SDG Indicator 6.3.2 Technical Guidance Document No. 4: Level 2 Reporting

This document provides guidance on SDG Indicator 6.3.2 Level 2 reporting, and complements the Introduction to SDG Indicator 6.3.2[1] and forms part of a series that provide detailed technical guidance on specific aspects of the indicator methodology. These resources are available through the SDG Water Quality Hub[2].

This document is aimed at practitioners seeking further information on Level 2 reporting and its relevance for their country's SDG Indicator 6.3.2 submission. This document:

- expands on the Level 2 concept presented in the Introduction to SDG Indicator 6.3.2;
- links to new technical documents on biological monitoring[3], macroplastics[4] and citizen-science[5]; and,
- details the Level 2 indicator[6] calculation and submission process.

Level 2 Overview

The Level 2 concept was created and developed in response to feedback gathered from SDG Indicator 6.3.2 national focal points and international experts following the 2017, 2020 and 2023 data drives (UNEP GEMS/Water 2019; 2022; 2025). Level 2 reporting is an optional workflow that provides Member States with the scope to report beyond the limitations of Level 1. Level 1 reporting is essential because it provides global comparability and is based on measures of water quality that are globally relevant, which is an essential aspect of all SDG indicators, but Level 2 reporting provides flexibility to report on water quality issues that may be regionally, nationally or even locally relevant. Level 2 provides this flexibility and takes reporting on water quality beyond the constraints of Level 1.

A Level 2 submission may either include the Level 1 physico-chemical parameter groups as one of two or more reporting components, or in the absence of Level 1 data, it could comprise one or more Level 2 data sources alone. Because Level 2 SDG Indicator scores can be customised to a national context, they are best used to track temporal or spatial trends at the national level. There are exceptions such as global Earth Observation (see below) or modelled products which can provide spatially and temporally consistent information.

Countries that choose to report at Level 2 will have two national indicator scores and currently, it is only the Level 1 score that is forwarded to the United Nations Statistical Division (UNSD). UNSD is the UN organisation that collates all SDG information.

When calculating this indicator at Level 2, the same general principles apply as those at Level 1. This means that water bodies are classified as either 'good' or 'not good' based on compliance of water quality measurements to respective

[1] https://wwqa.info/knowledge-center/sdg632/SDG632_Introduction-to-the-Methodology
[2] https://sdg632hub.org/
[3] https://wwqa.info/knowledge-center/sdg632/SDG632_Technical-Guidance-Document-No5-Biological-Monitoring
[4] https://wwqa.info/knowledge-center/sdg632/SDG632_Technical-Guidance-Document-No7-Macroplastics
[5] https://wwqa.info/knowledge-center/sdg632/SDG632_Technical-Guidance-Document-No6-Citizen-Science
[6] https://wwqa.info/knowledge-center/sdg632/SDG632_Technical-Guidance-Document-No4-Level-2-Reporting

targets. Also, where possible, countries are encouraged to report at Level 2 using the same water body and Reporting Basin District (RBD) hydrological units that are used for Level 1 reporting. This helps ensure spatial comparability between the two indicator scores.

Countries that choose to report at Level 2 can do so either in parallel or in sequence to their Level 1 submission. Reporting at Level 2 is achieved through a separate reporting template that is structurally similar to that of Level 1. This can be found on the SDG Water Quality Hub.

The differences between Level 1 and Level 2 are illustrated in Figure 1 and are summarised below.

- **Data Collection**: Level 1 is limited to *in situ* data only. Water quality is either measured at the monitoring location or a sample is collected for subsequent analysis. Whereas Level 2 data can be collected by remote methods such as satellite-based Earth observation or other remote sensing approaches.
- **Data Type**: Level 1 is constrained to the five core physico-chemical parameter groups (oxygen, salinity, nitrogen, phosphorus and acidification), whereas Level 2 can include additional physico-chemical parameters as well as include pathogen, biological or ecosystem approaches to water body classification. Countries may combine one or several additional data types in their Level 2 submission.
- **Data Source**: Level 1 data are usually derived from national monitoring programmes implemented by national agencies or authorities responsible for monitoring, but may include other sources such as academic, private sector or citizen science initiatives. Level 2 differs because it provides countries with the opportunity to use these same sources as Level 1, but to also incorporate data derived from Earth observation or modelled products.

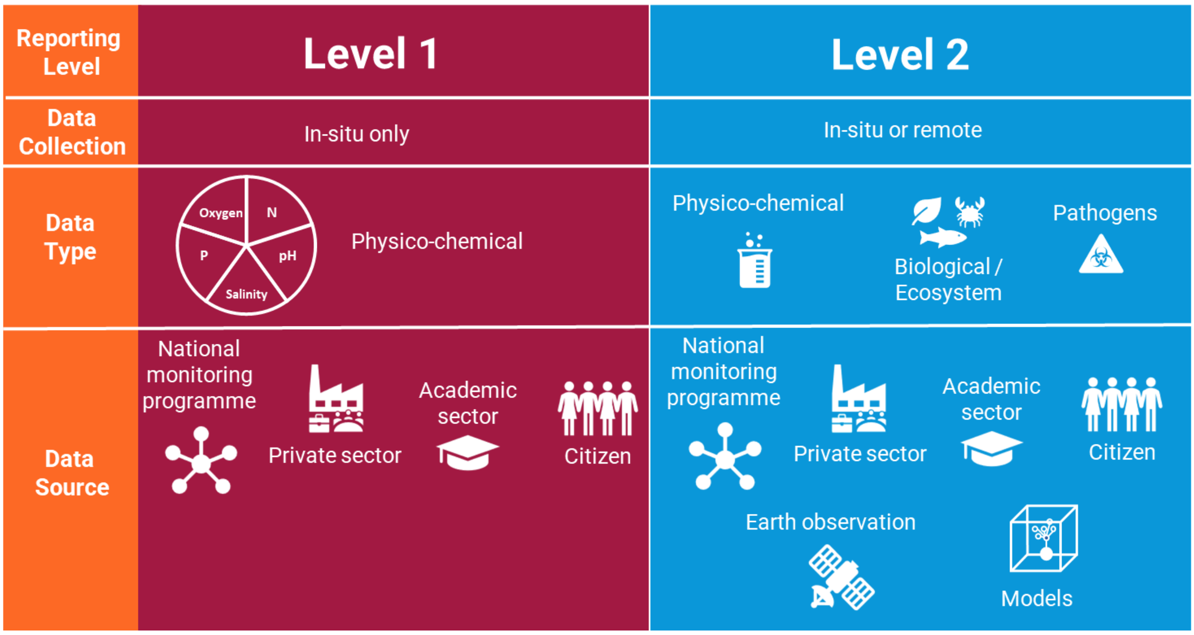


Figure 1: Level 1 and Level 2 data types and sources that can be used for SDG indicator 6.3.2 reporting

Level 2 sub-indicators that countries may include in their submission are shown in Figure 2. This is a non-exhaustive list and there may be other cases that countries may wish to include, but those shown cover commonly used approaches.

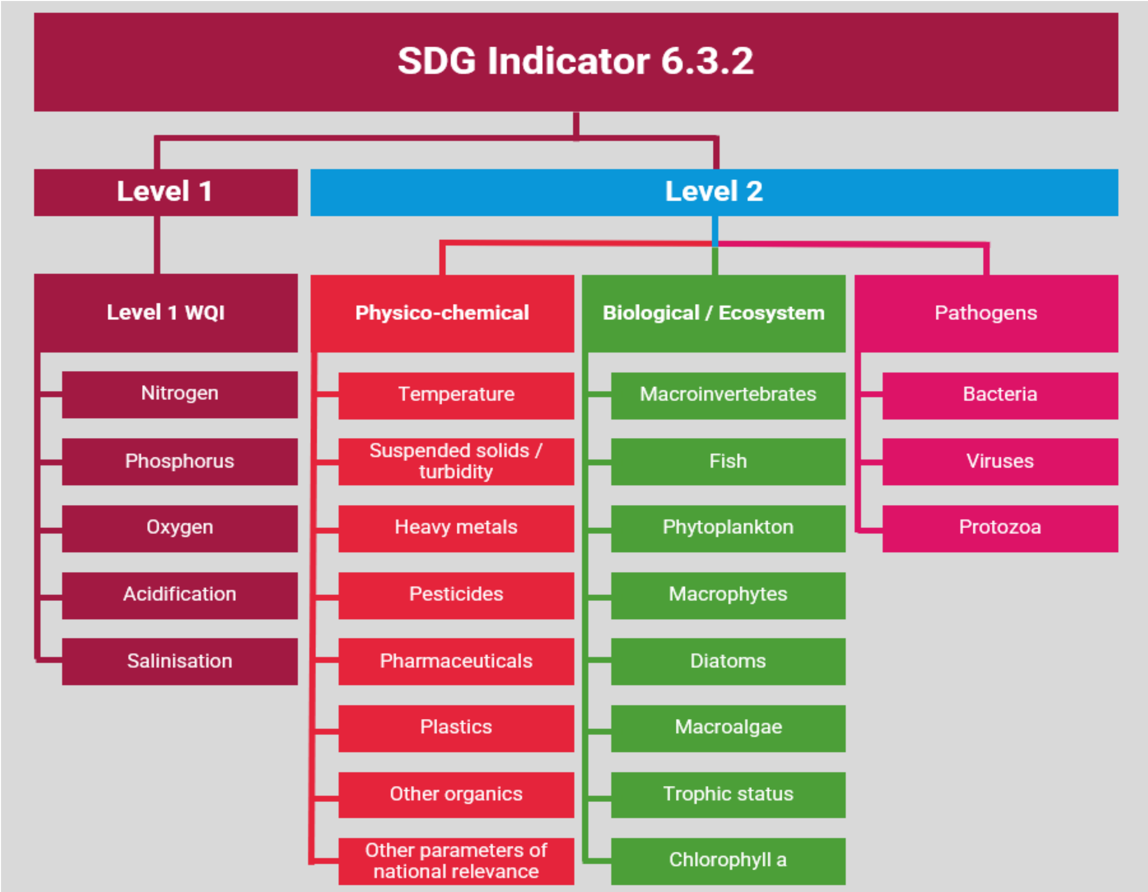


Figure 2: Schematic of Level 1 and Level 2 Sub-indicators

Level 2 Data Types

The three Level 2 data types are described in more detail below. One or several data types may be packaged in a Level 2 submission as separate reporting components.

Physico-chemical parameters

Based on national monitoring objectives, most countries routinely collect ambient water quality data beyond those parameters required for Level 1 reporting such as temperature, turbidity, colour or suspended solids. They may also include toxic substances that occur naturally from a geological origin (geogenic) such as fluoride or arsenic, or related to pollution from activities such as agriculture or mining (anthropogenic) such as pesticides or mercury.

Level 2 reporting can include data on any physical or chemical parameter which is collected as part of a routine monitoring programme. The impact of the parameter on the freshwater ecosystem or human health will determine the method of data integration. This is discussed in below in the Level 2 Calculation Process section.

Plastic pollution is a pervasive and persistent problem in many surface waters. To provide a mechanism to include macroplastics data into the SDG monitoroing framework, a new macroplastics methodology has been developed based on the work of the WWQA Plastics Workstream. This is described in a new technical guidance document which outlines the rationale for monitoring macroplastics and describes how the data generated can be reported for the SDGs as well as feed into national and regional reporting processes and frameworks aimed at reducing plastic pollution.

Biological and Ecosystem

There are many biological and ecological approaches to monitoring ambient water quality, but no single method has been tried and tested globally. Most have been developed for a country or region, and then adapted for use in another. For example, the Biological Monitoring Working Party (BMWP) method developed in the UK (Biological Monitoring Working Party, 1978) was adapted for the South African Scoring System (SASS) and further developed into the most recent version SASS5 (Dickens and Graham, 2002).

A new technical guidance document on biological monitoring has been developed to support countries seeking initial direction on initiating biological monitoring, and also guidance on how to incorporate existing biological data into the SDG reporting framework.

Many biological methods work on the principle that aquatic organisms respond to changes in their environment in measurable ways. In response to poor water quality, species may not be able to survive or will move to a different location to avoid the unfavourable conditions. Less severe responses include a reduction in reproduction or growth rates (Friedrich *et al*., 1996). Macroinvertebrates are commonly used to monitor the quality of streams and wadeable rivers. Some methods rely on the identification of indicator species (presence/absence) or look at the diversity and abundance of the species found. Certain species are more sensitive to poor water quality and are not found where oxygen levels are continuously or periodically low, whereas the abundance of more tolerant species is higher.

When biological approaches have been established, they are often more economical to operate than those that employ techniques that measure physical and chemical characteristics of water. They are not useful for providing information on whether specific parameter target values have been exceeded or not, but they provide a better overall assessment of water quality if implemented correctly.

Pathogens

Untreated domestic sewage effluent is one of the most serious and prevalent forms of water pollution globally. Pathogens carried in the wastewater can lead to serious health issues and contribute to high child mortality rates in many least-developed countries. Access to safely managed drinking water services is measured by SDG indicator 6.1.1. In 2020, the indicator team found that only 74 per cent of the world's population had access to a safely managed drinking water supply (WHO and UNICEF, 2021).

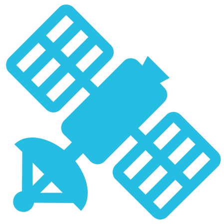
There are many bacterial, viral and protozoan pathogens that can be found in freshwaters. Some of these are included in routine monitoring of drinking water sources but not necessarily in dedicated ambient water monitoring programmes. Microbiological approaches may look for the presence or absence of indicator bacteria that suggest the presence of bacteria that may be harmful to humans. Examples are thermotolerant coliforms, such as *Escherichia coli*, which can be used as an indicator of faecal contamination of water.

Data Sources

As with Level 1, Level 2 data can be sourced from the national monitoring programmes, private or academic sectors as well as citizen science monitoring programmes as long as those data are analysed at the monitoring location or collected for later laboratory analysis. In addition, Level 2 can draw upon water quality information sources that go beyond the Level 1 *in situ* approach and include remote sensing data such satellite-based Earth Observation or modelled data products if the models can be regularly updated with new input data.

Citizen-generated data were considered a Level 2 data source during the 2020 data drive but were upgraded to Level 1 (if data on Level 1 parameters are collected) in 2023. This remains the case for the covering both Level 1 and Level 2 reporting is detailed in a new technical guidance doc, so is not elaborated on here.

Earth Observation

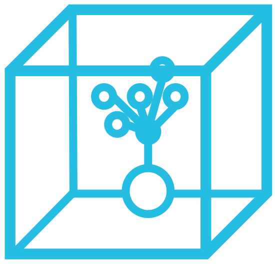


Earth Observation satellite data are increasingly being used for water-quality monitoring. However, they are limited to optically-detectable water quality parameters, such as turbidity, chlorophyll and total suspended solids; and to date, no single method has been adopted as the global standard. The technology is currently most suitable for relatively large bodies of water, such as lakes and wide rivers, because the spatial resolution available from current satellite images for global applications is not fine enough for smaller water bodies. Given the extensive spatial and temporal coverage of current and upcoming satellite missions, satellite data could prove to be an important additional data source for monitoring large rivers and lakes in the near future.

A new EO indicator has been developed through a *World Water Quality Alliance (WWQA) EO Workstream*[7] project that will ensure harmonised information generated for both SDG Indicators 6.3.2 and 6.6.1. This standalone EO-based indicator draws upon the Copernicus Land Monitoring Service[8] (CLMS) Lake Water Quality (CLMS 300 m) Water Quality product and can be scaled to produce global water quality data at 300 m spatial resolution for the 4300 plus lakes in CLMS database. This product generates lake-level indicator statistics that can be scaled to sub-national (river basin) and national levels, as well as used to generate regional and global statistics. This will be made available through the SDG Water Quality Hub (6.3.2) and Freshwater Ecosystem Explorer (6.6.1). This new indicator will be released in 2026 for both SDG indicators and made available through the SDG Water Quality Hub and the Freshwater Ecosystems Explorer[9].

UNEP have aligned the SDG Indicator 6.3.2 Level 2 satellite-based Earth Observation and the SDG Indicator 6.6.1[3] water quality sub-indicator of Level 2 method to provide a global dataset of water quality of large lakes

Modelled data



Mathematical models have been used to estimate pollutant concentrations and distribution for several decades and can be used to assess the effectiveness of management measures aimed at improving water quality. The complexity of models has increased considerably over the last 50 years (Whitehead *et al.*, 2019), with some addressing pollutant fate, transport and degradation of a compound within a water body, while others model the movement of pollutants from land-based sources to a water body. Calibration and validation using real-world data are essential steps for any model to ensure that it gives an accurate representation of the situation or scenario.

Water quality models use data on variables such as climate, population, ground/surface water interactions, reaction kinetics of the compound being modelled, land use characteristics and topography. The quality of the model output is entirely dependent on the quality of the data used in the model and also the suitability of the model with regards to approach and calibration.

Models can be specific and applied to national-scale for individual parameters. For example, a map of fluoride concentrations in groundwater in India was produced using a combination of real-world data and information on geology, climate and soil types. The model predicts areas where the fluoride concentration is likely to be over 1.5 mg L^{-1} (Podgorski *et al.*, 2018). They can also be applied at regional scales for multiple parameters inclduding nitrogen, phosphorus and turbidity concentrations for Africa (Nkwasa et al., 2024).

When considering incorporating model outputs for SDG Indicator 6.3.2 reporting, it is important to ensure that outputs are current and updatable on a regular basis. Models that rely on historical data or that are generated on a one-time basis are unable to track progress on water quality improvement and are therefore unsuitable for this indicator.

[7] https://wwqa.info/workstreams/earth-observation-for-water-quality
[8] https://land.copernicus.eu/en/products/water-bodies?tab=lake_water_quality
[9] https://www.sdg661.app

Level 2 Calculation Process

It is important to note that using Level 1 information as part of a Level 2 submission is encouraged, but in the absence of any Level 1 data, a Level 2 submission can rely upon Level 2 data sources only.

Below are options and guidelines on Level 2 indicator calculation. It is important to reiterate that the same general principles apply for Level 2 as to Level 1. This is relevant for the spatial hydrological units used (water bodies and RBDs); the target concept when working with quantitative values; and, the binary classification system.

A classification system that includes more gradations than the binary approach can be used, but a binary conversion (to good vs not good) must be incorporated to align with the reporting framework. For example the European Water Framework Directive (WFD) uses five categories: high, good, moderate, poor and bad. In this case, water bodies classed as either high or good quality would qualify as 'good'.

A Level 2 classification can be calculated by one of three mechanisms. Level 2 data can be used:

- to **expand spatial coverage** and fill gaps in the data record;
- used in a '**one out, all out**' approach; or by
- **extending the parameter list** beyond the five core Level 1 parameters.

Figure 3 illustrates how the type of data available determines the most suitable approach.

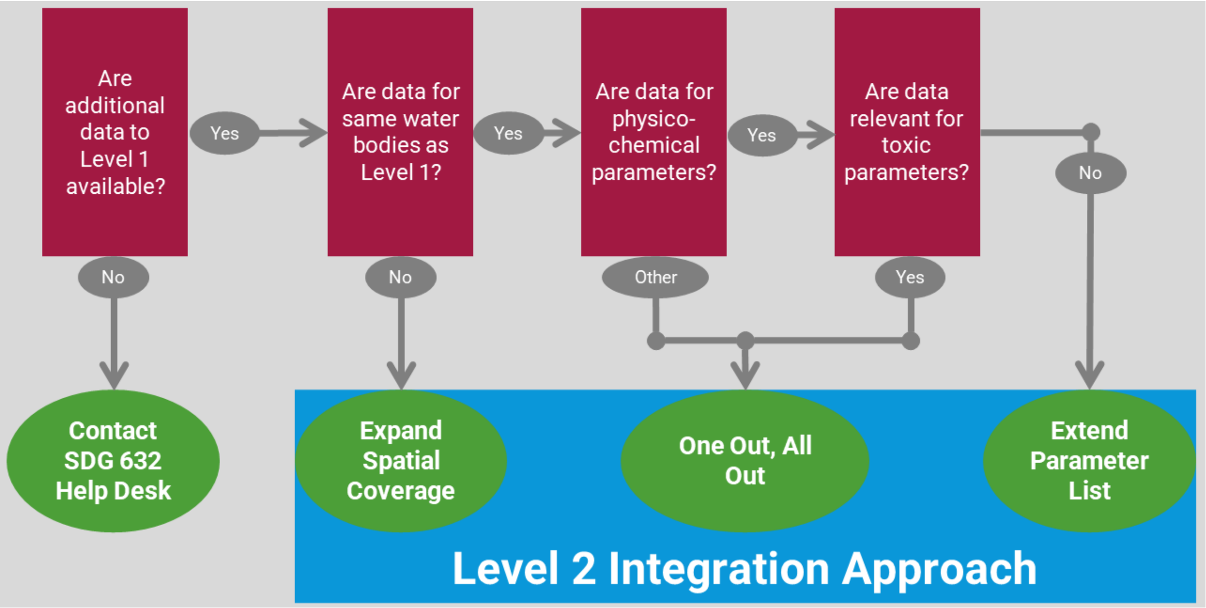


Figure 3: SDG Indicator 6.3.2 Level 2 Submission Decision Tree

In circumstances where more than one data type is being integrated and no single integration approach is suitable, the above decision tree can be applied to each data type individually. For example, a country may intend to **extend spatial coverage** by adding satellite-based Earth observation data for lakes, whilst simultaneously **extend the parameter list** by adding a general physico-chemical parameter such as turbidity, as well apply a **one out, all out** approach for a toxic reporting component such as a heavy metal. This information on how the data are integrated is captured in the Level 2 Reporting Template.

Expand spatial coverage

Expanding the spatial coverage approach is applicable if Level 2 data are available to supplement Level 1 data spatially by filling gaps in the data record. For example, Level 1 data may be available for river and groundwater bodies, yet unavailable for lakes and reservoirs. In this case, satellite-based Earth observation data of lakes and reservoirs would be combined with the Level 1 data for rivers to provide a more comprehensive national indicator score which is based on all water body types rather than just the rivers and groundwaters alone. Table 1 below shows how this could work.

Alternatively, if a country does not have an *in situ* monitoring capacity, Earth observation data could be used alone as a Level 2 submission.

Table 1: Example of how Level 2 data can be used to supplement Level 1 data

Water body type	Number of water bodies		
	Level 1	Level 2	Total
River	1000	0	1000
Lake	0	200	200
Groundwater	100	0	100

One Out, All Out

To classify a water body using this approach, water quality data are grouped into reporting components and assessed separately. For example, if both physico-chemical Level 1 data, and biological Level 2 data are available for the same river water body, water quality is classified for each reporting component separately and this information feeds into the overall classification. An overall 'good' classification is only returned if both reporting components return a positive result. If either one or both do not, the water body is classified as 'not good' (Figure 4).

This approach is relevant if:

- Level 2 data are available for the same water bodies as Level 1 data;
- Level 2 data include toxic parameters;
- pathogens are included in the calculation; or if
- an approach other than a physico-chemical one is used, such as a biological assessment.

A limitation of this approach is that for countries which are actively expanding their monitoring capacity, over time it may appear that water quality is degrading. In reality, the apparent degradation may simply reflect the additional monitoring effort, an effect of 'the more you look, the more you will find' phenomenon. This effect can be countered if Level 1 reporting is maintained and considered separately. The robustness and simplicity of Level 1 reporting ensures that efforts to improve ambient water quality are reflected in the indicator score over time. The Level 2 information provides critical information on pressures to water quality that can help guide management decisions.

Figure 4: Example of Level 2 data integration with Level 1 using a one out, all out approach

Combining pathogen or toxic compound data with Level 1 data should always follow the 'one out, all out' approach of classification. Especially if water bodies are used directly for drinking water without treatment. If a water body does not meet good status due to pathogenic contamination or due to the presence of a toxic compound it should be classified as not good.

Extend Level 1 Parameter List

This approach to Level 2 reporting is relevant when adding a non-toxic parameters to the five Level 1 parameters. These may include parameters such as temperature, suspended solids, turbidity or alkalinity. The same classification process is applied as for Level 1, but the percentage compliance calculation relies on more measurements from a broader range of parameters.

Table 2 shows the calculation for a single water body where at Level 1, in this example 41 of 50 measurements were compliant with their targets resulting in a compliance ratio of 82 per cent. Using Level 1 data alone this water body would be classified as 'good'. When suspended solids and chlorophyll measurements were added to the parameter list, only 49 of the 70 measurements were compliant, resulting in a compliance ratio of 69 per cent. The Level 2 classification for this water body would be 'not good'.

Table 2: Example of how additional parameters can be used to supplement Level 1 parameters

Reporting Level	Level 1					Level 2	
Parameters	Dissolved oxygen	Electrical conductivity	Nitrogen	Phosphorus	pH	Suspended solids	Chlorophyll
Number of measurements	10	10	10	10	10	10	10
Number of measurements met target	10	8	8	8	7	3	4
Water body classification	(Total = 41 of 50 measurements met targets = 82 %) **Level 1 Water body classification = Good**						
	(Total = 49 of 70 measurements met targets = 69 %) **Level 2 Overall Water body classification = Not good**						

Summary

Reporting at Level 2 is optional and can be undertaken either in parallel or in sequence to Level 1 reporting. The flexibility built into Level 2 reporting will result in varied submissions that will make comparison between different countries' indicator scores difficult. But a global comparison is not the main driver for this reporting workflow. Level 2 reporting was developed in response to feedback received from countries that highlighted the limitations of Level 1 reporting.

The information reported will help develop insight into national monitoring and assessment capacity in different world regions and provide a platform for peer-to-peer learning and engagement. It will facilitate targeted capacity development to those initiating or expanding their monitoring and assessment capacities, and ultimately, help fill the significant data gaps reported in the 2020 and 2023 data drives (UNEP 2021, UNEP 2024).

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