

## Water Indicators

Indicator	Value	Description	Source
Overall Basin Risk (score)	2.98	Overall Basin Risk (score)	
Overall Basin Risk (rank)	30	Overall Basin Risk (rank)	
Physical risk (score)	3.16	Physical risk (score)	
Physical risk (rank)	32	Physical risk (rank)	
Regulatory risk (score)	2.13	Regulatory risk (score)	
Regulatory risk (rank)	147	Regulatory risk (rank)	
Reputation risk (score)	3.30	Reputation risk (score)	
Reputation risk (rank)	27	Reputation risk (rank)	
1. Quantity - Scarcity (score)	2.43	1. Quantity - Scarcity (score)	
1. Quantity - Scarcity (rank)	73	1. Quantity - Scarcity (rank)	
2. Quantity - Flooding (score)	3.87	2. Quantity - Flooding (score)	
2. Quantity - Flooding (rank)	45	2. Quantity - Flooding (rank)	
3. Quality (score)	4.12	3. Quality (score)	
3. Quality (rank)	16	3. Quality (rank)	
4. Ecosystem Service Status (score)	3.52	4. Ecosystem Service Status (score)	
4. Ecosystem Service Status (rank)	15	4. Ecosystem Service Status (rank)	
5. Enabling Environment (Policy & Laws) (score)	2.00	5. Enabling Environment (Policy & Laws) (score)	
5. Enabling Environment (Policy & Laws) (rank)	132	5. Enabling Environment (Policy & Laws) (rank)	
6. Institutions and Governance (score)	2.25	6. Institutions and Governance (score)	
6. Institutions and Governance (rank)	141	6. Institutions and Governance (rank)	
7. Management Instruments (score)	2.23	7. Management Instruments (score)	
7. Management Instruments (rank)	137	7. Management Instruments (rank)	
8 - Infrastructure & Finance (score)	2.00	8 - Infrastructure & Finance (score)	
8 - Infrastructure & Finance (rank)	105	8 - Infrastructure & Finance (rank)	
9. Cultural Diversity (score)	1.00	9. Cultural importance (score)	
9. Cultural Diversity (rank)	131	9. Cultural importance (rank)	
10. Biodiversity Importance (score)	3.49	10. Biodiversity importance (score)	

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Indicator	Value	Description	Source
10. Biodiversity Importance (rank)	99	10. Biodiversity importance (rank)	
11. Media Scrutiny (score)	4.00	11. Media Scrutiny (score)	
11. Media Scrutiny (rank)	12	11. Media Scrutiny (rank)	
12. Conflict (score)	3.45	12. Conflict (score)	
12. Conflict (rank)	19	12. Conflict (rank)	
1.0 - Aridity (score)	1.70	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geodatabase. CGIAR consortium for spatial information.
1.0 - Aridity (rank)	75	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geodatabase. CGIAR consortium for spatial information.
1.1 - Water Depletion (score)	2.59	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. <i>Elem Sci Anth</i> , 4.
1.1 - Water Depletion (rank)	68	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. <i>Elem Sci Anth</i> , 4.
1.2 - Baseline Water Stress (score)	3.05	World Resources Institute's Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). <i>Aqueduct 3.0: Updated decision relevant global water risk indicators</i> . Technical note. Washington, DC: World Resources Institute.

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Indicator	Value	Description	Source
1.2 - Baseline Water Stress (rank)	52	World Resources Institute's Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). Aqueduct 3.0: Updated decision relevant global water risk indicators. Technical note. Washington, DC: World Resources Institute.
1.3 - Blue Water Scarcity (score)	2.06	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. <i>Science advances</i> , 2(2), e1500323.
1.3 - Blue Water Scarcity (rank)	114	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. <i>Science advances</i> , 2(2), e1500323.
1.4 - Projected Change in Water Discharge (by ~2050) (score)	3.00	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. <i>Proceedings of the National Academy of Sciences</i> , 111(9), 3245-3250.
1.4 - Projected Change in Water Discharge (by ~2050) (rank)	13	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. <i>Proceedings of the National Academy of Sciences</i> , 111(9), 3245-3250.

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Indicator	Value	Description	Source
1.5 - Drought Frequency Probability (score)	1.80	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscale drought index sensitive to global warming: the standardized precipitation evapotranspiration index. <i>Journal of climate</i> , 23(7), 1696-1718.
1.5 - Drought Frequency Probability (rank)	159	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscale drought index sensitive to global warming: the standardized precipitation evapotranspiration index. <i>Journal of climate</i> , 23(7), 1696-1718.
1.6 - Projected Change in Drought Occurrence (by ~2050) (score)	4.27	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming-simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
1.6 - Projected Change in Drought Occurrence (by ~2050) (rank)	13	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming-simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.1 - Estimated Flood Occurrence (score)	4.00	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.
2.1 - Estimated Flood Occurrence (rank)	33	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.

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Indicator	Value	Description	Source
2.2 - Projected Change in Flood Occurrence (by ~2050) (score)	1.34	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming-simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.2 - Projected Change in Flood Occurrence (by ~2050) (rank)	172	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming-simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
3.1 - Surface Water Contamination Index (score)	4.12	<p>The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury).</p> <p>The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).</p>	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. <i>Nature</i> , 467(7315), 555.

Indicator	Value	Description	Source
3.1 - Surface Water Contamination Index (rank)	16	<p>The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury).</p> <p>The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).</p>	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. <i>Nature</i> , 467(7315), 555.
4.1 - Fragmentation Status of Rivers (score)	4.11	<p>This risk indicator is based on the data set by Grill et al. (2019) mapping the world's free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI &lt; 95% are considered as fragmented at a certain degree.</p>	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. <i>Nature</i> , 569(7755), 215.
4.1 - Fragmentation Status of Rivers (rank)	10	<p>This risk indicator is based on the data set by Grill et al. (2019) mapping the world's free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI &lt; 95% are considered as fragmented at a certain degree.</p>	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. <i>Nature</i> , 569(7755), 215.
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (score)	1.64	<p>For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control. The forest cover data is based on Hansen et al.'s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.</p>	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. <i>science</i> , 342(6160), 850-853.

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Indicator	Value	Description	Source
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (rank)	113	<p>For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control.</p> <p>The forest cover data is based on Hansen et al.'s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.</p>	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. <i>science</i> , 342(6160), 850-853.
4.3 - Projected Impacts on Freshwater Biodiversity (score)	4.67	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. <i>Journal of Applied Ecology</i> , 50(5), 1105-1115.
4.3 - Projected Impacts on Freshwater Biodiversity (rank)	11	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. <i>Journal of Applied Ecology</i> , 50(5), 1105-1115.
5.1 - Freshwater Policy Status (SDG 6.5.1) (score)	2.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.1 - Freshwater Policy Status (SDG 6.5.1) (rank)	114	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.2 - Freshwater Law Status (SDG 6.5.1) (score)	2.00	<p>This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Law(s)" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.</p> <p>For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.</p>	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

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Indicator	Value	Description	Source
5.2 - Freshwater Law Status (SDG 6.5.1) (rank)	113	<p>This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “National Water Resources Law(s)” indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.</p> <p>For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.</p>	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (score)	2.00	<p>This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “National IWRM plans” indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.</p> <p>For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.</p>	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (rank)	130	<p>This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “National IWRM plans” indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.</p> <p>For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.</p>	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.1 - Corruption Perceptions Index (score)	3.00	<p>This risk Indicator is based on the latest Transparency International's data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.</p>	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.1 - Corruption Perceptions Index (rank)	97	<p>This risk Indicator is based on the latest Transparency International's data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.</p>	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.2 - Freedom in the World Index (score)	1.00	<p>This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.</p>	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.



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Indicator	Value	Description	Source
6.2 - Freedom in the World Index (rank)	135	This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.
6.3 - Business Participation in Water Management (SDG 6.5.1) (score)	2.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "Business Participation in Water Resources Development, Management and Use" indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.3 - Business Participation in Water Management (SDG 6.5.1) (rank)	117	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "Business Participation in Water Resources Development, Management and Use" indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (score)	2.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "Sustainable and efficient water use management" indicator, which corresponds to one of the five national level indicators under the Management Instruments category.  For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (rank)	121	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "Sustainable and efficient water use management" indicator, which corresponds to one of the five national level indicators under the Management Instruments category.  For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

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Indicator	Value	Description	Source
7.2 - Groundwater Monitoring Data Availability and Management (score)	3.00	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMM Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.2 - Groundwater Monitoring Data Availability and Management (rank)	44	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMM Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.3 - Density of Runoff Monitoring Stations (score)	2.51	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km <sup>2</sup> of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
7.3 - Density of Runoff Monitoring Stations (rank)	138	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km <sup>2</sup> of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
8.1 - Access to Safe Drinking Water (score)	1.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.1 - Access to Safe Drinking Water (rank)	103	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.2 - Access to Sanitation (score)	3.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.

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Indicator	Value	Description	Source
8.2 - Access to Sanitation (rank)	73	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (score)	2.00	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (rank)	147	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
9.1 - Cultural Diversity (score)	1.00	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
9.1 - Cultural Diversity (rank)	131	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
10.1 - Freshwater Endemism (score)	3.01	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.

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Indicator	Value	Description	Source
10.1 - Freshwater Endemism (rank)	123	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (score)	3.98	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (rank)	67	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
11.1 - National Media Coverage (score)	4.00	This risk indicator is based on joint qualitative research by WWF and Tecnomia (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnomia (TYP SA Group)
11.1 - National Media Coverage (rank)	21	This risk indicator is based on joint qualitative research by WWF and Tecnomia (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnomia (TYP SA Group)
11.2 - Global Media Coverage (score)	4.00	This risk indicator is based on joint qualitative research by WWF and Tecnomia (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnomia (TYP SA Group)
11.2 - Global Media Coverage (rank)	12	This risk indicator is based on joint qualitative research by WWF and Tecnomia (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnomia (TYP SA Group)

## Country Overview - Bulgaria

Indicator	Value	Description	Source
12.1 - Conflict News Events (RepRisk) (score)	4.00	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.1 - Conflict News Events (RepRisk) (rank)	14	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.2 - Hydro-political Risk (score)	2.90	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. <i>Global environmental change</i> , 52, 286-313.
12.2 - Hydro-political Risk (rank)	56	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. <i>Global environmental change</i> , 52, 286-313.
Population, total (#)	7127822	Population, total	The World Bank 2018, Data , homepage accessed 20/04/2018
GDP (current US\$)	53237882473	GDP (current US\$)	The World Bank 2018, Data , homepage accessed 20/04/2018
EPI 2018 score (0-100)	67.85	Environmental Performance Index	
WGI -Voice and Accountability (0-100)	47.14	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, <i>The Worldwide Governance Indicators: Methodology and Analytical Issues</i> (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: <a href="https://ssrn.com/abstract=1682132">https://ssrn.com/abstract=1682132</a>

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Indicator	Value	Description	Source
WGI -Political stability no violence (0-100)	59.61	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: <a href="https://ssrn.com/abstract=1682132">https://ssrn.com/abstract=1682132</a>
WGI - Government Effectiveness (0-100)	65.38	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: <a href="https://ssrn.com/abstract=1682132">https://ssrn.com/abstract=1682132</a>
WGI - Regulatory Quality (0-100)	73.56	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: <a href="https://ssrn.com/abstract=1682132">https://ssrn.com/abstract=1682132</a>
WGI - Rule of Law (0-100)	53.85	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: <a href="https://ssrn.com/abstract=1682132">https://ssrn.com/abstract=1682132</a>
WGI - Control of Corruption (0-100)	51.44	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: <a href="https://ssrn.com/abstract=1682132">https://ssrn.com/abstract=1682132</a>

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Indicator	Value	Description	Source
WRI BWS all industries (0-5)	1.27	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at <a href="http://wri.org/publication/aqueduct-country-river-basin-rankings">http://wri.org/publication/aqueduct-country-river-basin-rankings</a> .
WRI BWS Ranking (1=very high)	106	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at <a href="http://wri.org/publication/aqueduct-country-river-basin-rankings">http://wri.org/publication/aqueduct-country-river-basin-rankings</a> .
Baseline Water Stress (BWS) - 2020 BAU (1=very high)	82	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .
Baseline Water Stress (BWS) - 2020 Optimistic (increasing rank describes lower risk)	84	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .
Baseline Water Stress (BWS) - 2020 Pessimistic (increasing rank describes lower risk)	85	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .

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Indicator	Value	Description	Source
Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk)	79	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .
Baseline Water Stress (BWS) - 2030 Optimistic (increasing rank describes lower risk)	83	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .
Baseline Water Stress (BWS) - 2030 Pessimistic (increasing rank describes lower risk)	82	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .
Baseline Water Stress (BWS) - 2040 BAU (increasing rank describes lower risk)	79	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .
Baseline Water Stress (BWS) - 2040 Optimistic (increasing rank describes lower risk)	82	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .
Baseline Water Stress (BWS) - 2040 Pessimistic (increasing rank describes lower risk)	81	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at <a href="http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings">http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings</a> .



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Indicator	Value	Description	Source
Total water footprint of national consumption (m <sup>3</sup> /a/cap)	2296.80	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands. <a href="http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf">http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf</a>
Ratio external / total water footprint (%)	18.72	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands. <a href="http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf">http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf</a>
Area equipped for full control irrigation: total (1000 ha)	115.50	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Area equipped for irrigation: total (1000 ha)	115.50	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
% of the area equipped for irrigation actually irrigated (%)	29.46	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Electricity production from hydroelectric sources (% of total)	9.81	World Development Indicators	The World Bank 2018, Data , homepage accessed 20/04/2018
Total internal renewable water resources (IRWR) (10 <sup>9</sup> m <sup>3</sup> /year)	21.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total internal renewable water resources (IRWR) (10 <sup>9</sup> m <sup>3</sup> /year)	0.30	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Water resources: total external renewable (10 <sup>9</sup> m <sup>3</sup> /year)	21.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13

## Country Overview - Bulgaria

Indicator	Value	Description	Source
Total renewable water resources (10 <sup>9</sup> m <sup>3</sup> /year)	21.30	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Dependency ratio (%)	1.41	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total renewable water resources per capita (m <sup>3</sup> /inhab/year)	2979.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
World happiness [0-8]	4.93	WorldHappinessReport.org	World Happiness Report, homepage accessed 20/04/2018

## Country Aspects

### 1. PHYSICAL ASPECTS

#### 1.1. WATER RESOURCES

##### 1.1.1. WATER RESOURCES

Renewable water resources in Bulgaria total 19.4km<sup>3</sup>.

The hydro-geographic network of the country is rather complex and in most of the regions quite dense, without very big rivers (with the exception of the River Danube, which forms the northern border). These peculiarities are due to the fact that the country has a small territory, is located near sea basins (the Black Sea to the east and the Aegean Sea to the south), and has a transitional continental climate and deeply indented relief. On average, the perennial flow is estimated at about 19-20 billion m<sup>3</sup> and, in a secured year, at 75 per cent or about 14 billion m<sup>3</sup>.

The following four River Basin Districts have been established by the National Water Act:

- Danube River Basin District (Pleven);
- Black Sea River Basin District (Varna);
- South-West Aegean River Basin District (Blagoevgrad);
- South-East Aegean River Basin District (Plovdiv);

##### 1.1.2. WATER USE

Water withdrawals in Bulgaria total around 10.5km<sup>3</sup>/year. Water use by sector is as follows:

- agricultural use, 19 per cent;
- domestic use, 3 per cent;
- industrial Use, 78 per cent.

#### 1.2. WATER QUALITY, ECOSYSTEMS AND HUMAN HEALTH

Major environmental problems include: air pollution from industrial emissions; the pollution of rivers with raw sewage, heavy metals and detergents; deforestation; forest damage caused by air pollution and resulting acid rain; soil contamination with heavy metals from metallurgical plants and industrial wastes.

A review within the four River Basin Districts of the significant pressures on surface water - i.e. those pressures with the capacity to cause impacts on some surface water bodies – has been carried out with reference to the environmental quality objectives identified in Article 4 of the Water Framework Directive.

Based on information from the four River Basin Districts, the following categories of substantial pressure have been identified:

- significant point source pollution of surface water;

- significant diffuse pollution of surface water;

- significant abstractions from surface water;

- significant water flow regulation and morphological alteration.

On the basis of this assessment of the significant pressures on the water bodies and the water bodies' sensitivity to them, initial identification of the water bodies at risk of not meeting the environmental objectives identified in the WFD was undertaken.

The risk status of these water bodies after assessment is shown in the table below.

RIVER BASIN DISTRICT	WATERBODIES		
	NOT AT RISK	AT RISK	POSSIBLY AT RISK
Danube	31	28	177
Black Sea	89	50	132
Eastern-Aegean	86	82	157
Western-Aegean	354	22	74

For the evaluation of the quality of groundwater bodies, the pollution thresholds of pollution protection indicators for groundwater have been used, in accordance with Annex 3 of Regulation 1 of 7 July, 2000 concerning the surveying, inspection, use and protection of groundwater, and Regulation 9 of 16 March, 2001, concerning water quality for drinking purposes. Water abstraction from groundwater is assessed in relation to available data regarding water abstraction equipment, including water use permits.

For the East-Aegean Sea River Basin District, the point sources and diffuse sources of pollution are graded by significance as a risk cause with regard to groundwater quality.

Assessment of the risk of meeting the 'good' status targets of groundwater bodies is presented in the next table:

	WATERBODIES				TOTAL
	Danube	Black Sea	East-Aegean Sea	West-Aegean Sea	
"NOT AT RISK"	0	16	12	15	36
"PROBABLY AT RISK"	86	17	27	9	141
"AT RISK"	0	18	15	0	33
<b>TOTAL</b>	<b>86</b>	<b>51</b>	<b>54</b>	<b>24</b>	<b>215</b>

## 2. GOVERNANCE ASPECTS

### 2.1. WATER INSTITUTIONS

Water management in the country is carried out and guided by the Ministry of Environment and Water, as this is the responsible institution at national level for the implementation of the Water Framework Directive in Bulgaria.

The national institutions responsible for and/or participating in water management are as follows:

- Ministry for Environment and Water (MoEW);
- Executive Environmental Agency (EEA) at the MoEW;
- Ministry of Regional Development and Public Works (MRDPW);
- Ministry of Health (MH);
- Ministry of Agriculture and Forestry (MAF);
- Ministry of Finance (MF);
- municipalities and local water companies;
- National Institute of Meteorology and Hydrology (NIMH) at the Bulgarian Academy of Sciences (BAS);
- Ministry of Economics and Energy (MEE);
- Ministry of Emergency Situations (MES).

### 2.2. WATER MANAGEMENT

Major water initiatives in Bulgaria are:

- the national strategy for the development and management of the water sector to 2015 (including the action plan to ensure sufficient good-quality water for all purposes 2005-2014);
- the operational programme for the environment 2007-2013;
- the Implementation Programme for Directive 91/271/ECC concerning urban wastewater treatment;
- the national programme for the construction of wastewater treatment plants in Bulgaria;
- the national report on water management at river-basin level in Bulgaria;
- the review of the requirements of Articles 5 and 6 of the Water Framework Directive;
- the national report for implementation of the requirements of Article 8 of the Water Framework Directive 2000/60/EC.

Under the new European scenario, the Water Framework Directive prescribes that management activities should aim to achieve the goals of the Directive within geographical areas or river basin districts. These are based largely on surface water catchments, together with the boundaries of associated groundwater and coastal water bodies.

For each river basin district, a river basin planning process must be set up. The first milestone of this planning process (analysis, monitoring, objective-setting and consideration of measures to maintain or improve water status) is the initial river basin management plan (RBMP).

For purposes of information and consultation, these RBMPs should be made available to the public. The RBMP will:

- record the current status of water bodies within the river basin district;
- set out the measures planned to meet the objectives;
- act as the main reporting mechanism to the Commission and the public.

The whole process of river basin management planning includes the preparation of programmes of measures at basin level for achieving the environmental objectives of the Water Framework Directive cost-effectively. Basic measures include control of pollution at source through the setting of emission limit values and through the setting of environmental quality standards. The use of economic instruments, such as water pricing, is part of the basic measures. Here, in particular, the 'polluter pays' principle should be taken into account. The Directive aims to ensure that pricing policies improve the sustainable use of water resources.

The planning, implementation and evaluation of the programme of measures is an iterative process that will probably include the RBMP of the first (2009), second (2015) or further cycles (2021, 2027).

### 2.3. WATER POLICY AND LEGAL FRAMEWORK

A guiding normative document in the field of water management is the Water Act, enacted in January 2000 and amended in 2006.

There follows a list of the national legislation that transposes into Bulgarian law the requirements of the Water Framework Directive.

•Water Act: promulgated State Gazette N 67 of 27 July, 1999, effective as of 28 January, 2000, amended, N 81 of 6 October, 2000, effective as of 6 October, 2000, N 34 of 6 April, 2001, N 41 of 24 April, 2001, amended, N 108 of 14 December, 2001, N 47 of 10.05.2002, effective as of 11 June, 2002, N 74 of 30 July, 2002, N 91 of 25 September, 2002, effective as of 1 January, 2003, amended N 42 of 9 May, 2003, transposing the fundamental river basin management principles of the Water Framework Directive;

•Regulations complementing the Water Act:

1.Regulation N 1 of 7 July, 2000 on exploration, use and protection of groundwater – SG N 57 of 2000 – transposing the requirements of Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances;

2.Regulation N 2 of 16.10.2000 on water protection against nitrate pollution from agricultural sources – SG 87 of 2000 – transposing the requirements of Directive 91/676/EEC related to water protection against nitrate pollution from agricultural sources;

3.Regulation N 3 of 16.10.2000 on the conditions and procedure for exploration, design, approval and exploitation of sanitary protection areas around water sources and drinking water supply facilities and around mineral water sources, intended for medicinal, prevention, drinking and hygiene purposes – SG N 88 of 2000;

4.Regulation N 4 of 20 October, 2000 on the quality of fish and shellfish water– SG N 88 of 2000 – transposing the requirements of the following directives:

- a. Directive 78/659 of the quality of fresh water needing protection or improvement in order to support fish life;
- b. Directive N 79/923 on the quality required of shellfish water;
- 5. Regulation N 5 of 8 November, 2000 on the conditions and procedure for establishing networks and on the activities of the National Water Monitoring System - SG N 95 of 2000;
- 6. Regulation N 6 of 9 November, 2000 on the emission standards for admissible concentration of hazardous and dangerous substances in waste water discharged in water sites – SG 97 of 2000, amended SG N 24/2004 transposing the requirements of the following documents:
  - a. Directive 76/464 on the pollution caused by certain dangerous substances discharged into aquatic environment of the Community and its daughter directives;
  - b. Directive 84/491; Directive 86/280; Directive 91/271 on urban waste water treatment;
- 7. Regulation N 7 of 14 November, 2000 on the conditions and procedure for discharge of industrial waste water in urban sewerage systems – SG N 88 of 2000;
- 8. Regulation N 8 of 25 January, 2001 on the quality of coastline sea water – SG N 10 of 2001;
- 9. Regulation N 9 of 16 March, 2001 on the quality of water intended for human consumption – SG N 30 of 2001 transposing the requirements of Directive 80/778 related to the quality of water intended for human consumption and revised Directive 98/80;
- 10. Regulation N 10 of 03 July, 2001 on the issue of permits for waste water discharge in water sites and designation of individual emission ceilings for point source pollution – SG N 66 of 2001;
- 11. Regulation N 11 of 25 February, 2002 on the quality of bathing water – SG N 25 of 2002 transposing the requirements of Directive 76/160 concerning the quality of bathing water;
- 12. Regulation N 12 of 18 June, 2002 on the quality requirements to surface water intended for drinking water supply – SG N 63 of 2002 transposing the requirements of Directive 75/440 concerning the quality required of surface water intended for abstraction of drinking water.

### 3. GEOPOLITICAL ASPECTS

The International Commission for the Protection of the Danube River (ICPDR) is an organization consisting of 14 member states (Germany, Austria, the Czech Republic, Slovakia, Slovenia, Hungary, Croatia, Bosnia and Herzegovina, Serbia, Bulgaria, Romania, Moldova, Montenegro and Ukraine) and the European Union. The commission, established in 1998, deals with the whole Danube River Basin, which includes tributaries and groundwater resources. Its goal is to implement the Danube River Protection Convention by promoting and coordinating sustainable and equitable water management, including conservation, improvement and rational use of waters.

To achieve good water status in the water bodies of the Danube region by 2015 (and beyond) and to ensure a sufficient supply of clean water for future generations, the Contracting Parties to the DRPC nominated the ICPDR as the coordination body for the development of a comprehensive management plan for the entire Danube River Basin using the principles of the EU Water Framework Directive.

Bulgaria has no major transboundary river basins in the Black Sea Basin District. The only exceptions are the Veleka and Rezovska rivers, which are transboundary with Turkey; as Turkey

currently has not made any commitments regarding the implementation of the WFD, coordination on these rivers has not been possible.

The East Aegean Sea River Basin District comprises three large international river basins – Arda (transboundary with Greece), Marista (transboundary with Greece and Turkey) and Tundja (transboundary with Turkey). Again, as Turkey has so far not made any commitments regarding the implementation of the WFD, coordination on transboundary rivers with this neighbour country was not possible.

Coordination with Greece to the extent required by the WFD has not been carried out due to difficulties in identifying the authorities in Greece that should be partners in such an exercise. The Bulgarian Ministry of Environment and Water has initiated such cooperation and is hopeful that an agreement on cooperation between the competent authorities for the WFD in Bulgaria and Greece could be signed in the near future. So far, cooperation for the implementation of the WFD with Greece is carried out on the basis of joint projects. Establishing proper coordination mechanisms for WFD implementation with Turkey is also envisaged in a longer time frame, of two to three years, when Turkey will have started the negotiation process for EU accession.

The West Aegean Sea River Basin District comprises two important international river basins: Struma (transboundary with the Former Yugoslav Republic of Macedonia (FYROM) and Greece) and Mesta (transboundary with Greece).

Again, coordination with Greece to the extent required by the WFD has not been carried out due to difficulties in identifying the authorities in Greece that should be partners in such an exercise. The Bulgarian Ministry of Environment and Water has initiated such cooperation and is hopeful that an agreement on cooperation between the competent authorities for the WFD in Bulgaria and Greece could be signed in the near future. So far, cooperation for the implementation of the WFD with Greece is carried out on the basis of joint projects.

As FYROM has so far not made particular commitments for the implementation of the WFD, coordination on transboundary rivers with this country has not been possible. Establishing proper coordination mechanisms for WFD implementation with FYROM is envisaged in a longer time frame, depending on FYROM's priorities in the field of the environment and, in particular, water management.