# Water Risk Filter

## Country Overview - Cambodia

## Water Indicators

| Indicator | Value | Description | Source |
|---|---|---|---|
| Overall Basin Risk (score) | 2.83 | Overall Basin Risk (score) | |
| Overall Basin Risk (rank) | 57 | Overall Basin Risk (rank) | |
| Physical risk (score) | 2.65 | Physical risk (score) | |
| Physical risk (rank) | 94 | Physical risk (rank) | |
| Regulatory risk (score) | 3.03 | Regulatory risk (score) | |
| Regulatory risk (rank) | 64 | Regulatory risk (rank) | |
| Reputation risk (score) | 3.17 | Reputation risk (score) | |
| Reputation risk (rank) | 40 | Reputation risk (rank) | |
| 1. Quantity - Scarcity (score) | 2.13 | 1. Quantity - Scarcity (score) | |
| 1. Quantity - Scarcity (rank) | 103 | 1. Quantity - Scarcity (rank) | |
| 2. Quantity - Flooding (score) | 3.98 | 2. Quantity - Flooding (score) | |
| 2. Quantity - Flooding (rank) | 28 | 2. Quantity - Flooding (rank) | |
| 3. Quality (score) | 2.32 | 3. Quality (score) | |
| 3. Quality (rank) | 136 | 3. Quality (rank) | |
| 4. Ecosystem Service Status (score) | 2.94 | 4. Ecosystem Service Status (score) | |
| 4. Ecosystem Service Status (rank) | 57 | 4. Ecosystem Service Status (rank) | |
| 5. Enabling Environment (Policy & Laws) (score) | 2.00 | 5. Enabling Environment (Policy & Laws) (score) | |
| 5. Enabling Environment (Policy & Laws) (rank) | 135 | 5. Enabling Environment (Policy & Laws) (rank) | |
| 6. Institutions and Governance (score) | 4.00 | 6. Institutions and Governance (score) | |
| 6. Institutions and Governance (rank) | 29 | 6. Institutions and Governance (rank) | |
| 7. Management Instruments (score) | 2.31 | 7. Management Instruments (score) | |
| 7. Management Instruments (rank) | 129 | 7. Management Instruments (rank) | |
| 8 - Infrastructure & Finance (score) | 4.35 | 8 - Infrastructure & Finance (score) | |
| 8 - Infrastructure & Finance (rank) | 36 | 8 - Infrastructure & Finance (rank) | |
| 9. Cultural Diversity (score) | 2.00 | 9. Cultural importance (score) | |
| 9. Cultural Diversity (rank) | 100 | 9. Cultural importance (rank) | |
| 10. Biodiversity Importance (score) | 3.80 | 10. Biodiversity importance (score) | |

Water Risk Filter

## Country Overview - Cambodia

| Indicator | Value | Description | Source |
|---|---|---|---|
| 10. Biodiversity Importance (rank) | 63 | 10. Biodiversity importance (rank) | |
| 11. Media Scrutiny (score) | 3.55 | 11. Media Scrutiny (score) | |
| 11. Media Scrutiny (rank) | 28 | 11. Media Scrutiny (rank) | |
| 12. Conflict (score) | 3.01 | 12. Conflict (score) | |
| 12. Conflict (rank) | 49 | 12. Conflict (rank) | |
| 1.0 - Aridity (score) | 1.00 | 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) | 130 | 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) | 1.39 | 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) | 109 | 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) | 1.13 | 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) | 139 | 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) | 3.69 | 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) | 48 | 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) | 1.08 | 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) | 156 | 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) | 2.94 | 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) | 76 | 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) | 2.91 | 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) | 170 | This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios. | Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development. |
| 2.1 - Estimated Flood Occurrence (score) | 4.05 | 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) | 27 | 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) | 2.62 | 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) | 70 | 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) | 2.32 | 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).<br><br>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) | 136 | 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).<br><br>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) | 2.57 | 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) | 90 | 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) | 4.17 | 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.<br>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. |

| Indicator | Value | Description | Source |
|---|---|---|---|
| 4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (rank) | 12 | 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.<br>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) | 2.00 | 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) | 129 | 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) | 2.00 | This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. | UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation. |
| 5.1 - Freshwater Policy Status (SDG 6.5.1) (rank) | 124 | This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. | UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation. |
| 5.2 - Freshwater Law Status (SDG 6.5.1) (score) | 2.00 | 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.<br><br>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) | 118 | 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.<br><br>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.<br><br>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) | 141 | 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.<br><br>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) | 4.00 | 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) | 48 | 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) | 5.00 | 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) | 22 | 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) | 3.00 | 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) | 68 | This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "Business Participation in Water Resources Development, Management and Use" indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category. | UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation. |
| 7.1 - Management Instruments for Water Management (SDG 6.5.1) (score) | 2.00 | This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "Sustainable and efficient water use management" indicator, which corresponds to one of the five national level indicators under the Management Instruments category.<br><br>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) | 130 | 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.<br><br>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) | 4.00 | 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) | 21 | 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) | 2.06 | 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) | 169 | 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) | 4.00 | 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) | 27 | 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) | 5.00 | 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. |

| Indicator | Value | Description | Source |
|---|---|---|---|
| 8.2 - Access to Sanitation (rank) | 22 | 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) | 3.00 | 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) | 91 | 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) | 2.00 | 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.<br>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) | 100 | 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.<br>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) | 2.60 | 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 - Cambodia

| Indicator | Value | Description | Source |
|---|---|---|---|
| 10.1 - Freshwater Endemism (rank) | 154 | 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) | 5.00 | 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) | 4 | 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) | 31 | 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) | 3.00 | 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) | 36 | 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) |

Water Risk Filter

## Country Overview - Cambodia

| Indicator | Value | Description | Source |
|---|---|---|---|
| 12.1 - Conflict News Events (RepRisk) (score) | 4.00 | This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class. | RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk. |
| 12.1 - Conflict News Events (RepRisk) (rank) | 21 | 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) | 2.01 | 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) | 128 | 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 (#) | 15762370 | Population, total | The World Bank 2018, Data , hompage accessed 20/04/2018 |
| GDP (current US$) | 20016747754 | GDP (current US$) | The World Bank 2018, Data , hompage accessed 20/04/2018 |
| EPI 2018 score (0-100) | 43.23 | Environmental Performance Index | |
| WGI -Voice and Accountability (0-100) | 52.38 | Water Governance Indicator | Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132 |

Water Risk Filter

## Country Overview - Cambodia

| Indicator | Value | Description | Source |
|---|---|---|---|
| WGI -Political stability no violence (0-100) | 17.73 | 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) | 24.52 | 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) | 34.13 | 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) | 12.50 | 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) | 8.17 | 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) | 0.44 | 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) | 139 | 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) | 120 | 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) | 120 | 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) | 120 | 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 - Cambodia

| Indicator | Value | Description | Source |
| --- | --- | --- | --- |
| Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk) | 130 | 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) | 131 | 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) | 128 | 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) | 135 | 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) | 136 | 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) | 133 | 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 - Cambodia

| Indicator | Value | Description | Source |
|---|---|---|---|
| Total water footprint of national consumption (m3/a/cap) | 1077.93 | 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 (%) | 5.71 | 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) | 353.60 | 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) | 353.60 | 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 (%) | 89.71 | 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) | 60.54 | World Development Indicators | The World Bank 2018, Data , hompage accessed 20/04/2018 |
| Total internal renewable water resources (IRWR) (10^9 m3/year) | 120.60 | 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) | 355.50 | 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) | 120.60 | 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

## Country Overview - Cambodia

| Indicator | Value | Description | Source |
|---|---|---|---|
| Total renewable water resources (10^9 m3/year) | 476.10 | Aquastat - Water Ressources | FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13 |
| Dependency ratio (%) | 74.67 | 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) | 30562.00 | Aquastat - Water Ressources | FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13 |
| World happiness [0-8] | 4.43 | WorldHappinessReport.org | World Happiness Report, homepage accessed 20/04/2018 |

# Country Aspects

## 1. PHYSICAL ASPECTS

### 1.1. WATER RESOURCES

#### 1.1.1. WATER RESOURCES

Cambodia has considerable water resource potential, with abundant surface water and aquifers and a high level of seasonal rainfall. However, this potential has not yet been developed for agriculture, industrial or household use. In spite of the abundance of water sources, many areas in the central plains and plateaus lack water in the dry season and are therefore dependent on unreliable rainfall patterns. Many rivers, streams, lakes, and their tributaries provide tremendous water resources for development. These water sources are divided into three systems: the Mekong River System; the Tonle Sap River System; and the river system flowing into the Gulf of Thailand. About 86% of Cambodia's territory (156,000km2) is included in the Mekong river basin, the remaining 14% draining directly towards the Gulf of Thailand.

The Mekong river and Lake Tonle Sap are connected by the Tonle Sap river, which twice a year reverses its direction of flow. From July to October, when the level of the Mekong is high, water flows into the Tonle Sap river, which fills Lake Tonle Sap, thereby increasing the size of the lake from 2,600km2 to about 10,500km2 at its maximum. The storage capacity of Lake Tonle Sap is estimated at 72km3. In November, when the level of the Mekong decreases, the Tonle Sap river reverses its flow, and water flows from Lake Tonle Sap to the Mekong river and thence to the Mekong Delta.

The average annual discharge of the Mekong entering Cambodia is estimated to be close to the discharge at Paksé (324.45km3/year) in Lao PDR, some 120 km upstream from the border with Cambodia. Other inflows to the Mekong-Tonle Sap system from outside the country amount to 29.9km3 from Viet Nam and 1.2km3 from Thailand. On average, 471.4km3/year flows out of the country in the Mekong channels and tributaries to Viet Nam.

The internal renewable surface water resource is estimated to be at 115.9km3. This figure does not include the unknown discharge of small rivers to the Gulf of Thailand and is thus probably an underestimate. Groundwater resources are estimated at 17.6km3, most of which is drained by the rivers and cannot be considered as additional water resources. The total renewable water resources of Cambodia are therefore estimated at 476.110km3/year.

#### 1.1.2. WATER USE

In 2006, total water withdrawal was about 2.184 km3, of which 2.053 km3 (94%) for agriculture, 0.98 km3 (4.5%) for municipalities and 0.33 km3 (1.5%) for industries. Most manufacturing and warehouses in Phnom Penh are located along the embankment of the Tonle Sap river north or the Bassac river south of the city, with mixed commercial and residential areas. Such locations allow direct access to river transport and high consumption of water. The industrial sector's water requirements are based upon the size of the factory.

Most provinces include significant areas where groundwater is used as the main source of domestic water supply. As of 2001, withdrawal of groundwater for domestic and drinking water supply was approximately 2 147 m3/day (WEPA, 2010). Groundwater is being exploited at ever-increasing rates, particularly by shallow tubewells for community and household water supply, as well as for irrigation. Besides the use of groundwater resources for domestic consumption and livestock watering, it is also being used widely in the industrial sector. Data and information relevant to the use of groundwater and its quality is not available.

The capacity of the existing dams is very low and has not been estimated. Only one small dam (Ochum, in the northeastern province of Ratanakiri) is used as a hydropower station, with an installed capacity of 1MW. The Kirirom power plant, which was installed in 1968 in Kompong Speu province with a capacity of 10MW, has not been in operation since 1970 due to war damage. A number of dams with high storage capacity are planned for the near future.

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

The quality of groundwater is generally satisfactory, although high iron concentrations and increased salinity levels have been encountered in some provinces (Svay Rieng, Prey Veng and Takeo).

Cambodia's major environmental problems are: illegal logging activities throughout the country and strip mining for gems in the western region along the border with Thailand, which have resulted in habitat loss and declining biodiversity (in particular, destruction of mangrove swamps, which threatens natural fisheries); soil erosion; a lack of access to potable water in rural areas; declining fish stocks as a result of illegal fishing and overfishing.

In the recent past, sedimentation of Lake Tonle Sap has given cause for concern. This concern is mainly due to the Mekong silt load, and to deforestation in the upper reaches of the Tonle Sap watershed. In the absence of reliable data on hydrology and sediments in this area, many scenarios have been developed. The most pessimistic forecast a drying-up of the lake within ten years, while other studies estimate that the lake would take 600 years to dry up. All these estimates reveal a need for reliable hydrological data. What is agreed by all concerned is the negative effect of sedimentation on the environment, particularly on fish.

The total proportion of the population with access to water supply was estimated at 19% in 1992. At that time, it was estimated that only 7,000 wells had been constructed (by international organizations) out of the 30,000 needed. Precise comprehensive data on the provision of environmental sanitation are not available. Access to sanitation is limited to an estimated 1.24 million people (13% of the population): about 53%of the urban population (mostly in Phnom Penh)

and 6% of the rural population.
A 1995 survey assessed the quality of water supply, wastewater and sanitation in the main towns of Cambodia. Most of the systems combined sewage and drainage water, and had not been maintained over the previous two decades. As a result, they were in a poor condition and not functioning properly. Drainage water often mixes with drinking water, with obvious health implications; floods are frequent during the rainy season as the sewers clog rapidly. Two of the most common water-related diseases linked to the development of irrigation are malaria and schistosomiasis.

# 2. GOVERNANCE ASPECTS

## 2.1. WATER INSTITUTIONS

Based on the Law on Environmental Protection and Natural Resources Management (1996), the Ministry of Environment plays an important role of facilitating 12 other ministries related to management of water environment and both freshwater and marine water in accordance with the Royal Government Policy in Poverty Alleviation. The following ministries and the Cambodia National Mekong Committee (CNMC) are directly involved in the water resource management of the country:
-the Ministry of Water Resources and Meteorology (MoWRAM)
-the Ministry of Public Works and Transport (MPWT)
-the Ministry of Agriculture, Forestry and Fisheries (MAFF)
-the Ministry of Industry, Mines and Energy (MIME)

## 2.2. WATER MANAGEMENT

A guiding normative document in the field of water management is the Law On Water Resources Management of the Kingdom of Cambodia (2007).
MoWRAM's SDP-WS defines five over-arching goals. The goal for water resources management and development is for Cambodia's water resources to be "managed and developed in an effective, equitable and sustainable manner. This achieves the greatest possible benefit for the people while conserving aquatic ecosystems."
Within this area of work, the priority goals are to ensure that:
-a National Irrigation and Drainage Strategy is in place, supported by river-basin plans in selected key basins and developed in collaboration with MAFF, MRD and MoE, to guide medium and long-term development of the sector;
-farmers of both irrigable cropland and predominantly rain-fed cropland are better able to manage water, over an area that is increasing by at least 100km2/year, and 'hardware' (infrastructure such as regulators and canals) and 'software' (improved management systems such as Farmer Water User Communities) are being developed in a fully complementary way;
-an integrated approach to water resources management and development is in use that considers all possible sources of water, linkages between water and other components of the basin environment, and varying human and ecological demands for water resources.

## 2.3. WATER POLICY AND LEGAL FRAMEWORK

Laws and policies related to water resources management in Cambodia are many and varied. They include (CDRI, 2008) the:
-New Constitution of the Kingdom of Cambodia 1993, Articles 58 and 59 (Jennar, 1995);
-Royal Decree on the Creation and Designation of Protected Areas (1993), which designated 23 areas covering about 3.3 million ha, equal to 18 percent of the total land area, including the Tonle Sap Great Lake. The objectives of the Royal Decree state that the management process can closely parallel those recommended in the United Nations List of National Parks and Protected Areas. This Royal Decree determined that the Ministry of Environment is responsible for the supervision of the development planning and management of a Natural Protected Area System in cooperation with the protection of the terrestrial, wetland and coastal environments;
-Law on Environmental Protection and Natural Resources Management, 1996;
-Royal Decree on Watershed Management, 1999;
-Circular No. 01 (11 January 1999) on the Implementation Policy of Sustainable Irrigation Systems;
-Subdecree on Watershed Management by MAFF, 2000;
-Sustainability of Operation and Maintenance of Irrigation System Policy, 2000;
-National Water Sector Profile, 2001;
-Natural Water Resource Policy, 2004; and the
-Law on Water Resources Management, 2007, with four subdecrees identified: river basin management, water allocation and licensing, water quality, and farmer water user community.

# 3. GEOPOLITICAL ASPECTS

Cambodia is part of the Mekong River Commission with Lao PDR, Thailand and Viet Nam. The four countries signed the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin (1995) and agreed on joint management of their shared water resources and development of the economic potential of the river. In 1996, China and Myanmar became Dialogue Partners of the MRC, and the countries now work together within a cooperation framework. The MRC supports the Mekong Programme, a Regional Cooperation Programme for the Sustainable Development of Water and Related Resources in the Mekong Basin, owned by its member countries.
The four goals of the organisation for 2006-2010 are:
-to promote and support coordinated, sustainable and pro-poor development;
-to enhance effective regional cooperation;
-to strengthen basin-wide environmental monitoring and impact assessment;
-to strengthen the Integrated Water Resources Management capacity and knowledge base of the MRC bodies, National Mekong Committees, Line Agencies and other stakeholders.

# 4. SOURCES

http://www.fao.org/nr/water/espim/country/cambodia/index.stm
http://www.fao.org/nr/water/aquastat/countries_regions/cambodia/index.stm
http://www.fao.org/nr/water/aquastat/countries_regions/cambodia/index.stm
http://www.eoearth.org/article/Water_profile_of_Cambodia
http://www.wepa-db.net/policies/state/cambodia/overview1_4.htm