Water Risk Filter

Water Indicators

Indicator	Value	Description	Source
Overall Basin Risk (score)	2.58	Overall Basin Risk (score)	
Overall Basin Risk (rank)	110	Overall Basin Risk (rank)	
Physical risk (score)	3.16	Physical risk (score)	
Physical risk (rank)	33	Physical risk (rank)	
Regulatory risk (score)	1.29	Regulatory risk (score)	
Regulatory risk (rank)	182	Regulatory risk (rank)	
Reputation risk (score)	2.11	Reputation risk (score)	
Reputation risk (rank)	179	Reputation risk (rank)	
1. Quantity - Scarcity (score)	2.66	1. Quantity - Scarcity (score)	
1. Quantity - Scarcity (rank)	58	1. Quantity - Scarcity (rank)	
2. Quantity - Flooding (score)	2.92	2. Quantity - Flooding (score)	
2. Quantity - Flooding (rank)	117	2. Quantity - Flooding (rank)	
3. Quality (score)	4.07	3. Quality (score)	
3. Quality (rank)	21	3. Quality (rank)	
4. Ecosystem Service Status (score)	4.18	4. Ecosystem Service Status (score)	
4. Ecosystem Service Status (rank)	1	4. Ecosystem Service Status (rank)	
5. Enabling Environment (Policy & Laws) (score)	1.10	5. Enabling Environment (Policy & Laws) (score)	
5. Enabling Environment (Policy & Laws) (rank)	168	5. Enabling Environment (Policy & Laws) (rank)	
6. Institutions and Governance (score)	1.50	6. Institutions and Governance (score)	
6. Institutions and Governance (rank)	175	6. Institutions and Governance (rank)	
7. Management Instruments (score)	1.38	7. Management Instruments (score)	
7. Management Instruments (rank)	178	7. Management Instruments (rank)	
8 - Infrastructure & Finance (score)	1.10	8 - Infrastructure & Finance (score)	
8 - Infrastructure & Finance (rank)	166	8 - Infrastructure & Finance (rank)	
9. Cultural Diversity (score)	1.00	9. Cultural importance (score)	
9. Cultural Diversity (rank)	165	9. Cultural importance (rank)	
10. Biodiversity Importance (score)	3.49	10. Biodiversity importance (score)	

Country Overview - Portugal

Indicator	Value	Description	Source
10. Biodiversity Importance (rank)	100	10. Biodiversity importance (rank)	
11. Media Scrutiny (score)	2.55	11. Media Scrutiny (score)	
11. Media Scrutiny (rank)	121	11. Media Scrutiny (rank)	
12. Conflict (score)	1.58	12. Conflict (score)	
12. Conflict (rank)	181	12. Conflict (rank)	
1.0 - Aridity (score)	1.39	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) geo-database. CGIAR consortium for spatial information.
1.0 - Aridity (rank)	88	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) geo-database. CGIAR consortium for spatial information.
1.1 - Water Depletion (score)	2.39	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. Elem Sci Anth, 4.
1.1 - Water Depletion (rank)	72	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. Elem Sci Anth, 4.
1.2 - Baseline Water Stress (score)	3.66	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.

Water Risk Filter

Indicator	Value	Description	Source
1.2 - Baseline Water Stress (rank)	31	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)	2.38	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. Science advances, 2(2), e1500323.
1.3 - Blue Water Scarcity (rank)	103	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. Science advances, 2(2), e1500323.
1.4 - Projected Change in Water Discharge (by ~2050) (score)	3.20	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. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.
1.4 - Projected Change in Water Discharge (by ~2050) (rank)	9	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. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.

Water Risk Filter

Indicator	Value	Description	Source
1.5 - Drought Frequency Probability (score)	2.14	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 multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.5 - Drought Frequency Probability (rank)	120	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 multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.6 - Projected Change in Drought Occurrence (by ~2050) (score)	4.92	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)	7	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)	2.99	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)	116	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.

Country Overview – Portugal

Indicator	Value	Description	Source
2.2 - Projected Change in Flood Occurrence (by ~2050) (score)	1.51	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)	165	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)	4.07	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). 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%).	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. Nature, 467(7315), 555.

Country Overview - Portugal

Indicator	Value	Description	Source
3.1 - Surface Water Contamination Index (rank)	21	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). 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%).	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. Nature, 467(7315), 555.
4.1 - Fragmentation Status of Rivers (score)	4.07	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 < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. Nature, 569(7755), 215.
4.1 - Fragmentation Status of Rivers (rank)	12	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 < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. Nature, 569(7755), 215.
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (score)	4.41	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.	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. science, 342(6160), 850-853.

Water Risk Filter

Indicator	Value	Description	Source
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (rank)	7	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.	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. science, 342(6160), 850-853.
4.3 - Projected Impacts on Freshwater Biodiversity (score)	4.62	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. Journal of Applied Ecology, 50(5), 1105-1115.
4.3 - Projected Impacts on Freshwater Biodiversity (rank)	12	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. Journal of Applied Ecology, 50(5), 1105-1115.
5.1 - Freshwater Policy Status (SDG 6.5.1) (score)	1.00	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)	175	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)	1.00	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. 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.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

Water Risk Filter

Indicator	Value	Description	Source
5.2 - Freshwater Law Status (SDG 6.5.1) (rank)	167	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. 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.	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	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. 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.	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)	154	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. 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.	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)	2.00	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.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.1 - Corruption Perceptions Index (rank)	167	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.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.2 - Freedom in the World Index (score)	1.00	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.

Indicator	Value	Description	Source
6.2 - Freedom in the World Index (rank)	154	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)	1.00	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)	169	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)	1.00	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)	172	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.

Water Risk Filter

Indicator	Value	Description	Source
7.2 - Groundwater Monitoring Data Availability and Management (score)	1.00	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 GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.2 - Groundwater Monitoring Data Availability and Management (rank)	169	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 GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.3 - Density of Runoff Monitoring Stations (score)	3.50	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 1000km2 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)	87	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 1000km2 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)	138	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)	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.

Water Risk Filter

Indicator	Value	Description	Source
8.2 - Access to Sanitation (rank)	154	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)	160	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)	165	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)	4.92	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.

Country Overview – Portugal

Indicator	Value	Description	Source
10.1 - Freshwater Endemism (rank)	36	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)	2.07	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)	145	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)	3.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (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 & Tecnoma (TYPSA Group)
11.1 - National Media Coverage (rank)	126	This risk indicator is based on joint qualitative research by WWF and Tecnoma (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 & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (score)	2.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (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 & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (rank)	117	This risk indicator is based on joint qualitative research by WWF and Tecnoma (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 & Tecnoma (TYPSA Group)

Country Overview - Portugal

Indicator	Value	Description	Source
12.1 - Conflict News Events (RepRisk) (score)	1.00	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)	174	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)	2.15	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. Global environmental change, 52, 286-313.
12.2 - Hydro-political Risk (rank)	105	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. Global environmental change, 52, 286-313.
Population, total (#)	10324611	Population, total	The World Bank 2018, Data , hompage accessed 20/04/2018
GDP (current US$)	204836597909	GDP (current US$)	The World Bank 2018, Data , hompage accessed 20/04/2018
EPI 2018 score (0-100)	71.91	Environmental Performance Index	
WGI -Voice and Accountability (0-100)	88.10	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: https://ssrn.com/abstract=1682132

Water Risk Filter

Indicator	Value	Description	Source
WGI -Political stability no violence (0-100)	86.21	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: https://ssrn.com/abstract=1682132
WGI - Government Effectiveness (0-100)	85.58	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: https://ssrn.com/abstract=1682132
WGI - Regulatory Quality (0-100)	76.44	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: https://ssrn.com/abstract=1682132
WGI - Rule of Law (0-100)	85.10	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: https://ssrn.com/abstract=1682132
WGI - Control of Corruption (0-100)	80.77	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: https://ssrn.com/abstract=1682132

Indicator	Value	Description	Source
WRI BWS all industries (0-5)	3.34	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 http://wri.org/publication/aqueduct-country-river-basin-rankings.
WRI BWS Ranking (1=very high)	53	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 http://wri.org/publication/aqueduct-country-river-basin-rankings.
Baseline Water Stress (BWS) - 2020 BAU (1=very high)	48	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Optimistic (increasing rank describes lower risk)	50	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Pessimistic (increasing rank describes lower risk)	48	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Water Risk Filter

Indicator	Value	Description	Source
Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk)	46	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Optimistic (increasing rank describes lower risk)	50	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Pessimistic (increasing rank describes lower risk)	45	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 BAU (increasing rank describes lower risk)	44	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Optimistic (increasing rank describes lower risk)	44	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Pessimistic (increasing rank describes lower risk)	40	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 http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Water Risk Filter

Indicator	Value	Description	Source
Total water footprint of national consumption (m3/a/cap)	2505.48	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.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Ratio external / total water footprint (%)	59.91	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.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Area equipped for full control irrigation: total (1000 ha)	583.70	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)	583.70	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 (%)	72.21	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)	16.88	World Development Indicators	The World Bank 2018, Data , hompage accessed 20/04/2018
Total internal renewable water resources (IRWR) (10^9 m3/year)	38.00	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) (10^9 m3/year)	39.40	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 (10^9 m3/year)	38.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13

Water Risk Filter

Indicator	Value	Description	Source
Total renewable water resources (10^9 m3/year)	77.40	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Dependency ratio (%)	50.90	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 (m3/inhab/year)	7478.00	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]	5.41	WorldHappinessReport.org	World Happiness Report, homepage accessed 20/04/2018

Country Aspects

1. PHYSICAL ASPECTS

1.1. WATER RESOURCES

1.1.1. WATER RESOURCES

Portugal has a mild climate, with rainy winters and warm summers. Extreme temperatures occur in the northeastern parts of the country in winter and the southeastern parts in summer. The Madeira and Azores Atlantic archipelagos have a milder temperature range.

It has a long-term average annual precipitation of 854mm/year. The long-term average of annual renewable water resources is estimated at 68,700 million m3/year, of which 55 per cent is considered internal water resources (38,000 million m3) and 45 per cent external water resources (30,700 million m3). In 2009, the total dam (reservoir) capacity was estimated at 11,610 million m3.

Despite the high annual average rainfall and flow values, and although Portugal is a relatively small country, there is great spatial, seasonal and temporal variability in rainfall, which is exacerbated by climate change, making flooding and drought unpredictable and at times making it difficult to sustain water flows, both in national and international rivers (MAOT, 2002)

In fact, Portugal is included in Annex IV (Northern Mediterranean region) of the United Nations Convention to Combat Desertification (UNCCD). It is one of the European Mediterranean countries where the risk of desertification is highest. The phenomenon of desertification is associated with soil degradation, caused by water erosion. Water scarcity is also an issue, depending on the region and the season. Given the importance of this issue for the country, water scarcity was selected as one of the priorities for the Portuguese Presidency of the Council of the European Union, in the second half of 2007.

Portugal has 10 river basin districts (eight in mainland Portugal, one in the Azores archipelago and one in Madeira archipelago), of which four share water with Spain. The RBDs are:
-Minho/Lima;
-Cávado/Ave/Leça;
-Douro;
-Vouga/Mondego/Lis;
-Tejo;
-Sado e Mira;
-Guadiana;
-Algarve;
-Azores archipelago;
-Madeira archipelago.

In terms of water resources, Portugal shares four hydrographic basins of five rivers (Minho, Lima, Douro, Tejo and Guadiana) with Spain. Three of Portugal's major rivers (the Tejo, Douro and Guadiana) originate in Spain, making Portugal dependent on Spain in terms of the quantity and quality of these resources. These RBDs are regulated by a convention on cooperation and sustainable use of water (Convenção de Albufeira) between Spain and Portugal.

1.1.2. WATER USE

Water withdrawal in the country in the year 2005 was estimated at 8,904 million m3. A small portion of the water resources (1.6 million m3) was produced by desalination processes.

This water abstraction can be itemized by user sector. In 2000, it was estimated that the amount of water dedicated to agriculture reached 6,178 million m3. These resources were used in 4,215km2 of the total area equipped for irrigation of 5,837km2 in the whole country, which represents a significant percentage (37.5 per cent) of the area dedicated to cultivation. For urban purposes, water abstraction was estimated at 1,086 million m3 and, for industrial uses, at 1,640 million m3.

As well as the need to share water resources, other constraints have to be addressed, such as: a land-use pattern favouring excessive urbanization, with consequent pressure on water resources; an agricultural sector that consumes around 75 per cent of the water used; and significant water losses when it is supplied both for human consumption and for agriculture.

A special case is the Algarve river basin district, which has an estimated level of abstraction of 320L/person/day. This seems to be related to the Algarve being the most prominent tourist region and, consequently, having a high floating population. This is something of a paradox: the Algarve is one of the regions with the lowest average rainfall, yet it has the most golf courses, which consume a great deal of water. It also has the highest average temperatures and the least available water, particularly in summer.

1.2. WATER QUALITY, ECOSYSTEMS AND HUMAN HEALTH

Portugal has recorded a positive, consistent and sustained improvement in both the quality of water distributed and the number of mandatory analyses for controlling such water. Data for the past decade bear witness to a clear improvement in water quality control, with a fall in percentages of both missing analyses and analyses in breach of the parametric values. In 2008, the sampling frequency compliance rate stood at 99.29 per cent, maintaining the rising trend recorded in previous years. Parametric value compliance rates also increased, rising from 97.43 per cent in 2007 to 97.62 per cent in 2008.

In 2008, coastal and transitional bathing waters achieved their best performance in five years, with 89.4 per cent being categorised as 'good' and only 1.1 per cent as 'poor', with the Regional Health Authority prohibiting bathing in 0.2 per cent of waters. Inland bathing water recorded a decrease in compliance in relation to the mandatory values, the rate falling from 93.5 per cent in 2007 to 92.8 per cent in 2008. The same occurred with compliance in relation to the guide values, which

fell from 43.5 per cent in 2007 to 42.3 per cent in 2008, a year in which bathing was prohibited in 5.2 per cent of such waters.

In terms of the quality of water bodies, the number of surface water monitoring stations recording quality as 'good' has increased year after year, reaching 35.5 per cent in 2008. However, the number of stations recording 'poor' or 'very poor' has also increased, although only slightly (36.5 per cent). These different statuses respond to those defined by the Water Framework Directive (Directive 2000/60 of the EU).

One of the main factors responsible for water body degradation is nutrient enrichment, particularly in the form of nitrogen and phosphorus, as a result of the use of fertilizers in agriculture, urban wastewater discharges and the discharge of wastewater streams from agro-industry and other industrial sectors. It should be noted that nitrate and phosphorus enriched water was identified as a significant concern in all RBDs, as were inputs from Spain, which were identified in all shared RBDs. In addition, groundwater contamination, flooding, microbiological pollution and organic pollution (CBO5, ammoniacal nitrogen) were identified in seven out of the eight continental RBDs of Portugal.

Nutrient enrichment leads to eutrophication issues in the water bodies, and is reflected in greater primary productivity and consequently in reduced dissolved oxygen and pH levels in the water. In extreme situations this can lead to loss of fauna and flora and a reduction in the quality of water for human consumption. In order to assess the trophic status of the principal reservoirs in continental Portugal for the period from 2004 to 2007, the total phosphorus and chlorophyll-a concentration was measured in 29 stations. Some 72 per cent, corresponding to 21 reservoirs, were found to be eutrophic, and 28 per cent, corresponding to eight reservoirs, to be mesotrophic. An analysis by river basin district shows that in the 2006-07 hydrological year the highest percentage of stations in which the status of reservoir water was categorised as eutrophic occurred in the Tejo (64 per cent), Sado and Mira (57 per cent) river basin districts.

In the context of Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources, from 2004 to 2007 more than 90 per cent of stations with a groundwater level above 5m recorded a nitrate concentration of less than 40mg/L. In addition, more than 80 per cent of stations with a groundwater level of less than 5m also recorded concentrations below the threshold of 40mg/L. The results show that, for most monitoring stations, the average nitrate ion concentration in the water appeared to be stable.

As regards nitrates in rivers, 100 per cent of stations recorded concentrations below 25mg/L for the maximum annual and winter average values. Annual and winter average concentrations in over 50 per cent of stations were stable. Maximum concentrations tended to decrease in over 60 per cent of stations. In reservoirs, more than 90 per cent of stations recorded maximum annual and winter average concentrations below 25mg/L. Annual and winter average concentrations in more than 70 per cent of stations were highly stable. In summary, there were not considered to be any urgent situations in terms of groundwater nitrate concentration.

Although the data regarding this pollution concern are improving, waste collection and processing levels remain relatively low, and a significant number of heavily polluting industries and agro-industrial holdings continue to lack effective waste processing systems. It is also estimated that around 8 per cent of the population of continental Portugal (according to 2007 data) does not have piped water in the home to meet basic needs. Sustainable water management has therefore been prioritized in various government programmes. A great deal remains to be done, however, despite the improvements brought about as a result of integrated planning under the national water plan, river basin plans, plans for the use of reservoirs and coastal development plans.

2. GOVERNANCE ASPECTS

2.1. WATER INSTITUTIONS

The National Water Institute (INAG) is the national water authority under the supervision of the Ministry for Environment, Spatial Planning and Regional Development. Water of Portugal (ADP) is in charge of water supply for households and sanitation, while water for irrigation is the responsibility of the Directorate-General of Agriculture and Rural Development (DGADR)

Regarding territorial water management, the river basin management plans are determined by the five Regional Coordination and Development Commissions, together with the administrations of hydrographical regions. The plans of those that are internationally shared are determined by INAG (in coordination with the Spanish water authorities). Inter-ministerial coordination is also managed by INAG.

2.2. WATER MANAGEMENT

One of the objectives of the Water Framework Directive (WFD) is to ensure the sustainable use of water resources in the EU. In accordance with the Directive, Portugal is formulating management plans for each of its 10 river basin districts. These planning tools, brought together in the National Water Plan that is currently being drawn up, underpin the management, protection and environmental, social and economic exploitation of water.

There are other significant planning schemes related to water issues in Portugal. Among them is the National Programme for Efficient Water Use (PNUEA), approved in 2005, the principal objective of which is to promote the efficient use of water, particularly in the urban, agricultural and industrial sectors, and to help to minimize the risk of water shortages and improve environmental conditions in water environments. In close relation with the PNUEA, the Strategic Water Supply and Waste Water Sanitation Plan (PEAASAR), framed in the period 2007-2013, provides for regular investment in the renewal and expansion of water supply and sanitation networks and the replacement of equipment. Targets for 2013 include ensuring that around 95 per cent of the country's total population has public water supply systems and that around 90 per cent has public urban wastewater sanitation systems.

To monitor compliance with the principal objectives and measures provided for in the national water plan and to characterize the country's water supply, drainage and wastewater treatment sectors, the National Water Supply and Waste Water System Inventory (INSAAR) was developed. It also operates as an instrument for monitoring and assessing PEAASAR II (2007-2013).

The National Strategy for Agricultural and Agro-industrial Waste (ENEAPAI), also covering the period from 2007 to 2013, is a key tool for defining and clarifying policy for these sectors, and constitutes a strategy for implementing an institutional, management and technical model that represents a sustainable alternative for processing waste, especially because it tries to implement a price structure, ensuring the application of the user-pays principle.

To reduce nitrate concentrations in water bodies, steps have been taken to promote good agricultural practice by raising farmers' awareness by means of nationwide training initiatives – especially in areas of greater risk – designed to explain and disseminate environmental techniques and good agricultural practice. The Code of Good Agricultural Practice (CBPA), to be applied voluntarily by farmers, was drawn up to satisfy one of the requirements of the Nitrates Directive. The Code establishes general pointers and guidelines, mainly with a view to helping farmers to take measures to rationalize the use of fertilizers, and a range of growing techniques and methods impacting on nitrogen dynamics in agricultural ecosystems so as to minimize nitrate losses and thus protect surface and groundwater from pollution. It should be noted that the number of holdings that have adopted integrated production systems and organic production methods has increased.

Finally, the special case of the Alqueva dam, whose reservoir is considered to be Europe's largest artificial lake, should be highlighted. It was built in the Alentejo to establish a strategic water reserve to supply agricultural, urban and industrial areas in a vast part of the region. This strategic reserve will allow water to be used even in periods of prolonged drought, since the Alentejo is characterized by its irregular water resources and climate – very hot dry summers, and cold and sometimes rainy winters. Its principal feature, however, is that rainfall is concentrated in a short period of the year, normally from November to February, and has equally irregular cycles: periods of drought may last for three or more consecutive years.

2.3. WATER POLICY AND LEGAL FRAMEWORK

The main Directives and related legislation in the European level, regarding the domain of water resources management are:

•Directive 80/68/EEC of 17 December, 1979 on the protection of groundwater against pollution caused by certain dangerous substances;
•Directive 82/176/EEC of 22 March, 1982 on limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis industry; covers inland surface water, territorial waters and internal coastal waters;
•Directive 83/513/EEC of 26 September, 1983 on limit values and quality objectives for cadmium discharges; sets limit values and quality objectives for cadmium discharges in the aquatic environment;
•Directive 84/156/EEC of 8 March, 1984 on limit values and quality objectives for mercury discharges by sectors other than the chlor-alkali electrolysis industry; sets limit values and quality objectives for mercury discharges in sectors other than the chlor-alkali electrolysis industry;
•Directive 84/491/EEC of 9 October, 1984 on limit values and quality objectives for discharges of hexachlorocyclohexane;
•Directive 91/271/EEC of 21 May, 1991 concerning urban waste water treatment;
•Directive 91/676/EEC of 12 December, 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (known as the Nitrates Directive);
•Directive 98/83/EC of 3 November, 1998 on the quality of water;
•Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy;
•Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March, 2004 on detergents;
•Decision 2006/507/EC of 14 October, 2004 concerning the conclusion, on behalf of the European Community, of the Stockholm Convention on Persistent Organic Pollutants (POPs);
•Directive 2006/7/EC of the European Parliament and of the Council of 15 February, 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (with effect from 31 December, 2014);
•Directive 2006/44/EC of 6 September, 2006 on the quality of fresh waters needing protection or improvement in order to support fish life (this Directive will be repealed by the Framework Directive on water as of the end of 2013);
•Directive 2006/11/EC of the European Parliament and of the Council of 15 February, 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community the European Union (this Directive will be repealed by the Framework Directive on water as of the end of 2013);
•Proposal for a European Parliament and Council Directive of 22 September, 2006 setting out a framework for soil protection and amending Council Directive 2004/35/EC [COM (2006) 231 final – not published in the Official Journal];
•Directive 2006/118/EC of the European Parliament and of the Council of 12 December, 2006 on the protection of groundwater against pollution and deterioration;
•Directive 2007/2/EC of the European Parliament and of the Council of 14 March, 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE);
•Commission Communication of 18 July, 2007: "Addressing the challenge of water scarcity and droughts in the European Union" [COM (2007) 414 final – not published in the Official Journal];
•Directive 2007/60/EC of the European Parliament and of the Council of 23 October, 2007 on the assessment and management of flood risks; aims to manage and reduce the risk of floods, particularly along rivers and in coastal areas;
•Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (the IPPC Directive);
•Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

As a member state of the European Union, Portugal has to implement this legislation in its own legal framework, defining specific laws for the implementation of the different Directives and common legislative principles. This is a responsibility of the National Water Institute (INAG), under

the supervision of the Ministry for Environment, Spatial Planning and Regional Development. Portugal transposed the EU Water Framework Directive into its legislation in December 2005.

3. GEOPOLITICAL ASPECTS

Portugal is a coastal nation in south-western Europe. It consists of a mainland on the Iberian Peninsula and the Atlantic archipelagos of the Azores and Madeira. It has a total area of 92,090km2. The only land borders are with Spain in the east and north. Portugal has an extensive coastline – 943km on the mainland and 917km in the islands. Its peripheral location in European terms implies certain handicaps, such as higher transportation costs and a greater distance to major markets and production centres.

Portugal is a democratic republic that was established at the beginning of the twentieth century. In 2008, Portugal had 10,627,250 inhabitants and a population density of 115 inhabitants per km2, with significant agglomerations in major cities such as Lisbon and Oporto. This asymmetric occupation of the territory, with a markedly higher population density along the coast, is the result of the abandonment of agricultural and forestry areas.

The Portuguese population has grown slightly in recent years, due more to immigration than to natural growth. For this reason the population is ageing fast, which is expected to have severe implications for future generations. In addition, the birth rate has been steadily decreasing

Over the last 40 years, Portugal has been transformed from a colonial country with territories across the world to a European country of medium dimensions. On the other hand, thanks to its island territories, the Portuguese Exclusive Economic Zone (EEZ) covers an area of almost 1.8 million km2.

Portugal has been a member of the United Nations since 1955 and is a founder member of the Latin Union, the Organization of Ibero-American States, the Organisation for Economic Co-operation and Development (OECD), the North Atlantic Treaty Organization (NATO) and the Community of Portuguese Language Countries.

Portugal has been a member of the European Union since 1986 and, since joining, it has become a diversified and increasingly service-based economy. There has been a considerable improvement in GDP – from EUR8,400/inhabitant in 1988 to EUR12,400/inhabitant in 2008. During the same period, the inflation rate decreased from 11.7 per cent to 2.6 per cent. In 2002, Portugal entered the Economic and Monetary Union together with 12 other Member States, having adopted the Euro as its official currency.

For much of the 1990s, economic growth was above the EU average, but it decreased during the period 2001-2008. GDP per capita is roughly two thirds of the EU-27 average. As stated in the OECD report, progress towards convergence with average OECD living standards has suffered a reversal since 2000, due in particular to weak labour productivity growth. Recent reforms have included some easing of employment protection legislation and improvements in upper-secondary education. Other key areas that need further reform include the improvement of standards in secondary education, the reduction of the administrative burden on businesses and the reform of employment protection legislation.

Portugal is very much dependent on external energy supplies. There is no coal, oil or natural gas to be found on Portuguese territory. However, in 2007, Portugal produced 42.3 per cent of its electricity from renewable sources, mainly hydropower. Wind energy is becoming a very important industry in Portugal, along with solar energy, the capacity of which increased tremendously in 2009 with the construction of one of the largest solar power plants in Europe.

Major infrastructural investments have been planned in Portugal, such as the new Lisbon airport, an additional bridge over the Tagus River in Lisbon and a new high-speed train connection between Lisbon and Madrid. In the energy sector, there are improvements planned at several hydroelectric power plants, which should increase production to 910MW in 2015. A further 10 new hydroelectric power plants are due to be completed by 2020, providing an extra 1,100MW. A new energy strategy was announced in March 2010, with its basis in the renewable energy and energy efficiency sector, which set new goals for 2020.

4. SOURCES

Aquastat – FAO. (1997). http://www.fao.org/nr/water/aquastat/main/index.stm

(EMWIS) Euro-Mediterranean Information System on know-how in the Water sector. Country Water Profiles. http://www.emwis.org/thematicdirs/countries-water-profiles.

(EEA) European Environmental Agency – (2011). The European Environment – State and Outlook 2010. http://www.eea.europa.eu/soer/.

INAG (2009). Report 'Questões significativas da gestão da água na Região Hidrográfica do Cávado, Ave e Leça, Douro, Guadiana, Minho e Lima, Ribeiras do Algarve, Sado e Mira, Tejo, e Vouga – Documento de apoio à Participação Pública'. Instituto da Água, Lisboa. http://dqa.inag.pt/dqa2002/port/docs_apoio/doc_nac/Docs_PartPublica/Relatorio_Resultados_PP_QSiGA_30_Junho_2009.pdf.

MAOT (2002). Plano Nacional da Água – Volumes I e II. Ministério do Ambiente e do Ordenamento do Território, Lisboa. http://www.inag.pt/inag2004/port/a_intervencao/planeamento/pna/pna.html.

MAOTDR, (2007). Estratégia Nacional para os Efluentes Agro-Pecuários e Agro-Industriais. Ministério do Ambiente, do Ordenamento do Território e do Desenvolvimento Regional, Lisboa. http://portal.min-agricultura.pt/portal/page/portal/MADRP/PT/servicos/Imprensa/nt_xvii/Documentos/01_ENEAPAI.pdf?_template.