting, recycling and disposal. Policy measures and societal engagement can support behavioural change, promote greater producer responsibility and introduce regulations on the use of plastics and waste management practices.

Interventions can only be effective if they are based on sound, up-to-date information. There is a need to monitor plastics in rivers to identify hotspots of plastic pollution and reveal temporal trends, to inform the development of measures to combat plastic pollution effectively, and to track the success of efforts to reduce plastic waste and clean up initiatives.

All figures on plastic pollution have one thing common: uncertainty. Compared to other water quality parameters, data on plastics, in particular in freshwater environments, is still scarce. This scarcity of data on plastic pollution is prevalent globally and not unique to the Nile Basin.

The Nile is considered to transport substantial amounts of plastic into the Mediterranean (Strokal et al. 2023), yet estimates of its contribution are based almost entirely on modelled data due to the lack of observational measurements. Moreover, plastic pollution in rivers has a dual significance: rivers are not only key transport pathways for plastic waste to the marine environment but also retain plastic pollutions where it poses risks to freshwater ecosystems and human health. Plastic debris in freshwater systems can harm aquatic organisms through ingestion and entanglement, degrade water quality, and potentially introduce toxic substances into the food web. In human terms, this pollution threatens livelihoods, especially in communities dependent on clean water for drinking, fishing, or agriculture.

1.1 The project

Germany is committed to combating marine plastic litter, supported by the Federal Ministry for the Environment, Climate Protection, Nature Conservation and Nuclear Safety (BMUKN). The project on

marine litter prevention is financially supported by BMUKN and is implemented by GIZ. GIZ supports partner organizations in selected regions to develop strategies and how to tackle marine litter. Nile Basin is one of the regions where the project is active. Nile Basin Initiative (NBI) is committed to enhance the current level of understanding of plastic pollution transported by the Nile and its source areas in the catchment. The first phase of the project on plastic pollution in the Nile Basin aimed at achieving a comprehensive understanding of the current extent of plastic pollution transported through the Nile Basin (Shesh et al. 2022). This analysis was conducted based on the analysis of waste streams and analysis of waste management practices.

The second phase covered under this contract aims to understand and assess existing approaches to monitor plastic in the Nile Basin, provide training on plastic monitoring and develop an Action Plan for the implementation of a plastic monitoring concept for the Nile Basin countries. The focus will be on macroplastic, as they contribute a substantial proportion of the total plastic pollution (in terms of mass) and can be monitored using simpler methods than are required for microplastics. This makes macroplastic an ideal starting point for the implementation of plastic pollution monitoring.

1.2 Why is an Action Plan needed?

Plastic pollution is a complex and transboundary challenge that requires coordinated, sustained action. The Action Plan for macroplastic monitoring provides a frame to ensure that monitoring efforts across the Nile Basin are harmonized in terms of methods, protocols, as well as data management and reporting standards. Without such alignment, data remain fragmented and incomparable, making it difficult to assess basin-wide trends or to design effective, collective interventions. The Action Plan also enables countries and institutions to harness the untapped potential of citizen science. By engaging communities in data collection, the spatial and temporal coverage of monitoring can be expanded significantly, while simultaneously fostering environmental awareness and stewardship.

The Action Plan also enables countries and institutions to leverage the largely untapped potential of citizen science. By involving communities in monitoring, the spatial and temporal coverage of observations can be significantly expanded, while fostering environmental awareness and stewardship. The Action Plan promotes the integration of macroplastic monitoring with existing hydrological and water quality programmes, improving efficiency and enabling a more comprehensive understanding of water quality. This integration ensures that macroplastic data do not remain isolated, but instead contribute meaningfully to broader environmental management and decision-making frameworks within the Nile Basin. The Action Plan provides recommendations for the subsequent steps to be undertaken at different levels to operationalize a macroplastic monitoring programme in the Nile Basin.

2 Background and Scope of the Action Plan

The scope of the Action Plan is to provide a tangible plan on how to implement a macroplastic monitoring programme in the Nile basin. The Action Plan recognizes the available capacities and resources regarding monitoring, data management as well as the integration of citizen science approaches. In particular, the Action Plan builds on the insights gained from the Baseline study (Schmidt et al. 2025) where the resources and capacities for macroplastic monitoring as well as on a review of methods to monitoring macroplastic and how they are applied in the Nile Basin and worldwide is provided. The Baseline study revealed several multidimensional capacity challenges with regard to macroplastic monitoring, in

particular related to the enabling environment, the implementation capacity as well as challenges related to awareness and communication. Despite these challenges, the stakeholder mapping demonstrated significant potential. Nearly 75% of stakeholders are engaged in clean-up and/or monitoring activities. The scope of the monitoring programme is focused on macroplastic in rivers but also includes lakes. A key thread of the Action Plan is to emphasize that macroplastic monitoring is an integral part of water quality monitoring.

2.1 Rationale

When plastic pollution was first recognized as a widespread environmental problem found almost everywhere—from oceans to drinking water—the focus was on microplastics. Microplastics are considered to pose risks to organisms, including humans and ecosystems, as they can enter the food chain, be ingested, and cause health risks for both wildlife and humans. Consequently, much research and monitoring activity has been targeted toward understanding the occurrence, transport, and impact of microplastics.

However, macroplastic—larger items such as plastic bottles, bags, and packaging—constitute the bulk of plastic pollution by mass. As macroplastic degrade, they release microplastic particles and plastic-associated chemicals such as flame retardants and plasticisers. Macroplastic can also cause direct negative impacts by blocking stormwater drains and the intake systems of drinking water facilities and sewage treatment plants. Macroplastic, such as plastic bags, bottles, and fishing nets, pose immediate physical threats to wildlife and livestock, including entanglement and ingestion.

While rivers are recognized as a major source of plastic pollution for the oceans, and plastics significantly impact freshwater systems, comprehensive data on the presence of plastics in rivers and lakes is largely missing. This data is essential for identifying pollution hotspots, tracking trends, and assessing the success of mitigation efforts.

Furthermore, tracking macroplastic helps locate pollution sources, supporting targeted cleanup efforts and preventing further environmental degradation through targeted policy measures. Macroplastic are generally easier to monitor, as they are often visible and more accessible for community involvement, such as citizen science initiatives. Thus, macroplastic are an ideal target when systematically monitoring plastic in rivers and lakes.

The focus of a monitoring programme on macroplastic does not exclude the monitoring of other size fractions parallel to macroplastic or the expansion at a later stage in the monitoring programme design. However, because of the relative simplicity, it is an ideal starting point for the implementation of plastic monitoring in a river basin (Figure 1).

Data on plastics in rivers and lakes that is available globally today is not based on systematic monitoring programmes but on sporadic measurements or surveys relying on projects covering a limited timeframe, primarily for exploratory studies. The Action Plan is developed to enable the establishment of a sustained macroplastic monitoring programme in the Nile Basin.

In the Monitoring Strategy for the Nile River Basin (NBI, 2010), monitoring is defined as: “...the process of repetitive observing, for defined purposes, of one or more elements of the hydrologic cycle and

related processes according to prearranged schedules in space and time and using comparable methodologies for data collection.” This includes water quality monitoring and (macro) plastics are a water quality parameter. According to Chapman et al. (1996), water quality monitoring is defined as: “Long-term, standardised measurement and observation of the aquatic environment in order to define status and trends.” In addition to the definition of monitoring in NBI (2010), the Action Plan emphasizes that monitoring programmes should be designed on a long-term sustained basis to detect changes over time to inform management decisions or ensure compliance with regulatory standards as well as to track deterioration and improvements.

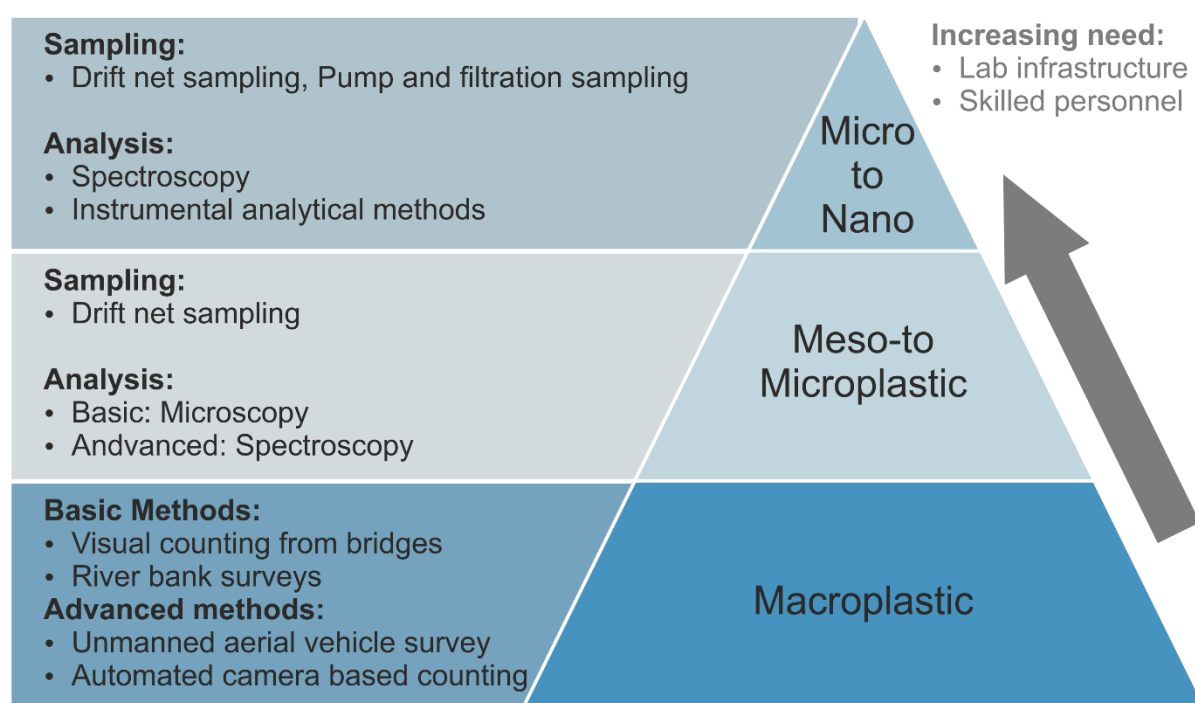


Figure 1: Hierarchical design of plastic monitoring programmes as proposed in the UNEP Guidelines for Monitoring Plastics in Rivers and Lakes (UNEP, 2021), starting with simpler methods and larger particles (macroplastic) and progressing toward smaller particles and more advanced analytical techniques. The Action Plan for the Nile Basin follows this approach, beginning with macroplastic monitoring and emphasizing simpler, accessible methods.

2.2 Alignment of macroplastic monitoring with NBI objectives on water quality and environmental monitoring

The efforts to establish a macroplastic monitoring programme in the Nile Basin are aligned with the broader strategies of the Nile Basin Initiative. On a high level, macroplastic monitoring and related interventions match the Shared Vision Objective of the Nile Basin Initiative, which is “**to achieve sustainable socio-economic development through equitable utilization of, and benefit from the shared Nile Basin water resources**”.

NBI 10 Year Strategy (2017 - 2027)

Freshwater quality plays a central role in achieving sustainable development throughout the Nile Basin. This is acknowledged in the 10 Year Strategy of the Nile Basin Initiative (NBI) for the period 2017-2027

(NBI, 2017). This strategy aims at providing the tool for implementing the Shared Vision Objective of the Nile Basin Initiative. Particular Goal 1 of the NBI Strategy, which aims to enhance availability and sustainable utilization and management of transboundary water resources and Goal 4, which aims to protect, restore and promote sustainable use of water-related ecosystems across the basin, explicitly address the need to establish monitoring programmes for water quantity and quality.

Monitoring Strategy for the Nile River Basin

In 2010 the NBI published the Monitoring Strategy for the Nile River Basin (NBI, 2010) to guide the development of comprehensive, basin wide monitoring programmes with a focus on Integrated Water Resources Management and hydro-meteorological data related to water resources development, water resources utilization, hydropower, rainfed and irrigated agriculture and climate change. Water quality, including fisheries, is also part of the monitoring strategy but is ranked with lower priority compared to hydro-meteorological monitoring. Macroplastic monitoring is an extension to the proposed core water quality parameters proposed in the monitoring strategy.

A central element of the Nile Basin Monitoring Strategy is Data Management and the easy access to monitoring data and derived data products. The strategic goal has been to implement a basin-wide information system which requires working on institutional and organizational processes as well as technical infrastructure.

Water Quality Management

As water quality monitoring is pivotal to river basin management and as particularly anchored in Goal 4 of the NBI 10 Year Strategy, the Nile Basin Initiative (NBI), in collaboration with the Nile Basin Discourse (NBD) and the Lake Victoria Basin Commission (LVBC) is implementing the Nile Cooperation for Climate Resilience (NCCR) project, which supports the improvement of national water quality monitoring networks and regional water quality information systems in the Nile Basin. This includes the provision of water quality sensors and laboratory equipment, the development of a water quality database and associated user interface in the Integrated Knowledge Portal (IKP) as well as building capacity on water quality monitoring, water quality analysis and modelling and improvement of communication and awareness in water quality management (<https://nilebasin.org/en/action-area/water-quality-management-system>).

Hydro- Meteorological Monitoring

Within the context of operationalisation of the Nile Basin Monitoring Strategy, the NBI is supporting the Member States in establishing and operationalising hydrological monitoring systems to provide more reliable data and information for water resources management (<https://nilebasin.org/en/action-area/hydromet>). The main activities include (1) the Rehabilitation/construction of selected stations, (2) procurement and installation of new monitoring equipment at stations, (3) upgrading national and regional data centres through acquisition of data management system hardware and software, (4) capacity building for national staff to support the hydrometric system installation and operation, and (5) information products to be generated from real data collected at regional stations to support decision making in water resources management. Overall the project includes 73 hydrological monitoring stations (gauges) selected for rehabilitation or construction. Under the umbrella of the Hydro met project, 39

water quality stations are equipped with water quality sensors. (<https://www.ciwaprogram.org/blog/building-on-the-success-of-the-regional-nile-basin-hydromet-project-nbi-addresses-water-quality-challenges-in-the-nile-basin/>)

Both hydrological and water quality monitoring sites can potentially serve as sites for macroplastic monitoring and are considered in the action plan.

Data management

The Monitoring Strategy for the Nile River Basin calls for effective management of monitoring data in order to provide timely, basin-wide harmonized ready-to-use monitoring data and derived data products. The macroplastic monitoring data should be under the same standards and policies as other monitoring data. The NBI operates a water quality database launched in 2023. Macroplastic data could be hosted (<https://nilebasin.org/waterqualitydatabase>) in this database.

NBI Gender Mainstreaming Policy and Strategy

The vision of the NBI Policy for mainstreaming Gender is a River Basin where the principles of gender equality and women's empowerment underpin sustainable human development, through equitable and sustainable use and management of water resources for poverty reduction (NBI Gender Mainstreaming Policy and Strategy, 2012). This Action Plan for Macroplastic Monitoring aligns with the gender mainstreaming strategy by ensuring that monitoring activities are inclusive and gender sensitive in particular if citizen science organisations are involved. This includes for example to select monitoring sites that are safe and easily accessible for women and other vulnerable groups to encourage their participation.

2.3 Methodological approach of the Action plan

The development of the Action Plan is based on the results of the Baseline study which include a literature review on macroplastic monitoring methods and their applications in the Nile Basin and worldwide. Insights into capacities and challenges for macroplastic monitoring have been provided through discussions and exchange with the Technical Working Group Members on Water Quality from the Nile Basin countries who attended a microplastic monitoring training workshop in Kisumu in February 2025, through face to face consultation with Stakeholders in Uganda and Kenya during a scoping mission and by the participants of a basin wide survey.

Those insights formed the basis for the development of a set of guiding principles which provide the guardrails for the breakdown into action items.

3 Strategic Vision of the Action Plan and objectives of the Actions Plan

Strategic Vision of the Action Plan

The Action Plan for Macroplastic Monitoring in the Nile Basin envisions a future in which macroplastic pollution in rivers and lakes is systematically monitored and transparently reported to inform about pollution hotspots, trends and ultimately to guide and evaluate interventions to reduce plastic pollution. By integrating macroplastic monitoring within existing water and environmental monitoring systems, and by engaging a wide range of stakeholders including government agencies, local communities, and civil society, the Action Plan supports evidence-based policy, strengthens environmental stewardship, and contributes to the protection of aquatic ecosystems and public health across the Nile Basin. Monitoring is not seen as an end in itself, but as a powerful tool to generate actionable evidence that can inform and shape policy at multiple levels. This includes guiding national legislation on plastic waste, supporting the introduction or refinement of extended producer responsibility frameworks, and informing regional strategies to reduce plastic leakage into freshwater systems. The Action Plan envisions to achieve sustained macroplastic monitoring programmes until 2030, aligned with the achievements of SGDs. The timeframe of the Action Plan covers 5 years until 2030, which coincides with the Achievement of the sustainable development goals.

Objectives of the Action Plan

The Action Plan is developed to achieve four key objectives:

- 1) To design a standardized and basin-wide monitoring approach for macroplastic in rivers and lakes, embedded within existing water quality and hydrological monitoring systems of the Nile Basin, to ensure coherence, efficiency, and mutual reinforcement of monitoring efforts.
- 2) To implement and sustain macroplastic monitoring at selected sites in the Nile Basin, using a phased approach that includes pilot testing and scale-up.
- 3) To develop and operationalize data management for macroplastic monitoring, ensuring data quality, accessibility, and integration with existing Nile Basin information platforms.
- 4) To engage citizen scientists, communities, and civil society in macroplastic monitoring, expanding spatial and temporal coverage and fostering environmental awareness and stewardship.

4 The guiding principles of the Action Plan

The Action Plan for implementing macroplastic monitoring in the Nile Basin proposes to be based on a set of guiding principles that form the guardrails for the more detailed action items. These principles serve to align the monitoring programme with the realities and opportunities of the Nile Basin, emphasizing feasibility, inclusivity, and sustainability. They reflect insights from the Baseline Study and stakeholder consultations, and from the participants of the training workshop in Kisumu in February 2025. These guiding principles emphasize simplicity in method selection, synergies with existing monitoring frameworks, meaningful engagement of citizen scientists, iterative learning through piloting, robust data management, and the long-term strengthening of institutional capacity (Figure 2).

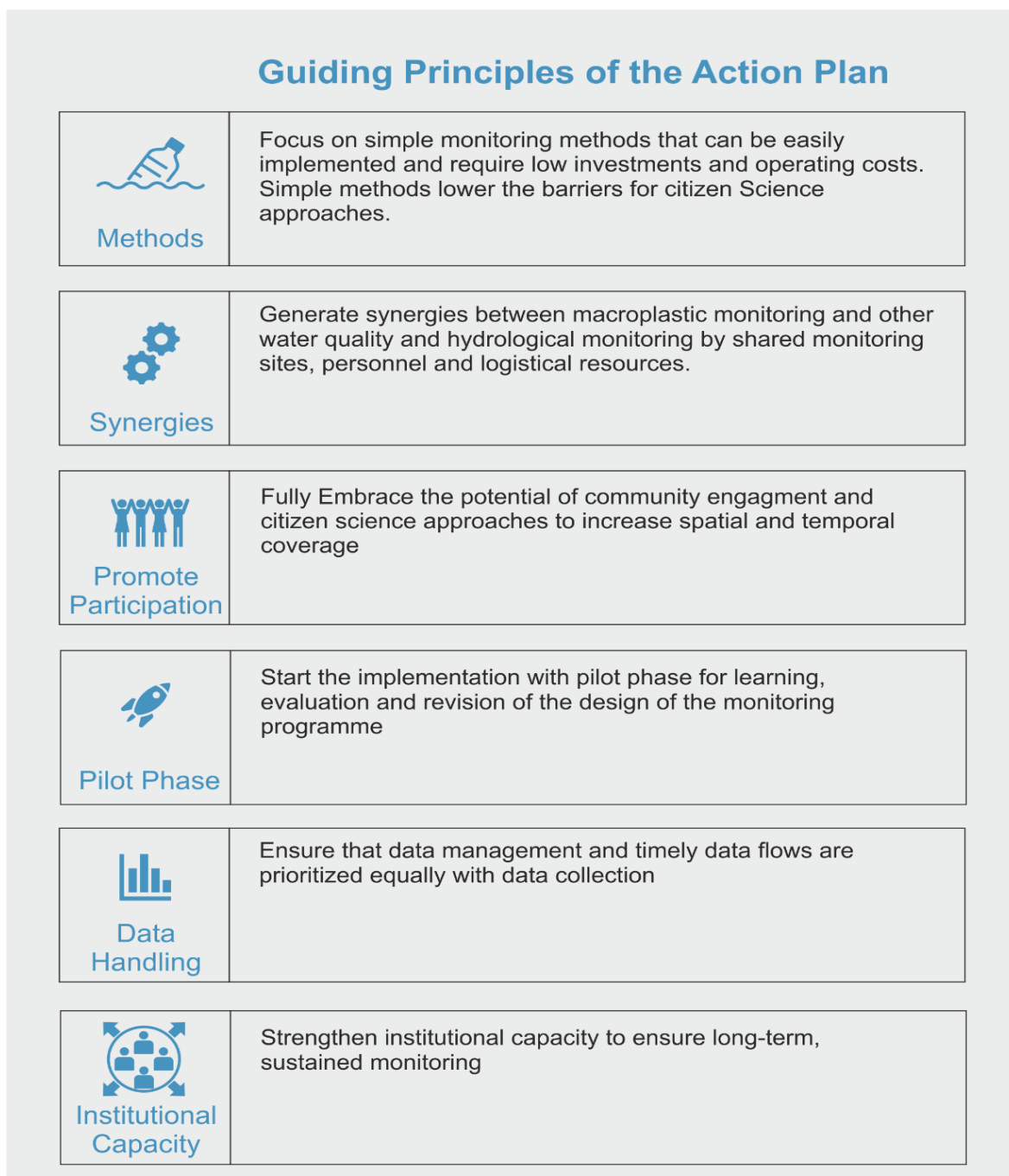


Figure 2: Overview on the Guiding principles of the Action Plan

4.1 Focus on simple methods

Macroplastic, unlike micro- or nanoplastic, can be monitored more easily through direct human observation, without the need for specialized equipment or advanced technical expertise. Various methods exist to detect macroplastic. Prioritizing simple approaches that do not require extensive technical infrastructure or expert knowledge offers two main advantages: it reduces implementation costs and resource requirements, and it enables broader participation – in particular, the involvement

of non-experts, including citizen scientists. This is especially important given the strong engagement of civil society in addressing plastic pollution.

A general framework for designing plastic monitoring programmes and selecting monitoring methods in freshwater systems is provided by the UNEP Guidelines for Monitoring Plastics in Rivers and Lakes (UNEP, 2021). These guidelines cover all size fractions of plastic pollution, from macro- to nanoplastic, and provide a comprehensive set of approaches and methods for monitoring. The scope of this Action Plan, with its focus on macroplastic, simplifies the design considerations for monitoring programmes, as the selection of size fractions can be narrowed from the outset.

The Baseline Study (Schmidt et al. 2025) revealed that globally, simpler methods for macroplastic monitoring — such as visual counting, riverbank surveys, and sample collection using nets, collection devices, or manual retrieval (in smaller rivers and streams) — dominate by far over more technical approaches such as fixed cameras on bridges or drone surveys (see also Annex 1 and the Baseline Report). The training workshop conducted as part of this project focused on two of these simpler methods: visual counting and riverbank surveys.

4.2 Generate synergies with water quality and hydrological monitoring

Generating synergies between macroplastic monitoring and existing hydrological and water quality monitoring programmes can significantly reduce costs by optimizing the use of human resources and logistics. Since the occurrence of macroplastic is often linked to hydrological factors, observing macroplastic at streamflow gauging sites can provide additional insights into variations in plastic transport. Overall, the integration of macroplastic monitoring into established monitoring frameworks would strengthen environmental monitoring in the Nile Basin.

Macroplastic monitoring remains a relatively new component in environmental observation systems, as scientific understanding of macroplastic transport and accumulation patterns in freshwater systems is still emerging. However, national and regional authorities have already established networks for hydrological and water quality monitoring under various mandates, including many that are linked to the Nile Basin Initiative (e.g., the Nile Basin hydro-meteorological and water quality monitoring network). By adding macroplastic as an additional parameter at hydrological and water quality sites, data collection efforts can be combined and made more efficient.

The Action Plan aims to integrate both institutional and citizen science-based approaches. A core set of macroplastic monitoring sites should be embedded into existing or planned institutional water quality and hydrometric monitoring networks, such as national monitoring systems supported by the Nile Basin Initiative. This integration helps formalize macroplastic pollution as a recognized environmental parameter. Since hydrological and water quality monitoring are often managed by separate authorities, coordination across institutions is essential to ensure coherent implementation.

4.3 Promote Participation, institutionalize and empower citizen engagement

Citizen science offers a powerful means to broaden the spatial and temporal reach of environmental monitoring efforts. In the case of macroplastic pollution—highly visible and of broad public concern—citizen involvement can yield both scientific and societal benefits. By enabling communities to contribute directly to data collection, the monitoring programme can achieve wider geographic coverage, generate more frequent data, and build local stewardship, ultimately increasing public engagement and policy relevance.

Beyond institutional monitoring, citizen science—the involvement of non-professionals in science-related activities—offers ample opportunities to incorporate the contributions of communities and Non-Governmental Organizations (NGOs) into macroplastic monitoring efforts. A stakeholder survey conducted during the Baseline Study (Schmidt et al. 2025) revealed that nearly 75% of respondents are already engaged in clean-up or monitoring activities, often over multiple years. Although these initiatives typically focus on plastic removal rather than formal monitoring, they hold significant potential for integration into systematic monitoring programmes.

Given the high visibility of plastic pollution, these community activities can be effectively aligned with structured monitoring frameworks. However, citizen science is not without challenges. It requires ongoing engagement, capacity development, and clear protocols to ensure data quality and consistency. Importantly, sustained support is needed to ensure reliability and continuity—not just as a cost-effective option, but as a legitimate and valued component of the monitoring landscape. Recognition and visibility of local actors is essential to maintain motivation and trust.

4.4 Learning Through Pilot Implementation of the Monitoring Programme

To ensure the successful and timely implementation of a macroplastic monitoring programme across the Nile Basin, it is essential to begin with a focused, limited-scale pilot phase. A pilot enables practical testing and iterative refinement of key components before full-scale deployment. It offers a critical opportunity to evaluate feasibility, optimize resource use, and build stakeholder confidence through demonstrable progress.

The proposed programme includes multiple components: institutional monitoring sites, citizen science contributions, data management infrastructure, and communication and reporting procedures. Piloting these elements in an integrated, real-world setting allows for coordinated testing, adaptive learning, and early identification of gaps or challenges.

During the hands-on training course in Kisumu (2025), country representatives developed initial drafts of national pilot programmes, including proposed monitoring sites and resource estimates (staff, equipment, training). These draft pilots provide a valuable starting point for designing the regional pilot phase.

The pilot phase will help refine methods, test data flows, establish coordination mechanisms, and identify capacity-building needs. It will also activate partnerships with civil society organizations and citizen scientists. Importantly, launching the pilot promptly capitalizes on the current momentum generated by the Action Plan and recent trainings—ensuring the transition from planning to practical implementation.

The pilot phase will help to refine the monitoring concept and methodology, to test data management procedures, establish coordination mechanisms with citizen scientists and civil society organizations and to identify resource and training needs.

Launching the pilot promptly will also capitalize on the momentum generated by the Action Plan and the recent training activities. Early implementation prevents stagnation and ensures that the planning process translates into action.

4.5 Prioritize Data Management and Timely Data Flows Alongside Data Collection

Effective data management is as critical as the collection of data itself. A monitoring programme only achieves its goals if the data it generates is accessible, reliable, and available in a timely manner. Ensuring smooth and transparent data flows—from the field to centralized repositories and ultimately to decision-makers—enables real-time responsiveness, promotes data use, and sustains engagement, especially when citizen scientists are involved. Without structured data management, valuable monitoring efforts may result in underused or inaccessible information.

Monitoring design efforts often emphasize site selection, sampling methods, and personnel deployment. However, without equal attention to data management, the collected data risks being fragmented, delayed, or lost. This is particularly important in a transboundary basin like the Nile, where harmonized data and centralized coordination are essential for coherent assessments and joint decision-making.

Data management is an integral part of the Action Plan and should be incorporated from the outset, beginning with the pilot phase. The Action Plan encourages hosting the macroplastic monitoring data in a centrally managed database for the entire Nile Basin. Central data hosting offers several benefits:

- **Standardization and Quality Control:** A central system ensures consistent data formats and facilitates quality control procedures.
- **Data Security:** Central hosting reduces redundant data storage and minimizes the risk of data loss from local devices.
- **Timely Data Availability:** A centrally hosted database, combined with options for mobile data submission, allows near-real-time monitoring data transfer directly into the central system.

The Nile Basin Initiative (NBI) has developed relevant data infrastructure, including a Water Quality Database and a hydro-meteorological data management system. These systems could potentially be adapted for macroplastic monitoring. However, their current usability and update frequency (e.g., last update to the water quality database in June 2022) should be critically reviewed.

As an alternative to NBI data infrastructures, cooperation with partners from the UNEP World Water Quality Alliance should be considered. One promising platform is FreshWater Watch, which supports data submission and hosting for water quality data collected by citizen scientists.

Centralized data hosting may raise concerns about data ownership, especially in a transboundary context. Several established licensing frameworks exist that can set clear rules regarding how data can be accessed, used, and attributed. It is recommended that data policies be agreed upon at the very beginning of the monitoring programme to avoid potential issues once data collection begins. Annex 4 provides an overview of widely used licensing frameworks applicable to data, software, and publications.

Additionally, formal agreements among countries or institutions regarding data use, responsibilities, and ownership can be established—or existing agreements may be adapted to this purpose.

4.6 Strengthen Institutional Capacity for Long-Term Monitoring Success

The success of a macroplastic monitoring programme depends not only on sound methodologies and efficient data flows, but also on the capacity of institutions to implement, coordinate, and sustain these efforts over time. Many agencies engaged in water quality or hydrological monitoring across the Nile Basin have limited experience and resources for tackling macroplastic pollution. Introducing macroplastic monitoring requires institutions to take on new tasks—such as classifying plastic waste, applying consistent monitoring protocols, and handling, storing, and transmitting new types of data.

To ensure meaningful implementation, targeted investment is needed in training, equipment, and organizational processes. Capacity development in this context is not a general or abstract recommendation, but a specific and strategic requirement for the success of the Action Plan. It enables national institutions to build ownership, integrate macroplastic monitoring into existing responsibilities, and maintain operations beyond short-term project funding.

Country consultations and the Baseline Study identified strong interest but uneven preparedness across the basin. Initial steps—such as the hands-on training provided in Kisumu (2025)—offer important foundations, but institutional strengthening must go further. This includes formalizing roles and workflows, allocating national budgets, harmonizing monitoring approaches, and enabling cross-agency coordination. Strengthening institutional capacity is therefore both a prerequisite for effective implementation and a guarantee of long-term impact and sustainability.

5 Implementation of the Action Plan for Macroplastic Monitoring in the Nile Basin (2025–2030)

The scope of the Action Plan is to provide a tangible plan on how to implement a macroplastic monitoring programme in the Nile basin. The Action Plan recognizes the available capacities and resources regarding monitoring, data management as well as the integration of citizen science approaches.

5.1 General recommendations based on the guiding principles

Focus on Simple Methods: For the implementation of the monitoring programme, it is recommended to use visual counting and bank surveys. These methods are widely applied globally and can be implemented by experts and non-experts. In addition, they do not require elaborate technical infrastructure or comprehensive expert knowledge. Standardized protocols are available to ensure harmonized macroplastic monitoring across the Nile Basin.

Generate synergies with water quality and hydrological monitoring: It is recommended to integrate macroplastic monitoring into national and regional hydrological and water quality monitoring frameworks. Priority should be given to sites already included in NBI-supported programmes or those regularly monitored by national water authorities (see also A 2). Overall, a flexible site selection strategy is recommended. Synergies can be realized not only through site co-location but also by aligning training

and data handling with other water quality monitoring efforts. Synergies can also be generated by embedding macroplastic data into regional and global reporting frameworks such as AMCOW's Pan-African Water and Sanitation Sector Monitoring and Reporting System (WASSMO) and the UN's SDGs would help ensure international recognition of the approach. Currently, through collaboration with UNEP's GEMS/Water programme, who are the custodians for SDG indicator 6.3.2 on ambient water quality, a Level 2 macroplastic sub-indicator is being developed (see also A3).

Promote Participation, institutionalize and empower citizen Engagement: Building on the existing engagement of civil society organizations, communities, and clean-up groups is an essential pillar of the Action Plan. By offering guidance and training their efforts can be integrated into structured monitoring activities. Contributions from citizen scientists must be acknowledged through proper attribution, visibility in data portals or reports, and timely feedback. This recognition fosters continued engagement and trust. Beyond data collection, citizen science serves as a means of public education and stewardship. Resources should be dedicated to long-term coordination, training, and communication with community participants. Opportunities should also be explored to integrate macroplastic monitoring into existing citizen science initiatives in the water sector, creating mutual benefits (e.g. <https://fwwearthw.hub.arcgis.com/pages/mara-river-basin>). Engagement with local communities could be facilitated through for example through Water Resource User Associations (WRUA) in Kenya or similar community-based organizations in other countries.

Prioritize Data Management and Timely Data Flows Alongside Data Collection: Effective data management is as crucial as data collection and must be integrated into the monitoring programme from the outset. Procedures for data handling should be designed during the pilot phase and refined as the programme scales up. The full data flow—from field observations to centralized storage, processing, and dissemination—should be clearly mapped. Existing infrastructure within the NBI, such as water quality and hydro-meteorological databases, should be assessed for their capacity to host macroplastic monitoring data. Where gaps exist, upgrades or complementary systems should be considered. Ensuring timely data flow is particularly important in the case of citizen science, where rapid feedback strengthens engagement and motivation. Policies on data ownership, access, and licensing should be defined early, ideally using open and transparent frameworks (e.g., Creative Commons, Open Data Commons). Capacity development for data handling and digital platforms should be part of the overall capacity-building efforts.

Learning Through Pilot Implementation of the Monitoring Programme: To build momentum and test the approach, pilot implementation is recommended at selected sites. These pilots should build on the draft strategies developed during the Kisumu training and be reviewed and refined with national partners. The pilot phase should include a representative set of institutional monitoring sites, citizen science contributions, and fully functional data flows (from field to database). This phase should be used as a learning opportunity, with regular evaluations and feedback from stakeholders to identify what works, what needs adjustment, and how best to scale up. In addition, the pilot will help identify real resource needs—whether human, financial, or technical—which can then inform basin-wide implementation planning. Lessons learned during pilot implementation should be documented systematically and shared across countries and institutions. This documentation will serve as a foundation for refining the regional strategy and building a robust, long-term monitoring programme

Strengthen Institutional Capacity for Long-Term Monitoring Success: The long-term success of macroplastic monitoring depends not only on sound methods and data systems, but also on the strength and readiness of the institutions responsible for carrying out this work. This includes technical training, formalizing staff roles and workflows, and creating linkages across departments or agencies. Building institutional capacity in this way fosters national ownership of the programme, supports integration into existing workplans and budgets, and reduces dependency on external funding.

5.2 Stakeholder engagement

Achieving the strategic goals of the NBI, and implementing the Action Plan for macroplastic monitoring in particular, requires the involvement of multiple stakeholder groups. Three stakeholder groups are of key relevance: 1) NBI Staff and NBI Governance Structure, 2) Institutional Stakeholders including academia, 3) Civil Society and Citizen Science Stakeholders (Figure 3).

NBI's internal structures play a central role in coordinating and supporting implementation efforts. This includes provision of training material and supporting the organisation of training workshops. NBI facilitates the collaboration and knowledge exchange across the Nile Basin countries through their Regional Expert Working Group on Water Quality and other related Regional Expert Working Groups (such as Hydrology). The NBI also supports the provision of infrastructure and technical support for data handling, including through the Nile Basin Water Quality Database.

Institutional stakeholders are primarily the government bodies and research institutions already engaged in hydrological and water quality monitoring. These include Ministries of Water (and /or related Ministries), national and regional water authorities as well as academia. These stakeholders bring monitoring expertise, logistical capacities, and in many cases, legal mandates for monitoring that are essential for the formal integration of macroplastic monitoring into national monitoring frameworks.

Citizen science is a cornerstone of the macroplastic monitoring approach in the Nile Basin. Civil society actors bring critical local knowledge and can foster public awareness and engagement. This stakeholder group includes community-based organizations, national and international NGOs, environmental youth groups and volunteer networks and citizen science organizations. Engagement with civil society stakeholders requires special attention, as this group is very diverse. A stakeholder mapping exercise conducted during the Baseline Study identified a diverse stakeholder landscape, comprising around 500 organizations across public, private, academic, and civil society sectors in the ten Nile riparian countries (see Baseline Report, Schmidt et al. 2025). A key partner for reaching and engaging with civil society stakeholders is the Nile Basin Discourse (NBD). Engaging civil society stakeholders in citizen science-based macroplastic monitoring requires a distinct approach from that used with institutional stakeholders. While institutional actors often operate under legal mandates and existing responsibilities for environmental monitoring, citizen scientists contribute on a voluntary basis. Therefore, sustained engagement relies on motivation, recognition, and support. To foster long-term participation, it is essential to ensure that citizen science contributions are valued and visible—for example, by acknowledging contributors in reports and integrating their data into regional assessments. Engagement should include accessible training, feedback mechanisms, and inclusive communication strategies to build trust, ownership, and sustained involvement across diverse local contexts.

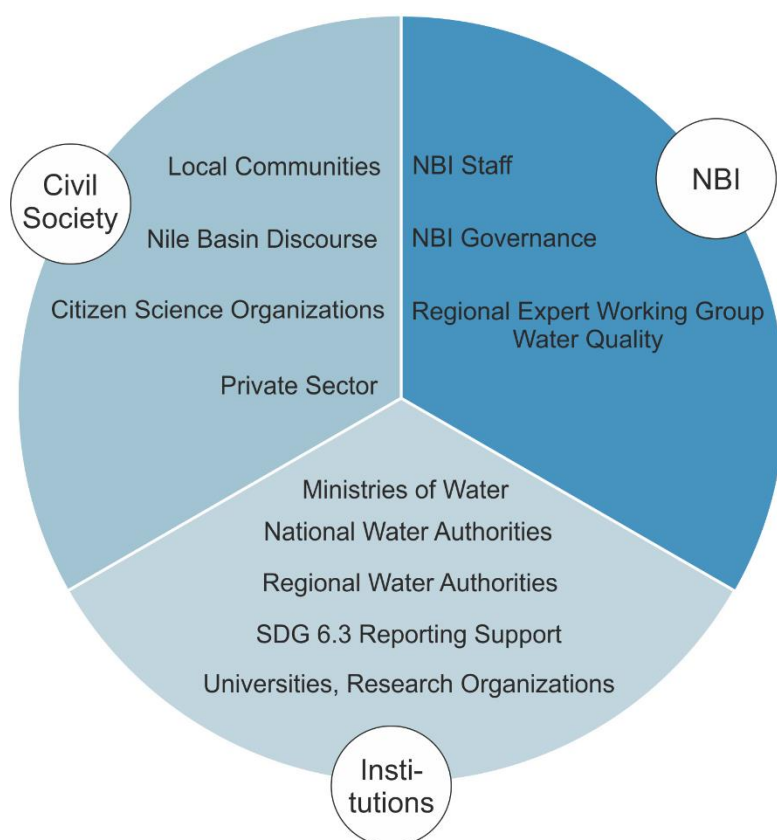


Figure 3: Key Stakeholder groups for a macroplastic monitoring programme

5.3 Action Items and Timeline

The implementation of macroplastic monitoring across the Nile Basin is structured into three phases: **Immediate (2025)**, **Mid-Term (2026–2027)**, and **Long-Term (2028–2030)**. Each phase builds on the previous one, moving from pilot development to regional expansion and institutional integration (Figure 4)

Action items are organized under four Action Areas, reflecting the key building blocks for operationalizing the monitoring framework derived from the guiding principles of the Action Plan: Technical Implementation of Monitoring, Data Handling, Citizen Science Engagement and Capacity Building.

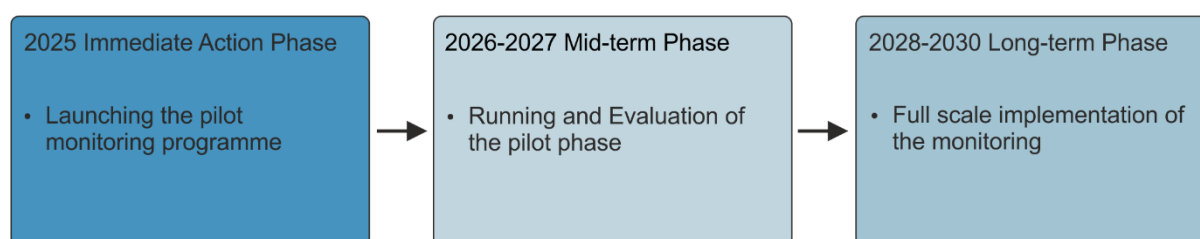


Figure 4: Overview on the three phases of the Action Plan

Immediate (short-term) Action Items should be started after approval of the action plan and should be started in 2025. Those Action items include mainly decisions and coordination required for the implementation of the monitoring programme, the evaluation of existing data infrastructures and the engagement with citizen scientists.

Mid-term Action Items are mainly related to implementation and the evaluation of the pilot monitoring programme and the preparation and onset of the full-scale implementation. The Action Items cover the time frame starting in early 2026 until the end of 2027.

Long-term Action Items include Scale up of the pilot monitoring programme to its full scale and preparing its extension to further parameters such as microplastics in the time frame from 2028 to 2030.

Table 1: Proposed Action Items Objective 1: To design a standardized and basin-wide monitoring approach for macroplastic in rivers and lakes, embedded within existing water quality and hydrological monitoring systems of the Nile Basin, to ensure coherence, efficiency, and mutual reinforcement of monitoring efforts

Action Item	Status	Sub Items	ST	MT	LT
Review and consolidate existing macroplastic monitoring protocols and methods	Available, finalization required	Compile international and regional protocols	x		
		Select appropriate methods for the Nile Basin	x		
Establish a coordination mechanism for monitoring design, operation and reporting	planned	Define membership and responsibilities for monitoring design, operation, reporting and management/generation of resources	x		
		Align existing NBI water quality/hydrology groups	x		
		Establish a steering group of the monitoring programme	x	x	x
Select pilot countries and monitoring locations	planned	Review proposed site from Kisumu workshop	x		
		Select national pilot sites	x		
Evaluate pilot results and adjust programme design	planned	Set up a contributor feedback and correction loop		x	
		Synthesize feedback on feasibility, data quality, engagement, and reporting workflows		x	
Define scale-up strategy and basin-wide rollout plan	planned, additional funding required	Select full scale monitoring locations aligned with water quality and hydrologic monitoring programmes		x	x
		Steering group coordinates the monitoring programme, organizes coordination meetings, and supports the mobilization technical and financial resources.		x	x
Expansion monitoring scope to include microplastics and other key water quality parameters (e.g., organic pollutants)	planned, additional funding required	Assess feasibility and capacity needs for integrating microplastic and organic pollutant monitoring into existing water quality programs at selected pilot sites.			x
		Seek strategic partnerships with universities, international research programs, and donor agencies to support technology transfer, capacity building, and long-term sustainability of expanded monitoring			x
		Develop training material for NBI e learning platform	x	x	

Develop and implement a continuous training and capacity building concept	planned, additional funding required	Set up training an on-site programme for institutional personnel including train the trainers for institutional and citizen science approaches		x	x
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Table 2: Proposed Action Items Objective 2: To implement and sustain macroplastic monitoring at selected sites in the Nile Basin, using a phased approach that includes pilot testing and scale-up.

Action Item	Status	Sub Items	ST	MT	LT
Implement institutional pilot monitoring programme	planned	Perform field monitoring at pilot locations	x		
		Use and test mobile and offline data collection tools	x	x	
		Set up and trial a central data hosting platform	x	x	
		Document roles and workflows each pilot site (e.g., who collects, validates, and submits data), identifying bottlenecks or gaps		x	
Evaluate pilot results and review programme design	planned	Evaluate pilot implementation, including data quality, logistical feasibility, on-site safety and institutional coordination		x	
		Review suitability of data collection and hosting solution and central platform, including usability, reliability, and interoperability with other monitoring systems.		x	
Implementation of the full-scale monitoring programme	planned, additional funding required	Perform operational monitoring at selected monitoring locations			x
		Operationalize and standardize data management (submission, hosting, evaluation), align with other water quality and hydrological monitoring programmes (including updates)			x
		Pilot the expansion of monitoring to microplastic (and other pollutants e.g. organic chemicals)			x

Table 3: Proposed Action Items Objective 3: To develop and operationalize data management for macroplastic monitoring, ensuring data quality, accessibility, and integration with existing Nile Basin information platforms

Action Item	Status	Sub Items	ST	MT	LT
Define data standards and metadata requirements	available, to be finalized	Develop standard data and meta templates for field collection (e.g., location, item type, count, weight)	x		
		Develop harmonized field protocols for data collection	x		
Decide on/ Develop a data submission and data hosting solution	planned, additional funding required	Review and test NBI platforms (e.g., Water Quality DB, Hydromet)	x		
		Test/Develop data submission solutions (Mobile App)	x	x	
		Establish operational support of data management (submission, hosting)		x	x
Ensure data quality control and validation procedures	planned	Define validation rules and QA/QC protocols	x	x	
		Set up and operate a contributor feedback and correction loop	x	x	x
Define data licensing and access policy	available, to be finalized	Choose appropriate licensing models (e.g. Creative Commons, see A 4)	x		
		Coordinate with NBI legal/policy structures	x		

Table 4: Proposed Action Items Objective 4: To engage citizen scientists, communities, and civil society in macroplastic monitoring, expanding spatial and temporal coverage and fostering environmental awareness and stewardship

Action Item	Status	Sub Items	ST	MT	LT
Identify and engage citizen science partners	available, to be finalized	Identify and engage with stakeholders for citizen-based monitoring for the pilot phase	x		
		Map relevant NGOs, youth groups, and schools for the full scale up		x	
		Establish national/regional focal points and networks to engage with citizen scientists	x	x	x
		Use Pilot sites as engagement and training hubs		x	
	planned, additional funding required	Develop gender sensitive safety guidelines for fieldwork	x		

Action Item	Status	Sub Items	ST	MT	LT
Develop citizen science monitoring protocols and data submission solution		Establish mechanisms to provide basic protective gear and observation protocols	x	x	
		Test/Develop data submission solutions tailored to citizen science, e.g. using regional languages (Mobile App)	x	x	
Provide training and support for citizen scientists	planned, additional funding required	Develop citizen-science specific training materials (print, digital, consider local languages)	x	x	
		Organize onsite workshops or webinars		x	x
		Ensure sustained availability of focal points	x	x	x
Create feedback and engagement mechanism	planned, additional funding required	Establish rapid processing and publishing of citizen-based monitoring results		x	x
		Recognize contributions (certificates, highlight contribution on NBI Websites, Social media)		x	x

Table 5: Gantt Chart of the Action Plan

Action Phase		ST		MT								LT											
	Year	2025		2026				2027				2028				2029				2030			
Action Items		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Objective 1																							
1.1 a Compile international and regional protocols																							
Select appropriate methods for the Nile Basin																							
Define membership and responsibilities for monitoring design, operation, reporting and management/generation of resources																							
Align existing NBI water quality/hydrology groups																							

Action Phase		ST	MT						LT											
	Year	2025	2026			2027			2028			2029			2030					
Establish a steering group of the monitoring programme																				
Review proposed site from Kisumu workshop																				
Select national pilot sites																				
Set up a contributor feedback and correction loop																				
Synthesize feedback on feasibility, data quality, engagement, and reporting workflows																				
Select full scale monitoring locations aligned with water quality and hydrologic monitoring programmes																				
Steering group coordinates the monitoring programme, organizes coordination meetings, and supports the mobilization technical and financial resources.																				
Assess feasibility and capacity needs for integrating microplastic and organic pollutant monitoring into existing water quality programs at selected pilot sites.																				
Seek strategic partnerships with universities, international research programs, and donor agencies to support technology transfer, capacity building, and long-term sustainability of expanded monitoring																				
Develop training material for NBI e learning platform																				
Set up training an on-site programme for institutional personnel including train the trainers for institutional and citizen science approaches																				
Objective 2																				
Perform field monitoring at pilot locations																				

Action Phase		ST	MT						LT											
	Year	2025	2026			2027			2028				2029				2030			
Use and test mobile and offline data collection tools																				
Set up and trial a central data hosting platform																				
Document roles and workflows each pilot site (e.g., who collects, validates, and submits data), identifying bottlenecks or gaps																				
Evaluate pilot implementation, including data quality, logistical feasibility, on-site safety and institutional coordination																				
Review suitability of data collection and hosting solution and central platform, including usability, reliability, and interoperability with other monitoring systems.																				
Perform operational monitoring at selected monitoring locations																				
Operationalize and standardize data management (submission, hosting, evaluation), align with other water quality and hydrological monitoring programmes (including updates)																				
Pilot the expansion of monitoring to microplastic (and other pollutants e.g. organic chemicals)																				
Objective 3																				
Develop standard data and meta templates for field collection (e.g., location, item type, count, weight)																				
Develop harmonized field protocols for data collection																				
Review and test NBI platforms (e.g., Water Quality DB, Hydromet)																				
Test/Develop data submission solutions (Mobile App)																				

Action Phase		ST	MT								LT											
	Year	2025	2026				2027				2028				2029				2030			
Establish operational support of data management (submission, hosting)																						
Define validation rules and QA/QC protocols																						
Set up and operate a contributor feedback and correction loop																						
Choose appropriate licensing models (e.g. Creative Commons, see A 4)																						
Coordinate data sharing policy with NBI legal/policy structures																						
Objective 4																						
Identify and engage with stakeholders for citizen-based monitoring for the pilot phase																						
Map relevant NGOs, youth groups, and schools for the full scale up																						
Establish national/regional focal points and networks to engage with citizen scientists																						
Use Pilot sites as engagement and training hubs																						
Develop gender sensitive safety guidelines for fieldwork																						
Establish mechanisms to provide basic protective gear and observation protocols																						
Test/Develop data submission solutions tailored to citizen science, e.g. using regional languages (Mobile App)																						
Develop citizen-science specific training materials (print, digital, consider local languages)																						

Action Phase		ST		MT						LT												
	Year	2025		2026				2027			2028				2029				2030			
Organize onsite workshops or webinars																						
Ensure sustained availability of focal points																						
Establish rapid processing and publishing of citizen-based monitoring results																						
Recognize contributions (certificates, highlight contribution on NBI Websites, Social media)																						

5.4 Financial Resources

Resources for technical implementing monitoring

As the monitoring approach is based on simple methods, the resources required to conduct the monitoring in the field requires mainly time from personnel and travel to the monitoring sites. As stated in the guiding principles, ideally macroplastic monitoring should not be isolated from other monitoring activities and thus resource needs can be minimized.

Resources for Data Handling and Management

A robust data infrastructure is essential for storing, processing, and analysing macroplastic monitoring data. The NBI implemented a data management system (https://nilebasin.org/hydromet/data_management) focused for hydro-meteorological data as well as a water quality data base (<https://nilebasin.org/waterqualitydatabase>). In particular the water quality data base could host macroplastic monitoring data.

For entering the macroplastic monitoring data, a mobile app could be a viable tool. Investment in app development or adaptation of existing platforms may be needed if the provision of a mobile app is envisioned. While the infrastructure setup requires upfront investment, ongoing maintenance costs (server hosting, software updates, and user support) should be considered for long-term sustainability.

Resources for Citizen Science and Community Engagement

Effective engagement of citizen scientists and local communities requires investment in outreach materials and communication strategies. This includes the development of awareness raising materials such as brochures, posters, and digital content for social media to encourage participation. A key resource is the establishment of a feedback mechanism, such as regular meetings or online dashboards where citizen scientists can see their contributions and how the data is being used. Recognition and incentives (e.g., certificates, public acknowledgments, or participation in stakeholder meetings) can help maintain motivation and long-term commitment. While the initial design of engagement strategies requires investment, continued participation depends on periodic reinforcement through active communication and visibility of monitoring results which requires backing by personnel.

Resources for Capacity Development

Establishing a macroplastic monitoring programme requires initial investment in capacity building and training in the monitoring methods. Training must be conducted for both institutional staff and citizen scientists to ensure standardized data collection. This includes workshops on visual counting protocols, safety procedures, and data recording techniques. Additionally, training materials such as manuals, video tutorials, and standardized field guides should be developed to ensure consistency. Initial investments may also include the development of digital training modules, allowing for scalable capacity building over time. While these resources require higher investment at the start, refresher training and periodic updates will ensure data quality and continuity.

Budget overview

The estimated budget is broken down into cost items for operating the monitoring programme including field data collection, data handling, and citizen science engagement and into investments such as for data infrastructure and the development (adaptation of a mobile app). Here a modular approach is outlined including estimates for a single site and the overall monitoring programme. The cost estimates are intended to provide order of magnitude estimate, help contributors and participants to oversee cost drivers and to offer scalable estimates from single pilot sites to a basin wide implementation. Budgets is provided for individual components of the monitoring programme so that they can be easily adjusted, scaled and recombined.

The estimated budget is broken down into cost items related to the operation of the monitoring programme—covering field data collection, data management, and citizen science engagement—as well as investment costs, such as the development and adaptation of data infrastructure (including a mobile application).

A modular approach is presented, with cost estimates provided both for operating a single monitoring site and for scaling up to a basin-wide programme. These estimates are designed to provide order-of-magnitude figures, helping contributors and participants understand key cost drivers and explore different implementation scales—from individual pilot sites to full programme deployment. Budget components are structured to allow flexibility: each element of the monitoring programme is presented separately, so that they can be easily adjusted, scaled, and recombined to suit different national contexts, implementation capacities, or available funding levels.

Table 6: Estimated annual operating costs per site for field measurements carried out by institutional staff

Cost Item	Unit	Costs (USD)	Notes/Assumptions
Institutional Field personnel for field data collection and data entry	person hours	360	Assumptions: 15 USD per hour, 2h per site, Monthly sampling, calculated as additional time for sampling
Transport (car+fuel or tickets)	trip	600	Assumption: Trips for sampling are back to back with water/quality hydrologic observation 50 USD per trip
Equipment (clipboards, gloves, vests)	set/team	40	one set 40 USD, refreshed every year
Operating costs for measurements per site and year		1000	

Table 7: Estimated annual operating costs data management, outreach, data synthesis

Cost Item	Unit	Costs (USD)	Notes/Assumptions
Data curation and data base maintenance	person days	6000	Assumptions: 250 USD per day, 2 days per month
Data synthesis, reporting generation	person days	3000	Assumptions: 250 USD per day, 1 day per month
Content generation social media accounts and NBI website	person days	3000	Assumptions: 250 USD per day, 1 day per month
Total annual costs data management, synthesis and reporting		12000	

Table 8: Estimated annual costs citizen science engagement

Cost Item	Unit	Min Costs (USD)	Max Costs (USD)	Notes/Assumptions
Communication material development/update and distribution	set	500	1000	Printed Information to be distributed locally
Onsite training events	per event	500	6000	highly depend on the spatial scale (bringing citizens together over a wider area would be more expensive than a smaller one)
Phone/ mobile data	set	500	1000	provision of phone and air time
Operating costs for measurements per site and year		1500	8000	

Table 9: Estimated costs for the pilot phase (2 years)

Cost Item	Min (USD)	Costs	Max (USD)	Costs	Notes/Assumptions
Operating costs per site for field measurements carried out by institutional staff	22000		22000		1 Pilot site per NBI country, 11 in total , 2 years of pilot phase
Operating costs data management, outreach, data synthesis	12000		12000		same as for full scale implementation
Citizen Science Engagement	4000		28000		2 onsite training events per year (4 in total)
Investment	5000		36000		same as for full scale implementation
Total costs (operating and investment) for a two-year pilot phase	43000		98000		

Table 10: Estimated annual costs full scale monitoring

Cost Item	Min (USD)	Costs	Max (USD)	Costs	Notes/Assumptions
Operating costs per site for field measurements carried out by institutional staff	100000		100000		100 Monitoring Sites in the Nile Basin
Citizen Science Engagement	2000		14000		2 onsite training events per year
Operating costs data management, outreach, data synthesis	12000		12000		
Total annual operating costs for a full-scale monitoring	114000		126000		
One-time Investment (already in Pilot Phase)	5000		36000		

6 Risk Assessment and Management

The implementation of the Action Plan is subject to a range of potential risks. This section provides a high-level overview of key risk categories and outlines the approach to managing these risks. A risk assessment is conducted using a risk matrix, which combines the likelihood of an event occurring with the impact it would have on the programme. This enables the identification of priority risks that require early mitigation. The proposed risk assessment and management approach is based on those typically applied in research projects funded by the European Union (Ahlers et al. 2021).

Likelihood	High	Medium	High	High
	Medium	Low	Medium	High
	Low	Low	Low	Medium
		Low	Medium	High
		Impact		

Figure 5: Matrix to assess to risk based on likelihood and

High level risk categories related to the implementation of the Action Plan are the following:

Institutional and Governance Risks: Risks related to unclear mandates, weak institutional coordination, or lack of political prioritization of (macroplastic) monitoring.

Financial and Resource Risks: Risks stemming from insufficient or unreliable funding and the limited allocation of staff and other essential resources.

Technical and Operational Risks: Risks associated with the practical execution of monitoring activities, including inadequate staff training, logistical issues and issues related to data management (technical and ownership/licensing)

Citizen Engagement Risks: Risks related to the engagement, motivation, and sustainability of citizen scientists.

Political Risks: Risks arising from social instability or broader political developments that could, for example, restrict access to monitoring sites

A set of risks known a priori is documented and assessed in Table 1. However, risks may evolve or emerge during the implementation of the Action Plan. Therefore, the risk assessment and risk register provided in this document are intended to be living tools, updated regularly to reflect new developments and to support adaptive management.

It is recommended to review and update the risk register at least annually, or more frequently if major changes occur. A structured mechanism should be in place for responsible actors to raise new risks, enabling timely responses and proactive mitigation measures.

Table 11: Initial version of a Risk Register for the Action Plan. This register should be reviewed and updated as part of the Action Plan evaluation

Date Raised	Responsible	Over-all Rating	Likelihood	Impact	Risk Description	Risk response
Institutional and Governance Risks						
2025-06-10	NBI	Medium	Medium	Medium	Mandates for macroplastic monitoring are unclear across national agencies, leading to gaps.	Specify institutional responsibilities; align with existing mandates for water quality monitoring.
2025-06-10	NBI	Low	Low	Medium	Macroplastic monitoring is not seen as a political priority	Raise awareness through policy briefs linking plastic pollution to SDG targets and national water quality goals
Financial and Resource Risks:						
2025-06-10	NBI, REWG	High	Medium	High	Limited financial resources to support long-term monitoring beyond pilot phase	Incorporate macroplastic monitoring into medium-term expenditure frameworks; explore funding from climate/environment-related sources
Technical and Operational Risks:						
2025-06-10	REWG	High	High	High	Observer bias among field teams reduces data comparability	Offer regular training; Perform test monitoring in parallel groups to quantify observer bias
2025-06-10	NBI	Low	Low	Medium	Uncertainty over data licensing/ownership hinders sharing and access	Draft and sign simple data-sharing agreements; promote use of open licenses (e.g., CC-BY); clarify attribution and access rules in training
Citizen Engagement Risks:						
2025-06-10	NBD	Medium	Low	Low	Difficulty in mobilizing sufficient numbers of citizen scientists at the start of the program	Use targeted engagement through regional networks and partners
2025-06-10	NBD	High	Medium	High	Drop-off in volunteer participation after initial engagement events	Maintain regular contact; create recognition systems (e.g., certificates, map visualizations); provide updates on how data are used
Political Risks:						
2025-06-10	REWG Water Quality	Low	Low	Medium	Access to certain monitoring sites is restricted because of local unrest	Consider accessibility and safety in site selection. Plan backup locations
		Medium	Medium	Medium	Changes in government delay or reverse prior commitments to monitoring	Maintain engagement with both political and technical staff

7 References:

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Annex

A1. Global Method use for macroplastic monitoring

One part of the current project on macroplastic monitoring in the Nile Basin was to conduct a review of macroplastic monitoring methods used in the Nile basin countries as well as globally. A total of 70 scientific studies were found which applied macroplastic different methods. Figure A 1 shows the relative frequencies of methods used revealing that riverbank surveys and visual counting of macroplastics on the river surface are applied in more than 50% of the studies. A more detailed overview is provided in (Schmidt et al. 2025).

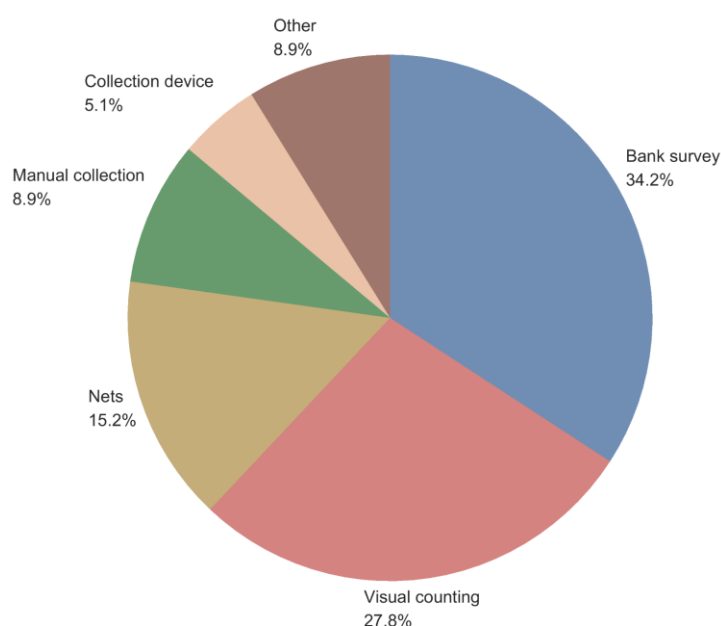


Figure A 1: Relative frequency of macroplastic monitoring method applications

A 2. Selection of monitoring location and times

As the existing knowledge on macroplastic transport mechanisms and abundance in rivers and lakes is still limited, it is not yet possible to propose an optimal set of monitoring locations solely based on macroplastic pollution patterns.

Monitoring locations

In line with the guiding principle of generating synergies with other environmental monitoring approaches, priority should be given to existing monitoring stations for water quality or hydrometric observations. These sites could be the ones that are part of the NBI hydro-meteorological and/or water

quality monitoring network. In addition, countries are encouraged to select sites in line with their regional water quality observations or for example driven by prior knowledge that certain locations are macroplastic pollution hotspots or are locations with ongoing interventions where monitoring can help to track success. In summary there is great flexibility regarding the selection of sites. By adding macroplastic as an additional parameter to hydrological and water quality sites, data can be combined (Figure A 2). For example, observing streamflow alongside macroplastic counts (e.g., items per time) allows for the calculation of macroplastic concentrations and provides insights into how macroplastic loads and concentrations respond to hydrological variations. For example, it has been observed that macroplastic loads can substantially increase during high discharge events as material is mobilized from the riverbed, banks, and surface runoff (van Emmerik et al. 2023).

Key locations in a catchment where high macroplastic pollution in rivers is expected include downstream of urban areas. Polluted riverbanks are typically also found in urban areas. However, there are no "wrong" monitoring sites, data from locations with low pollution levels are equally valuable, providing a broader understanding of macroplastic distribution.

With regard to citizen science-based monitoring and community-driven clean ups, they are active in a specific river, city or settlement. Those sites should be kept and integrated into the monitoring. However, awareness on safety issues should be raised.

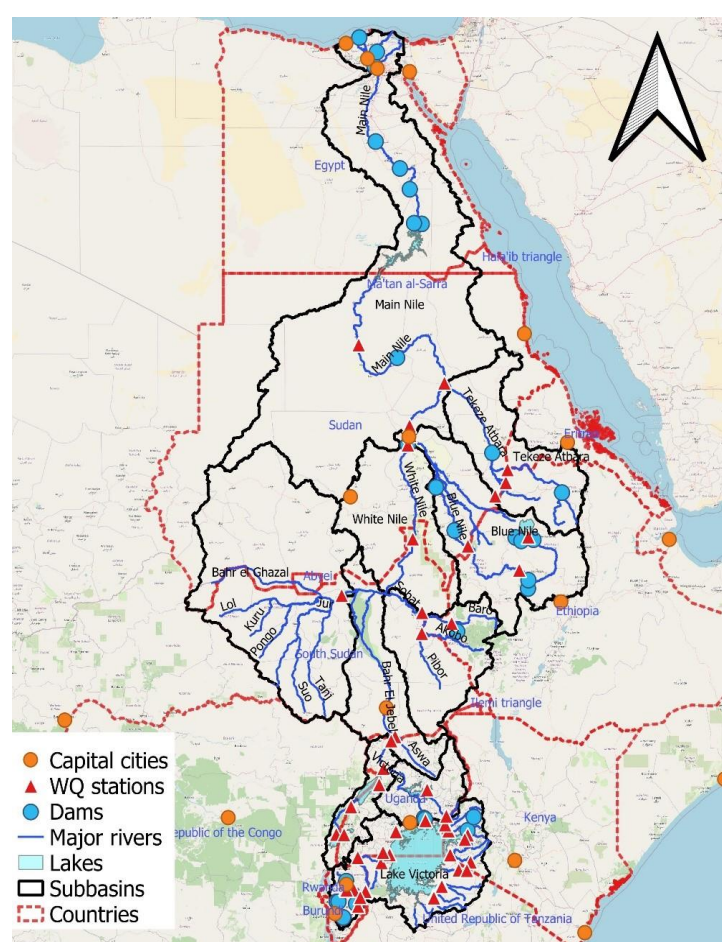


Figure A 2:Map of the proposed water quality monitoring stations in the Nile Basin. (source: <https://nilebasin.org/en/action-area/water-quality-management-system>). These locations are ideal to consider as candidate sites for implementing a macroplastic monitoring programme.

Monitoring frequency

In general, a higher monitoring frequency will provide more insights into patterns and pollution trends - this holds true not only for macroplastic. Macroplastic mobilization from terrestrial source and riparian areas is often driven by hydro-meteorological conditions. The occurrence of macroplastic items in rivers and lakes often increases during wet periods with higher rainfalls and stream flows (van Emmerik et al. 2023). Therefore, it is recommended that with the monitoring frequency potential seasonal patterns can be captured, which calls for a monitoring frequency of monthly to 3-monthly measurements. If the total number of possible observations is constrained, it is recommended that at least a 3-monthly observation frequency is targeted and that fewer monitoring sites are selected in this case. A sustainable, regular, long-term monitoring programme should be preferred over the number of sites.

Criteria for the selection of monitoring sites

The Action Plan can only provide general criteria for selecting monitoring sites (Table A 1). The actual selection of sites depends on a multitude of factors and is the responsibility of local experts with on-the-ground knowledge. Here three categories of selection criteria are proposed: Strategic Suitability, Safety and Accessibility.

Strategic Suitability refers to the relevance of a monitoring site in terms of its location within the river network and its potential to provide insights into macroplastic pollution trends and overall patterns. Ideally, sites should be representative of different pollution levels, such as areas downstream of urban centres where macroplastic accumulation is expected. Sites should align with existing hydro-meteorological or water quality monitoring sites or citizen science activities to allow for integrated analysis and synergies regarding the use of resources.

Safety considers potential risks associated with conducting monitoring activities at a given site. Factors such as steep or unstable riverbanks, high traffic on bridges, the presence of dangerous animals, and crime risks must be evaluated. A safe monitoring location ensures that participants, including citizen scientists, can conduct observations without undue risk.

Accessibility addresses the practical aspects of reaching and using a monitoring site. Sites should be legally accessible. The distance to reach the sites should be considered as well, and also if they are reachable by public transport. It is also essential to consider potential gender aspects – for example, women citizen scientists may have less access to cars and face greater mobility constraints due to cultural norms or safety concerns. Ensuring accessibility for all groups, regardless of gender, helps maintain diverse participation which promotes sustainable engagement.

Table A 1. Scheme supporting the selection of monitoring sites. Additional criteria can be added. Note that in practice, criteria will never be met completely.

Criteria	Considerations	yes	no
Strategic Suitability	Is the location already part of hydrological/water quality monitoring?		

Criteria	Considerations	yes	no
	Can personnel from hydrological/water quality monitoring conduct the visual counting/ bank surveys?		
	Is there a bridge to conduct visual counting?		
	Is the location already part of activities of communities/NGO (CS organizations e.g. activity in cleanups)?		
Safety	Steep eroded riverbanks, unstable ground, dangerous animals		
	Are there safety issues (crime, traffic, steep banks or unstable ground, dangerous animals)?		
	For visual counting: Is there heavy traffic on the bridge?		
	Does the bridge have a separate pedestrian/cycling lane?		
Accessibility	Can the bridge or the river banks be accessed safely and legally?		
	Can the site be reached by public transport /foot?		
	Is a car required to reach the site?		

A 3. Citizen Science for Water Quality Monitoring and SDG Indicator 6.3.2 reporting

SDG target 6.3 states: “By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally”. To track progress towards the target, SDG indicator 6.3.2 monitors the proportion of bodies of water with good ambient water quality. Currently, there are substantial data gaps regarding water quality in many regions of the world. The latest (UNEP, 2024) progress update on Ambient Water Quality stated that “by 2030, the health and livelihoods of 4.8 billion will be at risk because there are insufficient data to understand how these water bodies are responding to the pressures put on them.”

Initiated by the World Water Quality Alliance, GEMS/Water and Earthwatch, there are ongoing projects to include citizen science-based data into SDG Indicator 6.3.2 reporting. Two countries, Sierra Leone and Zambia have included CS data for SDG Indicator 6.3.2 reporting. In Sierra Leone, the number of water bodies assessed and the number of data records, doubled when CS data were included. Five more countries are expected to use CS data for Indicator 6.3.2 reporting in 2026.

Linking citizen science with SDG Indicator 6.3.2 has already had a positive impact and raised awareness of the water quality issues. In addition to generating data, this approach has the advantage of connecting national authorities that are responsible for monitoring a country's freshwaters with those communities that are best placed to protect and restore them. Adding macroplastic to the list of water quality parameters would further strengthen this relationship and advance efforts to reach SDG Target 6.3 by 2030.

A 4. Data Licensing Options

Data sharing is essential for maximizing the impact of the monitoring programme as it enables the aggregation and interpretation of the monitoring data in the context of the entire basin. Often there are still misconceptions about data sharing as it is perceived as losing control or ownership of data which is not the case. There are a number of established licensing frameworks which regulate how data can be accessed, used, and attributed, ensuring data contributors retain control while facilitating collaboration. Below is an overview and widely used licensing options (Table A).

Table A 2: Potential licensing frameworks for monitoring data

License	Description	Link for More Information
Creative Commons (CC)	Flexible licensing with options from public domain (CC0) to more restrictive (CC BY-NC). Often used for data-sharing in research.	creativecommons.org
Open Data Commons	Licensing from public domain to attribution and share-alike options. Common for open data projects.	opendatacommons.org
Community Data License Agreement (CDLA)	Designed for collaborative projects. Permissive (very open) and Sharing (share-alike) versions.	cdla.dev
GNU General Public License (GPL)	Typically for software but adaptable for data with share-alike requirements.	gnu.org/licenses/gpl

A5 Pilot Sites proposed during the Workshop

The sites have been proposed as part of an exercise to develop a macroplastic monitoring strategy during the Workshop in Kisumu in February 2025. Those sites could serve as candidate sites for the implementation of a macroplastic monitoring pilot phase (Table A2).

Table A 2 Proposed pilot monitoring sites as outcome of an exercise during the Kisumu workshop

Country	Locations	Available Resources	Notes
Burundi	Ruvubu River	No funding available but staff from hydrologic monitoring station can be involved	
Democratic Republic Congo	Semiliki River	Human Resources are available but no additional funding	Currently no safe travel possible
Ethiopia	Akaki River Basin	4 hydrological stations, 20 water quality monitoring sites, funding for personnel, equipment and logistics to be mobilized	
Kenya	Kibos River (close to Kisumu)	Limited water quality personnel based in the lab but there is a working arrangement between WRA and the community (WRUA (Water Resource Users Association) and gauge meter readers), 5 Water quality monitoring sites, additional funding for logistics and personnel required	
Rwanda	Akagera River (specifically at Kanzene Bridge)	3 Water quality monitoring stations along the river, funding required for personnel and logistics	
South Sudan	Nile (close to Juba)	No funding available but personnel from different stakeholders	
Sudan	Nile (North of Khartoum)	No funding available	
Tanzania	Mirongo River	One hydrological station, Water User Association could be involved in monitoring, no funding available	
Uganda	Rwizi River Catchment	5 Hydrological station, 3 Water Quality Monitoring sites, technical staff, no funding available	



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