

STEP-BY-STEP MONITORING METHODOLOGY FOR INDICATOR 6.5.2

PROPORTION OF TRANSBOUNDARY BASIN AREA WITH AN OPERATIONAL ARRANGEMENT FOR WATER COOPERATION

1. MONITORING CONTEXT

1.1 INTRODUCTION OF THE INDICATOR

Target 6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

Indicator 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation

The indicator is defined as the proportion of transboundary basin¹ area with an operational arrangement for water cooperation. It is derived at the country level by adding up the surface areas of the transboundary surface water catchments and transboundary aquifers (i.e. ‘transboundary’ basins) that are covered by an operational arrangement and dividing the obtained result by the aggregate total area in a country of all transboundary basins (both catchments and aquifers). The result is multiplied by 100 to obtain it expressed as percentage share.

Most of the world’s water resources are shared: 592 transboundary aquifers have been identified and transboundary lake and river basins cover nearly one half of the Earth’s land surface and account for an estimated 60% of global freshwater. Approximately 40% of the world’s population lives in river and lake basins shared by two or more countries and over 90% lives in countries that share basins. Development of water resources has impacts across transboundary basins, potentially on co-riparian countries, and use of surface water or groundwater may affect the other resource, these usually being interlinked. Intensive water use, flow regulation or pollution risks going as far as compromising co-riparian countries’ development aspirations and therefore transboundary cooperation is required. However, cooperation is in most cases not advanced.

Specific agreements or other arrangements concluded between co-riparian countries are a key precondition to ensure long-term, sustainable cooperation. International customary water law (as reflected in the Convention on

¹ See definition in Section 2.1.

the Law of the Non-navigational Uses of International Watercourses (New York, 1997), the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), and the draft Articles on The Law of Transboundary Aquifers (2008; UN General Assembly resolutions 63/124, 66/104, 68/118, and 71/150)), as well as existing experience and good practices, all point to minimum requirements for operational cooperation.

This is the basis for the explicit call for transboundary water cooperation in the wording of target 6.5 and the importance of monitoring this indicator to complement indicator 6.5.1 which measures the advancement of Integrated Water Resources Management (IWRM).

1.2 TARGET-SETTING FOR THE INDICATOR

The 2030 Agenda for Sustainable Development specifies that all SDG targets “are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but taking into account national circumstances.” The global ambition of the target 6.5 is to implement IWRM at all levels, “including through transboundary cooperation as appropriate”. A reliable definition of the spatial coverage of transboundary basins and their full coverage by operational cooperation arrangements, that is, an indicator value of 100 per cent, should be aimed at. With this ambition, it is up to each country to set their own target for progress in the implementation of transboundary cooperation.

Both surface waters and groundwaters should be covered by cooperation arrangements. The relative importance of these two resources differs by country; therefore the possibility to disaggregate the data by surface and groundwaters enable countries to get a good insight into where more effort is required.

2. PROPOSED MONITORING METHODOLOGY

2.1 MONITORING CONCEPT AND DEFINITIONS

The proposed monitoring has as basis the spatial coverage of transboundary basin areas located in each country, and focuses on monitoring whether these areas are covered by cooperation arrangements that are operational. The criteria needing to be met for the cooperation on a specific basin being considered “operational” seeks to capture whether the arrangement(s) indeed provide an adequate basis for cooperation in water management.

Transboundary basins are basins of transboundary waters, that is, of any surface waters (notably rivers, lakes) or groundwaters (aquifers) which mark, cross or are located on boundaries between two or more states. For the purpose of the calculation of this indicator, for surface waters, the basin is the extent of the catchment area; for groundwater, the area considered is the extent of the aquifer².

² In the International Law Association 2004 Berlin Rules “‘Aquifer’ means a subsurface layer or layers of geological strata of sufficient porosity and permeability to allow either a flow of or the withdrawal of usable quantities of groundwater”, while in the EU Water Framework Directive “‘Aquifer’ means a subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater, and in the ILC Draft Articles “aquifer” means ‘a permeable water bearing geological formation underlain by a less permeable layer and the water contained in the saturated zone of the formation’ (UNGA A/RES/68/118). For more

Arrangement for water cooperation: a bilateral or multilateral treaty, convention, agreement or other formal arrangement, such as memorandum of understanding, between riparian countries that provides a framework for cooperation on transboundary water management. Agreements or other kind of formal arrangements may be interstate, intergovernmental, interministerial, interagency or between regional authorities.

Operational: For an agreement or other kind of formal arrangement (e.g. a memorandum of understanding) for cooperation between the riparian countries to be considered operational, all the following criteria need to be fulfilled:

- There is a joint body, joint mechanism or commission (e.g. a river basin organization) for transboundary cooperation;
- There are regular (at least once per year) formal communications between riparian countries in form of meetings (either at the political or technical level);
- There is a joint or coordinated water management plan(s), or joint objectives have been set;
- There is a regular exchange (at least once per year) of data and information.

Progress by a particular country towards the cooperation aspect of the target, reflected by the indicator value, can be achieved either by establishing new operational cooperation arrangements with co-riparian countries, or making existing arrangements operational by developing and regularizing activities, or expanding the coverage of cooperation arrangements with the ultimate objective to cover all surface waters and groundwaters.

2.2 RECOMMENDATIONS ON SPATIAL AND TEMPORAL COVERAGE

The spatial information on transboundary surface water basins' boundaries and the extents of the catchment areas are commonly available and essentially static; consequently, once determined, no updating need is expected.

The information on the areal extent of transboundary aquifers may evolve over time as such information is generally more coarse but likely to improve because of the evolving knowledge on aquifers. Technical studies and exchange of information will improve the delineation and might also lead to the identification of additional transboundary aquifers.

In situations where more than two riparian countries share a basin, but only some of them have operational cooperation arrangements, the indicator value may mask the gap that a riparian country does not have cooperation arrangements with both its upstream and downstream neighbours. Such complementary information can be obtained by aggregating data at the level of the basins but not from the reporting at the national level.

The legal basis for cooperation develops slowly: conclusion of new agreements on transboundary waters is commonly a long process that takes many years.

The operability of cooperation is more dynamic as it evolves with the expansion of cooperation. The operability can be expected to evolve over shorter time frames, and in a year or two, progress could potentially be observed.

details on the term « aquifer », e.g. Model Provisions on Transboundary Groundwaters (UNECE, 2014) can be referred to.

3. DATA SOURCES AND COLLECTION

3.1 DATA REQUIREMENTS TO COMPUTE THE INDICATOR

3.1.1 BASIN AREA/DELINEATIONS:

For a **transboundary river or lake**, the basin area is determined by the extent of its catchment. The catchment area of a surface water body should be understood as the area receiving the waters from rain or snow melt, which drain downhill (on the surface or below the surface of the ground in the unsaturated or saturated zones) into a surface water body. In hydrological terms the term “catchment area” equally applies to areas from which water drains downhill into a part of the river (for example, the area upstream of the point of the confluence of a river with its tributary or the area upstream of the outflow of a lake) or areas from which water drains downhill into the totality of a river (i.e. the area upstream of the point where the river flows into the sea, an enclosed lake or desert sink). The boundaries of the catchment and its extent are easily obtained from topographic maps.

For a **transboundary aquifer**, the extent is derived from the aquifer system delineation which is commonly done relying on information of the subsurface (notably the extent of geological formations). As a general rule, the delineation of aquifer systems is based on the delineation of the extent of the hydraulically connected water-bearing geological formations. Aquifer systems are three-dimensional objects and the aquifer area taken into account is the projection on the land surface of the system. For more information on aquifer as a water statistical unit and on types of aquifers, International Recommendations for Water Statistics can be referred to³.

Surface areas of a country which are part of a transboundary river, lake or aquifer basin (in km²) are derived from intersecting basin areas by country borders.

3.1.2 COOPERATION ARRANGEMENTS AND THEIR OPERATIONALITY:

Countries should also gather information on all their **cooperation arrangements** on all their transboundary waters (both surface and groundwater) including information on the geographic scope of such arrangements (e.g. are both surface waters and groundwaters covered by the arrangement? Is the basin fully or only partially covered, e.g. only the section close to the border?).

In addition, for each basin and under each cooperation arrangement, countries should gather information determining the **operationality** of the arrangements. Namely on the following aspects:

- Existence of a joint body, joint mechanism, commission (e.g. a river basin organization) for transboundary cooperation;
- Regular (at least once per year) communications between riparian countries in form of meetings - either at the political or technical level;
- Existence of joint or coordinated water management plan(s), or of joint objectives;
- Regular exchange of data and information (at least once per year) between riparians.

These criteria do not have to be embedded in the agreement/arrangement but should be happening in practice.

³ United Nations Department of Economic and Social Affairs, Statistical Division, Statistical papers Series M 91, 2012.

3.1.3 AGGREGATION/DISAGGREGATION

Data would be most reliably collected at the national level. Basin level data can also be disaggregated to country level (for national reporting) and aggregated to regional and global level.

3.2 SOURCES OF DATA – SHORT AND LONG TERM

At the country level, ministries and agencies responsible for surface water and groundwater resources (depends on the country but commonly ministry of the environment, water, natural resources, energy or agriculture; institutes of water resources, hydrology or geology, or geological surveys) typically have the spatial information about the location and extent of the surface water basin boundaries and aquifer delineations (as Geographical Information Systems shapefiles). Information on existing arrangement and their operability is also commonly available from the same institutions.

Moreover, a number of organizations at the basin level, notably established river basin organizations, with a mandate for transboundary cooperation have databases with information on water resources, in some cases also on transboundary aquifers, in the basin and on related cooperation. The Parties to the respective basin agreements report specific information which may be relevant for monitoring the indicator and for coordinating reporting by countries. Some transboundary cooperation organizations or ministries that represent a riparian party to an agreement make available information about their meetings and activities (monitoring and planning cooperation and information sharing), in some cases through websites, which can contribute to validating information on operability.

3.2.1 REGULAR REPORTING CONTRIBUTING TO THE INFORMATION COLLECTION

The process of reporting under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) will contribute to the gathering of the information needed for the calculation of the indicator, especially on the cooperation arrangements, transboundary waters covered by them as well as operability. The Convention's regular reporting on transboundary water cooperation, involving Parties and interested non-Parties to the Convention, will collect this information every 3 years as of 2017. The reporting covers transboundary rivers, lakes and groundwaters⁴. More than 100 countries participate in the Water Convention's activities. The United Nations Economic Commission for Europe acts as Secretariat for the Water Convention.

Some countries already report to regional organizations (e.g. the European Union or the Southern African Development Community) on the advancement of transboundary water cooperation, and similar arrangements could be strengthened and facilitated.

3.2.2 EXISTING DATA SOURCES FOR BASELINE INFORMATION AND INITIAL ESTIMATES (SHORT TERM)

In the absence of available information at the national level, global datasets on transboundary basins as well as about agreements and organizations for transboundary cooperation are available, which could be used in the absence of more detailed information, in the short term in particular.

⁴ For more information, please refer to http://www.unece.org/env/water/transboundary_water_cooperation_reporting.html

Delineations of transboundary basins

For basins which have not been delineated nationally, in particular for transboundary aquifers, the most up-to-date delineations are available through the Transboundary Waters Assessment Programme (TWAP)⁵. TWAP covered 286 main transboundary rivers, 206 transboundary lakes and reservoirs and 199 transboundary aquifers. Relevant information has also been compiled for 592 transboundary aquifers (including transboundary groundwater bodies as defined in the European Union Water Framework Directive) by the UNESCO ISARM project. Such delineations could be used if no other information is available. Gradually the quality of the spatial information can be improved.

Cooperation arrangements

Existence of treaties is available from the International Freshwater Treaties Database⁶, maintained by Oregon State University (OSU). This was last updated to include all arrangements up to 2008. The treaty database includes in total 686 international freshwater treaties.

Organizations for transboundary water cooperation: International River Basin Organization (RBO) Database⁷ detailed information about over 120 international river basin organizations, including bilateral commissions, around the world. The comprehensive information includes, for example, functional scope, decision making and information sharing mechanisms, as well as whether groundwater issues are a part of the organization's scope.

Regional assessments describing and inventorying agreements have been undertaken, contributing to the baseline globally, for example, status of transboundary water cooperation in the pan-European region⁸; regional inventories of transboundary aquifers under the Internationally Shared Aquifer Resources Management programme (UNESCO's International Hydrological Programme)⁹.

3.3 RECOMMENDATIONS ON DATA MANAGEMENT

Standard quality control and quality assurance procedures for the data collected, applicable to geo-spatial data should be applied.

The spatial data of basin areas should ideally be kept as GIS shapefiles to facilitate the necessary calculations, at different scales, if needed. It is a good practice to store the GIS data on surface waters and groundwaters as distinct data layers, while ensuring consistency of coordinate systems and projection used to allow for easy calculations using appropriate spatial analysis tools.

Enough supporting information to enable interpretation and reporting should also be stored. It is particularly important to keep track of operationality to ensure consistency in reporting over time. Also for this information, keeping track of cooperation on surface waters and groundwaters separately is advisable.

Exchange of information and ideally harmonization of approaches by coordinating among co-riparian or aquifer sharing countries would be beneficial. Especially, consistency among all countries sharing transboundary waters

⁵ <http://www.geftwap.org/>

⁶ Available at <http://www.transboundarywaters.orst.edu/publications/atlas/index.html>

⁷ Available at <http://www.transboundarywaters.orst.edu/research/RBO/index.html>

⁸ http://www.unece.org/env/water/publications/pub/second_assessment.html

⁹ <http://www.isarm.org/>

confirming that cooperation arrangements are operational would be valuable. The data may be improved gradually with country-to-country dialogue and technical investigations, notably on transboundary aquifers.

4. STEP-BY-STEP DATA COLLECTION AND COMPUTATION OF INDICATOR

The calculation of the indicator requires to:

- Identify all transboundary basins (both surface waters and groundwater);
- Calculate the extent in the country of each transboundary basin (and the total area in the country of all transboundary basins = sum of the catchment areas of all transboundary surface waters + sum of the extent of all transboundary aquifers);
- For each transboundary basin (both surface waters and groundwater) determine whether there is an operational arrangement for transboundary cooperation and whether it is applicable to the entire transboundary basin area or (a) particular sub-basin(s) contained within it;
- Calculate the ratio: sum of the transboundary basin areas in the country covered by an operational arrangement for transboundary cooperation, over the total area in the country of all transboundary basins.

Figure 1 below provides of flowchart of the approach. The following sections detail the different steps.

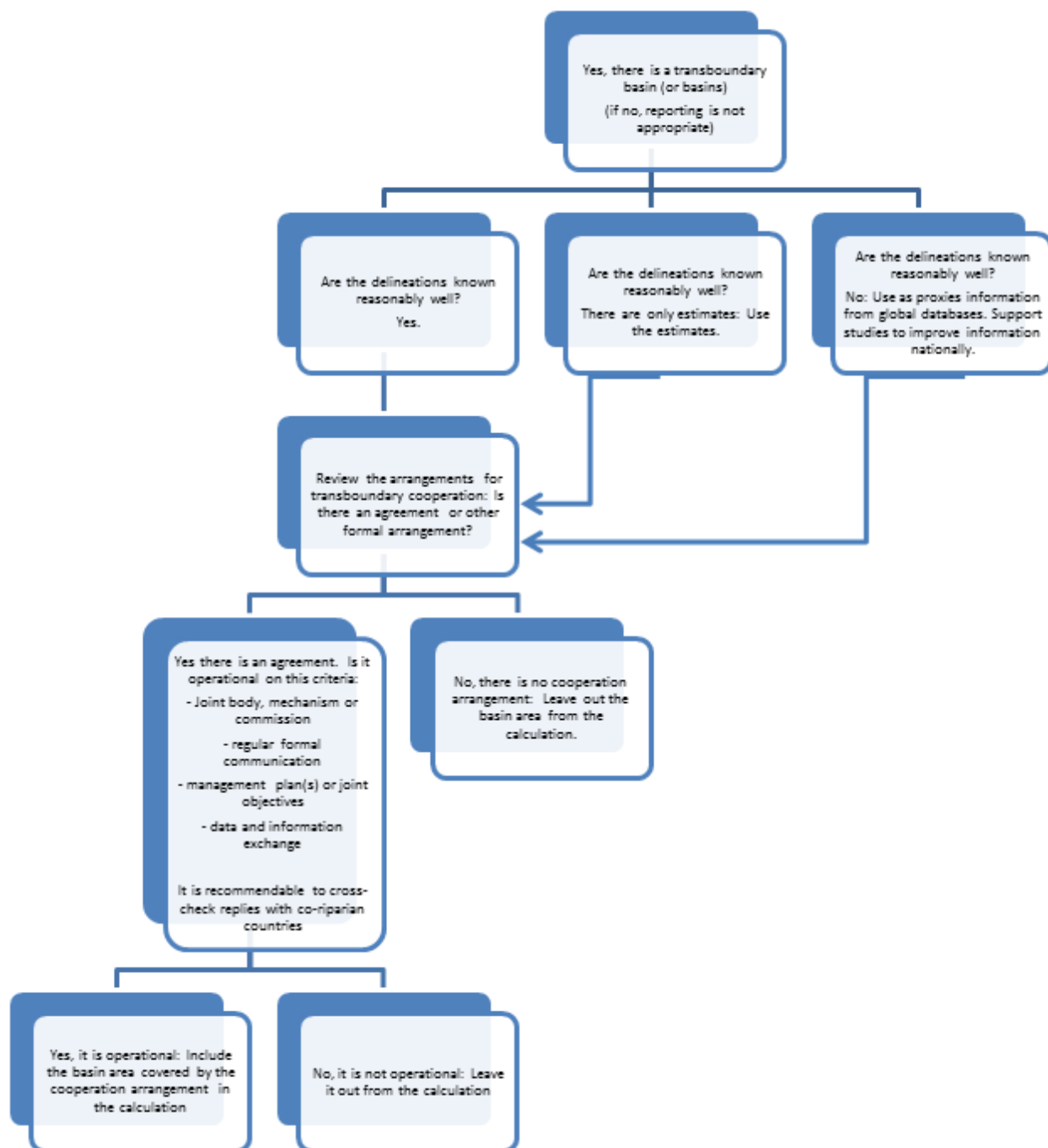


Figure 1 Flowchart on how to calculate the indicator

4.1.1 STEP 1 IDENTIFY THE TRANSBOUNDARY SURFACE WATERS AND AQUIFERS

As the first step, it should be identified which surface waters and groundwaters in the territory of the country are transboundary. While the identification of transboundary surface water is straightforward, the identification of transboundary aquifers requires investigations. The absence of transboundary surface waters should not be taken as evidence for the absence of transboundary aquifers, especially in arid areas.

If there are no transboundary surface waters or groundwaters, reporting is not applicable.

4.1.2 STEP 2 CALCULATE THE SURFACE AREA OF EACH TRANSBOUNDARY BASIN AND THE TOTAL SUM

Commonly at least the basins of the rivers and lakes have been delineated through topographic maps and the basin area is known or easily measurable.

For transboundary aquifers, at least estimates of aquifer extents are available in ministries and/or agencies competent in the field of water resources. If estimates are not available and further studies are not possible, information on delineation gathered from global databases can be used (see section 3.2 above).

In the case of hydraulically connected superimposed aquifer layers, the aquifer should be treated as a single multi-layer aquifer system. When different aquifer systems not hydraulically connected are vertically superposed, the different relevant projected areas are to be considered separately, unless the different aquifer systems are managed conjunctively. When the delineation of aquifer systems is based on other rules at country level, this delineation can be used. This is particularly the case for the “groundwater bodies” defined in the European Union.

Whenever possible, the delineations of the surface water basins and of the aquifer extent should be verified, detailing them with supporting data reviews or investigations, if necessary. It is good to ensure the consistency of this information with co-riparian/aquifer sharing countries.

The total transboundary surface area in the country is the sum of the surface areas in the country of each of the transboundary basins and aquifers (expressed in km²). Transboundary areas for different types of systems (e.g. river basin and aquifer) or multiple aquifers may overlap. The area of transboundary aquifers, even if located within a transboundary river basin, should be added to be able to track progress of cooperation on transboundary aquifers. As both the area of surface water basins and aquifers counts towards the total transboundary basin area can be larger than the area of the country itself, but as the indicator value is a percentage, its value can be at most 100 per cent.

The calculations can most easily be carried with GIS. Once generated, with appropriate tools for spatial analysis, the shapes of the surface catchments and the aquifers can be used to report both disaggregated (for the surface water basin or aquifer) and aggregated (agreement exists on either one).

The next step will determine which basins’ area should be accounted as having an operational arrangement in calculating the indicator value.

4.1.3 STEP 3 REVIEW EXISTING ARRANGEMENTS FOR TRANSBOUNDARY COOPERATION IN WATER MANAGEMENT AND VERIFY WHICH TRANSBOUNDARY WATERS ARE COVERED BY A COOPERATION ARRANGEMENT

Review all existing agreements and other arrangements (e.g. treaties, conventions, memoranda of understanding) concerning transboundary waters shared by the country and inventory them, associating them to the different identified transboundary basins (both surface waters and groundwater).

As also old agreements/arrangements provide a basis for operational cooperation, the review should not be limited to recent agreements only. Moreover, the scope of the agreements varies: some of them refer only to a

specific use, while others cover multiple uses. It is the next steps that allow for the determination whether the different arrangements operationally support transboundary water cooperation.

There are very few cases in which there is an existing institutional framework supporting transboundary water cooperation without a formal agreement or other arrangement. In such cases, if the criteria for operability are fulfilled, the relevant basin should count to the calculation of the indicator.

Some operational arrangements for integrated management of transboundary waters in place cover both surface waters and groundwaters. In such cases, it should be clear that the geographical extent of both (i.e. the sum of the transboundary surface water basin and transboundary aquifers' extent) is used to calculate the indicator value.¹⁰

In other cases, the area of application may be limited to a border section of the watercourse and in such cases only the corresponding area should be considered as potentially having an operational arrangement for calculating the indicator value.

At the end of this step, it should be known which transboundary basins are covered by cooperation arrangements (and their respective areas).

4.1.4 STEP 4 CHECK WHICH OF THE EXISTING ARRANGEMENTS FOR TRANSBOUNDARY COOPERATION IN WATER MANAGEMENT ARE OPERATIONAL

The following check-list allows determining whether the cooperation arrangement on a particular basin or in relation to a particular co-riparian country is operational:

- existence of a joint body, joint mechanism or commission for transboundary cooperation;
- regularity (at least once per year) of formal communication in form of meetings (either at the political or technical level);
- existence of joint or coordinated water management plan(s), or of joint objectives;
- regular exchange of information and data (at least once per year).

If any of the conditions is not met, the cooperation arrangement cannot be considered operational.

This information is currently available in countries and can also be withdrawn from global, regional or basin reporting systems (see section 3.2 above).

4.1.5 STEP 5 CALCULATE THE INDICATOR VALUE

Calculate the indicator value, that is, the area share by adding up the surface areas in the country of the transboundary surface water basins or aquifers that are covered by an operational cooperation arrangement and dividing it by the total summed up area in the country of all transboundary basins (including aquifers), multiplied by 100 to obtain a percentage share.

¹⁰ Ideally operational arrangements should clearly consider groundwaters in the whole transboundary river basins, as surface waters and groundwaters should be managed conjunctively – i.e. not only the transboundary aquifers should be considered (see UNECE Model Provisions on Transboundary Groundwaters, 2014). However, in the framework of the indicator calculation, only groundwaters in transboundary aquifers are taken into account.

A part of the country territory that is covered by two operational agreements one for the surface water and the other for an aquifer will be double-counted. This means that the areas of surface water basin and the extent of aquifers will be both included in the calculation. This allows to track progress on cooperation on both surface waters and groundwaters.

If an operational agreement covers only a sub-basin (or a portion of the transboundary basin), this will be considered in the calculation by computing the relevant area covered by the operational arrangement (and not the whole basin area).