Water Risk Filter

Country Overview - Jordan

Water Indicators

Indicator	Value	Description	Source
Overall Basin Risk (score)	2.92	Overall Basin Risk (score)	
Overall Basin Risk (rank)	42	Overall Basin Risk (rank)	
Physical risk (score)	3.17	Physical risk (score)	
Physical risk (rank)	31	Physical risk (rank)	
Regulatory risk (score)	1.82	Regulatory risk (score)	
Regulatory risk (rank)	161	Regulatory risk (rank)	
Reputation risk (score)	3.25	Reputation risk (score)	
Reputation risk (rank)	32	Reputation risk (rank)	
1. Quantity - Scarcity (score)	4.28	1. Quantity - Scarcity (score)	
1. Quantity - Scarcity (rank)	6	1. Quantity - Scarcity (rank)	
2. Quantity - Flooding (score)	2.61	2. Quantity - Flooding (score)	
2. Quantity - Flooding (rank)	133	2. Quantity - Flooding (rank)	
3. Quality (score)	1.57	3. Quality (score)	
3. Quality (rank)	167	3. Quality (rank)	
4. Ecosystem Service Status (score)	2.03	4. Ecosystem Service Status (score)	
4. Ecosystem Service Status (rank)	126	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)	165	5. Enabling Environment (Policy & Laws) (rank)	
6. Institutions and Governance (score)	3.00	6. Institutions and Governance (score)	
6. Institutions and Governance (rank)	86	6. Institutions and Governance (rank)	
7. Management Instruments (score)	1.70	7. Management Instruments (score)	
7. Management Instruments (rank)	164	7. Management Instruments (rank)	
8 - Infrastructure & Finance (score)	1.10	8 - Infrastructure & Finance (score)	
8 - Infrastructure & Finance (rank)	159	8 - Infrastructure & Finance (rank)	
9. Cultural Diversity (score)	3.00	9. Cultural importance (score)	
9. Cultural Diversity (rank)	40	9. Cultural importance (rank)	
10. Biodiversity Importance (score)	3.11	10. Biodiversity importance (score)	

Indicator	Value	Description	Source
10. Biodiversity Importance (rank)	116	10. Biodiversity importance (rank)	
11. Media Scrutiny (score)	4.00	11. Media Scrutiny (score)	
11. Media Scrutiny (rank)	15	11. Media Scrutiny (rank)	
12. Conflict (score)	2.36	12. Conflict (score)	
12. Conflict (rank)	115	12. Conflict (rank)	
1.0 - Aridity (score)	4.02	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)	11	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)	3.57	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)	14	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)	4.13	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.

Indicator	Value	Description	Source
1.2 - Baseline Water Stress (rank)	11	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)	4.95	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)	10	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)	2.48	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)	42	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.

Indicator	Value	Description	Source
1.5 - Drought Frequency Probability (score)	5.00	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)	5	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)	4.51	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) . 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)	10	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)	2.66	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)	131	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.

Indicator	Value	Description	Source
2.2 - Projected Change in Flood Occurrence (by ~2050) (score)	1.56	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)	164	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)	1.57	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.

Indicator	Value	Description	Source
3.1 - Surface Water Contamination Index (rank)	167	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)	2.19	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)	106	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)	1.00	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.

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Indicator	Value	Description	Source
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (rank)	163	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)	4.95	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)	6	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)	161	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.

Indicator	Value	Description	Source
5.2 - Freshwater Law Status (SDG 6.5.1) (rank)	148	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)	135	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)	3.00	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)	100	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)	4.00	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)	48	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)	120	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)	156	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.

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 GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.2 - Groundwater Monitoring Data Availability and Management (rank)	52	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)	3.69	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)	70	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)	109	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.

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Indicator	Value	Description	Source
8.2 - Access to Sanitation (rank)	127	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)	150	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)	3.00	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)	40	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)	4.71	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)	42	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)	1.50	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)	178	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 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)	25	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)	4.00	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)	15	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)

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Indicator	Value	Description	Source
12.1 - Conflict News Events (RepRisk) (score)	2.00	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)	121	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)	2.72	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)	65	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 (#)	9455802	Population, total	The World Bank 2018, Data , hompage accessed 20/04/2018
GDP (current US$)	38654727746	GDP (current US$)	The World Bank 2018, Data , hompage accessed 20/04/2018
EPI 2018 score (0-100)	62.20	Environmental Performance Index	
WGI -Voice and Accountability (0-100)	26.67	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

Country Overview - Jordan

Indicator	Value	Description	Source
WGI -Political stability no violence (0-100)	25.12	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)	58.65	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)	54.33	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)	62.02	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)	64.42	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

Country Overview - Jordan

Indicator	Value	Description	Source
WRI BWS all industries (0-5)	4.59	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)	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 http://wri.org/publication/aqueduct-country-river-basin-rankings.
Baseline Water Stress (BWS) - 2020 BAU (1=very high)	15	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)	15	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)	15	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.

Country Overview - Jordan

Indicator	Value	Description	Source
Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk)	15	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)	12	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)	15	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)	14	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)	14	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)	14	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

Country Overview - Jordan

Indicator	Value	Description	Source
Total water footprint of national consumption (m3/a/cap)	1678.02	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 (%)	85.80	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.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Area equipped for full control irrigation: total (1000 ha)	78.86	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)	103.40	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 (%)	93.97	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)	0.32	World Development Indicators	The World Bank 2018, Data , hompage accessed 20/04/2018
Total internal renewable water resources (IRWR) (10^9 m3/year)	0.68	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)	0.26	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)	0.68	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13

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Country Overview - Jordan

Indicator	Value	Description	Source
Total renewable water resources (10^9 m3/year)	0.94	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Dependency ratio (%)	27.21	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)	123.40	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]	5.16	WorldHappinessReport.org	World Happiness Report, homepage accessed 20/04/2018

Country Aspects

1. PHYSICAL ASPECTS

1.1. WATER RESOURCES

1.1.1. WATER RESOURCES

The average annual precipitation according to the observations made during the last 70 years is around 8.35km3/year, fluctuating from 2.97 (1998/1999) to 17.8km3/year (1966/1967) (Directorate of Planning and Water Resources, 2005).

Total internal renewable water resources are estimated at 682 million m3/year. Long-term average internal renewable surface water resources are approximately 485 million m3/year. They reached 533 and 652 million m3 in 2004 and 2005 respectively (Directorate of Planning and Water Resources, 2005). Surface water resources are unevenly distributed among 15 basins. River flows are generally of a flash-flood nature, with large seasonal and annual variation. The largest source of external surface water is the Yarmouk River, which enters from the Syrian Arab Republic after first forming the border with it. It then joins the Jordan River coming from Israel, taking its name. The natural annual flow of the Yarmouk River is estimated at about 400 million m3, of which about 100 million m3 are withdrawn by Israel. However, the total actual flow is much lower at present as a result of the drought and the upstream Syrian development works of the 1980s. The Yarmouk River is the main source of water for the King Abdullah Canal (KAC) and is thus considered to be the backbone of development in the Jordan Valley. A main tributary of the Jordan River, controlled by the King Talal Dam and also feeding the KAC, is the Zarqa River. There are also 6–10 small rivers called "Side Wadis" going from the mountains to the Jordan Valley. Other basins include the Mujib, the Dead Sea, Hasa and Wadi Araba.

Jordan's groundwater is distributed among 12 major basins, 10 of which are renewable groundwater basins and two in the southeast of the country are fossil groundwater aquifers. Total internal renewable groundwater resources have been estimated at 450 million m3/year, of which 253 million m3/year constitute the base flow of the rivers. Groundwater resources are concentrated mainly in the Yarmouk, Amman–Zarqa and Dead Sea basins. The safe yield of renewable groundwater resources is estimated at 275.5 million m3/year. At present most of it is exploited at maximum capacity, in some cases beyond safe yield. Of the 12 groundwater basins, six are being overexploited, four are balanced and two are underexploited. Overexploitation of groundwater resources has degraded water quality and reduced exploitable quantities, resulting in the abandonment of many municipal and irrigation water-well fields, such as in the area of Dhuleil. The main non-renewable aquifer presently exploited is the Disi aquifer (sandstone fossil) in southern Jordan, with a safe yield estimated at 125 million m3/year for 50 years. Other non-renewable water resources are found in the Jafer Basin, for which the annual safe yield is 18 million m3. The Water Authority of Jordan estimates that the total safe yield of fossil groundwater is 143 million m3/year for 50 years.

Ten dams have been constructed in the last five decades with a total capacity of around 275 million m3. The main dam is the King Talal Dam on the Zarqa River, with a total capacity of 80 million m3. The Unity Dam on the Yarmouk River shared between Jordan and the Syrian Arab Republic will be completed in 2007 and will have a total reservoir capacity of 110 million m3. All the dams, except the Karamah Dam on Wadi Mallaha, are built on the Side Wadis with their outlets to the Jordan Valley and are used to store floods and base flows, regulate water and release it for irrigation. According to the water annex in the Jordanian–Israeli treaty, a regulating dam was built on the Yarmouk River downstream of the diversion point of KAC. Another dam should be built in the lower water course of the Jordan River on the border between Jordan and Israel. The dam capacity will be 20 million m3.

Over the last three decades sewage water networks have been constructed in cities and towns to serve around 70 per cent of the population in Jordan. Twenty-three sewage treatment plants are in operation and the treated wastewater is used in irrigation. More than 80 per cent of sewage water of the Greater Municipality of Amman is treated in four plants and then released into the Zarqa River. The mixed water is then stored in the King Talal Dam reservoir to be used in irrigation in the middle Jordan Valley irrigation schemes (this involves 78 per cent of the treated wastewater). A small quantity (around 9 per cent) is used for irrigation in the Zarqa River catchment area. Treated wastewater from the other plants is used around the plants and/or mixed with surface water to irrigate areas in the Side Wadis. The wastewater entering the treatment plants reached 101.8 and 107.4 million m3 in 2004 and 2005 respectively, while reused treated wastewater in these two years was around 86.4 and 83.5 million m3 respectively. Reused wastewater is an essential element of Jordan's water strategy. Sewage treated wastewater should be the most important source of water in irrigation in the near future.

Under Jordanian law it is forbidden to discharge untreated wastewater into the watercourses or to use it for irrigation. Houses and industries that are not connected to the sewerage network and use cesspools, haul the septic water to existing wastewater treatment plants or to a special dump area. The septic haulers are not closely regulated, and the origins of much of the septic water are not precisely known (MWI, 2002).

In 2002, the total installed gross desalination capacity (design capacity) in Jordan was 11,163 m3/day (Wangnick Consulting, 2002). Desalinated water production became significant only in 2005, reaching 10 million m3/year.

1.1.2. WATER USE

Water withdrawal varies according to the year. It was around 866 and 941 million m3 in 2004 and 2005 respectively. In 2005, agricultural water withdrawal accounted for 65 per cent of the total

water withdrawal, and water withdrawal for domestic and industrial purposes accounted for 31 and 4 per cent respectively.
During periods of water shortage strict measures are taken, such as rationing water allocations and reducing or banning the cultivation of irrigated summer vegetables. Overexploitation of renewable groundwater resources by farmers is a common practice. It reached 158 million m3 in 2002 and in 2003, 147 million m3 in 2004 and 144 million m3 in 2005.
Treated wastewater is discharged to open wadis where it flows either to the reuse sites or to dams and is then mixed with rainwater or base flows. Different irrigation methods are used depending on the effluent quality, the type of crops irrigated and the availability of mixing water. Furrow, flooding and localized irrigation methods are used. Sprinkler irrigation is not used, in compliance with the Jordanian standards for reuse from a health point of view. Also, chloride concentration in effluents exceeds the permissible limit for the use of sprinklers, which affects the crops adversely.
Although most of the treated wastewater flows by gravity to wadis and reservoirs, effluents from plants are pumped to reuse sites such as Madaba, Aqaba, Kufranja and Ma'an. Part of the effluent from Aqaba and Madaba is disposed of through evaporation when the quantity exceeds agricultural needs. While some factories and industries reuse part of the industrial water on a small scale and mainly for cooling purposes, this water is generally reused for on-site irrigation (MWI, 2002).

1.2. WATER QUALITY, ECOSYSTEMS AND HUMAN HEALTH

The development of water resources for irrigation and expansion of the irrigated area, which is cultivated intensively, are causing negative impacts such as:
-Soil erosion on steep lands due to heavy rains and flood leads to an increase in sediment loads in the dams/reservoirs and the washing away of fertile top soils in the highlands and the Side Wadis. Heavy silt loads in KAC water resulted on many occasions in a suspension of water pumping in the Deir Alla Amman domestic water supply project during some winter months with heavy rainfall.
-Deterioration in the quality of irrigation water is caused by sewage-treated wastewater, particularly in drought years. Improving the treatment process and installing desalination plants are expected to overcome this problem.
-Heavy use of pesticides, insecticides and animal (poultry) fertilizer is deteriorating the soil, affecting the quality of agricultural products, mainly vegetables, and causing a fly problem in the Jordan Valley in winter, which is annoying the inhabitants and threatening tourism.
-Plastic sheets used in greenhouses and in drip irrigation (mulch) affect the fertility of the soil.
-Overexploitation of groundwater due to intensive irrigation reduces the yield of the tube wells and increases pumping costs due to a drop in the water table of the aquifers.
-There is a large drop in the water surface in the Dead Sea and a dangerous reduction in its water area. The level of the Dead Sea was said to fall each year by 85cm due to extensive water use in the Jordan Basin.
-There is a lack of sewage water networks in towns and villages in the Jordan Valley and other irrigated areas. Houses depend on septic tanks to handle sewage water.
On the other hand, some positive impacts of irrigated agriculture include:
-access to improved and safe drinking water facilities for the majority of the inhabitants in the Jordan Valley and other irrigated areas;
-expansion of the green cover;
-production of fresh vegetables all year round;
-increase in the socioeconomic standard of people in the Jordan Valley due to the integrated development plan carried out by JVA in that region.
Much of Amman's wastewater treated effluent is discharged in the Zarqa River and is impounded by the King Talal Dam, where it is blended with fresh floodwater and subsequently released for irrigation use in the Jordan Valley. The increased supply of water to Jordan's cities came about at the expense of spring flows discharging into such streams as the Zarqa River, Wadi Shueib, Wadi Karak, Wadi Kufrinja and Wadi Arab. The flow of freshwater in these streams was reduced as a result of increased pumping from the aquifers and the flow was replaced with the effluent of treatment plants, a process that transformed the ecological balance over time (MWI, 2002).
Contaminated water is a source of many human infections, causing diarrhoea and other diseases. In Jordan, the most common parasite causing diarrhoea is Entamoeba histolyca, while Salmonella and Shigella are the most common bacteria. Naturally, children are more exposed to such infections than adults.

2. GOVERNANCE ASPECTS

2.1. WATER INSTITUTIONS

The ministries in charge of the water sector and the institutions involved in irrigation are:
-The Ministry of Water and Irrigation (MWI) in cooperation with the Jordan Valley Authority (JVA) and the Water Authority of Jordan (WAJ)
-The Ministry of Agriculture (MOA)
-The Ministry of Environment (MOE)
-The Ministry of Health (MOH)
-The National Center for Agricultural Research and Technology Transfer
-The Water and Environment Research and Study Center, University of Jordan.
The MWI was established in 1988 with the JVA and the WAJ under its umbrella. The Minister of Water and Irrigation is the Chair of the Board of Directors of the WAJ and the JVA. Before the establishment of the MWI, the JVA and the WAJ were two autonomous authorities directly under the responsibility of the Prime Minister of Jordan.
The main concerns of the MWI are:
-formulating and implementing an irrigation policy and strategy;
-planning and developing water resources and controlling water allocation and use;
-preparing a water master plan and the annual water balance budget;
-establishing a water data centre;
-human resources development and training programmes for the water sector; and

-public awareness programmes.
The JVA is in charge of the integrated development plan in the Jordan Valley. Its main tasks are:
-construction, operation and maintenance of dams in the Side Wadis and in the Jordan Valley;
-construction, operation and maintenance of public irrigation schemes in the Jordan Valley;
-delivering and distributing irrigation water to farmers and collecting irrigation water charges;
-encouraging farmers to adopt modern irrigation methods and to save water and improve farm irrigation efficiency;
-working with international donors and farmers on farm irrigation practices and scheduling;
-implementing emergency plans to face water shortage in dry years and seasons; and
-implementing public awareness and water conservation programmes in irrigation.
The WAJ is responsible for:
-providing licences to farmers to utilize groundwater for irrigated agriculture, checking the drilling of tube wells and carrying out the testing of the yield of the wells; and
-checking the abstraction from the tube well in the groundwater basins, pursuant to Law No 83 (2003) to reduce overexploitation of renewable groundwater resources practised by farmers.
The Ministry of Health (MOH) is responsible for ensuring the safety of drinking water. The MWI, MOH and the General Corporation for Environmental Protection (GCEP) under MOE all monitor water quality.

2.2. WATER MANAGEMENT

The main objective of water management programmes is to optimize water use in irrigation, adopt modern irrigation and agricultural techniques and increase the yield of irrigated crops and the income per unit of land and water.
The main entities involved in irrigation water management are:
-the MWI, in association with the JVA and WAJ and the MOA;
-the private sector through agricultural companies specialized in irrigation and manufacturers of drip irrigation facilities;
-international donors through grants to the MWI, JVA and directly to farmers.
Private agricultural and irrigation companies provide financial and technical support to farmers. They train farmers in farm irrigation and agricultural techniques. They deliver irrigation equipment, greenhouses and modern agricultural supplies to thousands of irrigation farms throughout the country. They provide farmers with small desalination units to improve the quality of water for irrigation.
Between 2005 and 2006, the International Programme for Technology and Research in Irrigation and Drainage (IPTRID) carried out the Project Design and Management Training Programme (PDM) for Professionals in the Water Sector in some countries of the Near East such as Jordan. The objective of the programme is to strengthen participants' capacities in developing more effective and efficient projects to address pressing water issues in the region (FAO, 2008).

2.3. WATER POLICY AND LEGAL FRAMEWORK

In public irrigation schemes in the Jordan Valley the government is fully responsible for the cost of construction, restoration and operation and maintenance (O&M). The construction costs of the irrigation schemes and dams are covered by international loans and the national budget. O&M costs are allocated annually in the national budget. Collected water charges cover less than 60 per cent of total O&M costs. Irrigation water is subsidized by the government.
In the private sector irrigation projects, investors and owners pay the full cost of construction and renovation and annual running O&M costs. The Agricultural Credit Corporation, private banks and agro-irrigation companies are financial sources for most irrigation activities in private farms.
In 2002, the MWI published the 'Water sector planning & associated investment programme 2002–2011'. The goals are to unify water sector projects, create uniform project baselines, schedule projects based on multiple scenarios, identify the role for private sector participation (PSP), and identify lowest cost solutions for development projects.
Jordan has been giving priority to the development of its limited water resources for different purposes. Limited financial and technical resources have forced Jordan to seek the assistance of international donors and development funds to implement intensive water development plans over the last five decades. Irrigation has been a major issue in the three- and five-year socio-economic development plans carried out by the government in the second half of the last century.
In 2002, the MWI published the Jordan Water Policy and Strategy consisting of the following:
-Water Strategy for Jordan (2002)
-Groundwater Management Policy (1998)
-Water Utility Policy (1998)
-Irrigation Water Policy (1998)
-Wastewater Management Policy (1998)
The issues covered by the Irrigation Water Policy are the sustainability of irrigation water resources, development and use, research and technology transfer, farm water management, irrigation water quality, management and administration, water pricing, regulation and control and irrigation efficiency.
Laws, bylaws and regulations are imposed to enable the relevant bodies to fulfil their responsibilities and perform their duties regarding water, irrigation and irrigated agriculture, such as the MWI bylaw, the JVA, WAJ, and MOA laws, the Environment Law and the Public Health Law. The latest bylaw prepared by the MWI and approved by the government is the Bylaw No. 85/2003 to control groundwater abstraction and reduce the overexploitation and depletion of the groundwater aquifers by farmers in the country.

3. GEOPOLITICAL ASPECTS

Most of Jordan's water resources are shared with other countries. The Yarmouk/Jordan River is the largest river of the country, where water allocation to riparian countries is one of the most difficult regional issues. Failure so far to develop a unified approach to managing these water resources has encouraged unilateral development by the various riparian countries.
In 1951, Jordan announced its plan to divert part of the Yarmouk River via the East Ghor Canal to

irrigate the East Ghor area of the Jordan Valley. In response, Israel began construction of its National Water Carrier (NWC) in 1953, resulting in military skirmishes between Israel and the Syrian Arab Republic. In 1955, the Johnston Plan called for the allocation of 55 per cent of available water in the Jordan River basin to Jordan, 36 per cent to Israel, and 9 per cent each to the Syrian Arab Republic and Lebanon. It was never signed by the countries involved, but it has served as a general guideline for appropriations within the basin. In 1964, the NWC opened and began diverting water from the Jordan River Valley. This diversion led to the Arab Summit of 1964 where a plan was devised to begin diverting the headwaters of the Jordan River to the Syrian Arab Republic and Jordan. The most recent directly water-related conflict occurred in 1969 when Israel attacked Jordan's East Ghor Canal following suspicions that Jordan was diverting excess amounts of water (Green Cross Italy, 2006). Later on, Israel and Jordan acquiesced to the apportionment, contained in the non-ratified 1955 Johnston Plan, for sharing the Jordan Basin's waters (Milich and Varady, 1998).

Jordan is affected by water development projects by the Syrian Arab Republic in the Upper Yarmouk Basin and by Israel in the Upper Jordan River and the occupied Golan Heights. Despite agreements with the Syrian Arab Republic and Israel, Jordan received only around 119 and 92 million m3/year from the Yarmouk water and Lake Tiberias in 2004 and 2005 respectively. This is only approximately 10 per cent of the total flow of the Upper Jordan and Yarmouk rivers. It is also much less than the water share from these two basins proposed by the Johnston Plan during negotiations in 1950s.

Although no comprehensive agreement exists on sharing the jointly-owned water resources, 11 plans for water use were prepared between 1939 and 1955. The last one was the Johnston Plan of 1955, allocating water between Jordan and the Syrian Arab Republic. In 1987, Jordan and the Syrian Arab Republic signed an agreement to build the Unity Dam on the Yarmouk River with a height of 100m and a storage capacity of 225 million m3. In 2003, the height of the dam was reduced to 87m and the storage capacity became 110 million m3. The dam was finally inaugurated in 2008. Because of the political conflict in the region, the case of the Yarmouk cannot be considered completely settled so far. The river is part of the Jordan River Basin. It needs therefore to be integrated into an agreement governing the whole drainage basin (Marina, 2010).

Jordan and Israel reached a compromise on water rights issues in the Jordan River Basin. The Jordanian–Israeli Peace Treaty, which was signed in October 1994, includes agreed articles on water presented in Annex II – Water Related Matters. According to the articles of this annex, Jordan is entitled to store 20 million m3 of the Upper Jordan winter flow on the Israeli side (in Lake Tiberias) and take it back during the summer months. Jordan is entitled to 10 million m3 of desalinated water from the saline Israeli springs near Tiberias and until the desalination plant is erected Jordan can get this quantity in summer from Lake Tiberias. Jordan can build a regulating/storage dam on the Yarmouk downstream of the diversion point of Yarmouk water to the KAC. Jordan can also build a dam of 20 million m3 capacity on the Jordan River and on its reach south of Lake Tiberias on the border between Jordan and Israel. Later, Jordan and Israel agreed to provide Jordan with 50 million m3 of desalinated water from the Israeli saline springs south of Lake Tiberias and until the desalination plant is erected Israel is providing Jordan with 25 million m3 from Lake Tiberias through the summer months. The regulating dam on the Yarmouk River was built and the water conveyor to transport water from Lake Tiberias in Israel to the KAC in Jordan was constructed just after the signing of the Peace Treaty.

In 2007, Jordan and the Syrian Arab Republic agreed to expedite the implementation of agreements signed between the two countries, especially with regard to shared water in the Yarmouk River Basin. They also agreed to continue a study on the Yarmouk River Basin based on previous studies. Currently, the Joint Jordanian–Syrian Higher Committee is discussing how to make use of the Yarmouk River Basin water and how to protect Yarmouk water against depletion. Talks will also include preparations for winter and storage at Al Wihdeh Dam. The establishment of the Wihdeh Dam was designed to enhance the supply of potable water to Jordan by providing it with 80 million m3 annually – 50 million m3 for drinking purposes and 30 million m3 for irrigation in the Jordan Valley. The dam was also created to enhance the environmental situation of the area surrounding the Yarmouk River Basin and activate tourism, in addition to generating power. The Syrian authorities have shown an understanding of Jordan's limited water resources (The Jordan Times, 2008).

On June 22 1999 Jordan ratified the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (UNTC).

4. SOURCES

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