

SECTOR ASSESSMENT (SUMMARY): AGRICULTURE AND NATURAL RESOURCES¹

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. Nepal is a Himalayan landlocked country bordered by the Tibetan Autonomous Region of the People's Republic of China in the north, and India in the east, south, and west. The country's elevation ranges from 70 meters (m) in the south to more than 8,800 m in the north. Nepal's climate has four seasons² along with a monsoon season that occurs during the summer and early autumn. About 80% of the annual precipitation falls during the monsoon with an annual distribution of rainfall ranging from about 150 millimeters (mm) to over 5,000 mm. Although temporally imbalanced, Nepal is naturally rich in water resources with about 225 billion cubic meters (cm³) (or average flow of 7,125 cm³/second) flowing annually through its 6,000 or more rivers.³ This water availability is distributed across three categories of rivers based on their origins: (i) the majority of water (78%) is from rivers originating from glaciers and snow-fed lakes, which form Nepal's four main river systems: Gandaki, Karnali, Koshi, and Mahakali; (ii) about 9% of the water flows in rivers originating from the Mahabharat, including Babai, Bagmati, Kamala, Kankai, Mechi, and West Rapti; and (iii) the remaining 13% flows in the streams and rivulets that originate from the Chure and Siwaliks hills. Only about 15 billion cm³ of the total is diverted: about 95.9% is used for agriculture, 3.8% for domestic purposes, and 0.3% for industry. In addition to surface water, around 8.8 billion cm³ is abstracted annually in the shallow and deep groundwater aquifers for irrigation and domestic water supply. The estimated hydropower potential of Nepal is 83,000 megawatts (MW), of which 114 projects with 45,610 MW have been identified as being economically feasible. Currently Nepal has a total installed hydroelectricity generation capacity of about 632 MW.

2. As Nepal lacks the necessary infrastructure to store water, much water is lost through high flows during the monsoon season.⁴ The four main river basins have average summer flows about 10 times higher than during winter, leading to acute shortages and the need for efficient and equitable sharing in the dry season. Limited infrastructure to abstract water from rivers and aquifers results in an economic water shortage. Furthermore, the erratic monsoon climate and mountainous topography makes Nepal vulnerable to water-induced disasters, which result in loss of lives and livelihoods, and damaged infrastructure. The situation will be exacerbated by climate change, with an expected increase in rainfall intensity during the monsoon, and possible lengthening of the dry season. In addition, projected increases in temperature are likely to augment the frequency and intensity of glacial outburst floods. Agriculture, the largest consumptive user of water in Nepal, employs about 74% of the country's workforce.

3. Located in central Nepal, the Bagmati River Basin (BRB) has an aerial extent of about 3,750 square kilometers (km²) and flows from the Shivapuri Nagarjun National Park with an elevation of 2,730 m to the Nepal-India border at Gaur. The BRB transects three distinct altitudinal physiographic zones (Mountain, Siwalik, and Terai) of the Nepal Himalayas and can

¹ This summary is based on the outputs of Asian Development Bank. 2010. *Technical Assistance to Nepal for Preparation of the Agricultural Development Strategy*. Manila (TA 7762-NEP). It covers four areas: (i) agriculture and rural sector development; (ii) water-based natural resource management; (iii) land-based natural resource management; and (iv) irrigation, drainage, and flood control. It is also based on ADB. 2012. *Technical Assistance to Nepal for Preparing the Bagmati River Basin Improvement Project*. Manila (TA 8050-NEP) (available on request).

² Spring: March–May; summer: June–August; autumn: September–November; and winter: December–February.

³ This corresponds to an annual per capita amount of 7,300 m³/second.

⁴ Current storage capacity in Nepal is estimated at 3.1 m³/capita considering only large dams.

be divided into three main areas: (i) the upper basin, which includes Kathmandu Valley the source of the Bagmati River; (ii) the middle basin, which includes the Mahabharat and Siwalik ranges; and (iii) the lower basin, which includes part of the Terai. The topography of the upper and middle basins is rugged with steep and high elevation terrain.

4. The BRB is considered the most water-stressed basin in Nepal. Water resources are declining due to natural and anthropogenic causes, and significant increases in freshwater demand to meet the expanding population and industry sector, and demand for irrigated agriculture. In addition, the rapid and unplanned expansion of Kathmandu City is placing tremendous pressure on water resources of the upper Bagmati River. In the absence of appropriate solid waste and wastewater management, the river has become the main waste collector drain: it now contains high fecal contamination, pathogenic bacteria, and bacteriological and physicochemical pollutants. The absence of pollution control measures has created serious health hazards for local residents, livestock, and aquatic flora and fauna. The river's physical deterioration has led to a loss of cultural and recreational amenities for local communities, which no longer respect or cherish the river environment. Rapid urbanization is increasing demands on water supply distribution in the valley. During dry season, about 80% of the upper Bagmati River flow is diverted for domestic use, leaving very little for irrigation and other sectors including the environment. Currently only 10% of surface water is used, as water during the rainy season is untapped due to the lack of seasonal storage facilities. As a result, municipal authorities, individuals, and companies continue to extract groundwater at an unsustainable rate. Groundwater extraction is estimated to be 4–5 times higher than the natural recharge and the water table has retreated by 35 m since 1993. The situation is aggravated by (i) the conversion of the recharge areas into residential areas, (ii) the lowering river stream and sand mining leading to riverbed deepening, and (iii) upstream catchment degradation. In Kathmandu Valley, the river is biologically dead, comprising heavily polluted sewage water that potentially endangers the health of downstream water users. Throughout the basin, frequent floods and riverbank erosion are the main threats to infrastructure, agricultural land, and people's lives and their livelihoods.

5. In the upper BRB, the government has begun implementing interventions identified in the Bagmati Action Plan (2009–2014),⁵ and is seeking to address water scarcity and improve wastewater management in Kathmandu Valley through several large Asian Development Bank (ADB)-financed projects.⁶ However, while these projects will address the immediate human needs, the problems affecting river environment degradation and long-term sustainable development in the BRB are complex and require additional attention. Opportunities to address these gaps were identified and developed under ADB technical assistance, which strategically assessed interventions from a river basin perspective and prepared a river basin profile, strategic investment road map for integrated water resources management (IWRM), and the Bagmati River Environment Management Program.⁷ The program analyzed the existing and future conditions of Kathmandu Valley, including planned water supply and wastewater treatment investments to identify additional interventions needed to address the people's critical priority: restoring the environment in the upper Bagmati River and achieving bathing standards at

⁵ Government of Nepal and National Trust for Nature Conservation. 2009. *Bagmati Action Plan (2009–2014)*. Kathmandu.

⁶ ADB. 2011. *Technical Assistance to Nepal for Preparing the Kathmandu Valley Urban Environment Improvement Project*. Manila (TA 7936-NEP), later renamed the Kathmandu Valley Wastewater Management Project; ADB. 2008. *Melamchi Water Supply Project*. Manila (Loan 1820 and Loan 8235); ADB. Year. *Kathmandu Valley Water Supply Augmentation through Public–Private Partnerships*. Manila (Loan 1820-NEP); ADB. 2012. *Country Operations Business Plan: Nepal, 2013–2015*. Manila.

⁷ Program was indicated in the volume 3 of the Final Report of TA 7547-REG. ADB. 2010. *Technical Assistance for Supporting Investments in Water Security in River Basins, Manila (TA 7547-REG)*.

Gokarna and Pashnupatinath. Interventions identified include (i) physical restoration of the riparian environment, (ii) increasing water availability in the river during the dry season to raise the river's assimilative capacity, and (iii) strategic placement of wastewater treatment facilities with higher treated-effluent standards.⁸ Based on stakeholder priorities, assistance for IWRM is generally for (i) improving river basin governance, (ii) improving the river environment in Kathmandu Valley, and (iii) reducing the impact of water-induced disasters throughout the basin.

6. Given the nature of the required improvements, particularly for the governance, allocation, and management of river basin resources, the public sector will need to lead the investment in IWRM. However the private sector can have an important role by providing water supply, sanitation, and irrigation services. For example, farmers using irrigated agriculture are undertaking successful large-scale groundwater development in the Terai. Most surface irrigation schemes in the country were initially farmer-managed but later improved through government programs. The major constraints to increasing and accelerating investment in water resource infrastructure include (i) a shortage of financial resources, (ii) limited technical capacity of government agencies to provide the staff and expertise to design and implement water resource improvement projects and support their operation after completion, and (iii) low technical and organizational expertise among water users (farmers, public water supply, and sanitation companies) in terms of water management.

7. Nepal experiences severe shortages of drinking water, increasingly polluted rivers, insufficient available water for irrigation of agricultural areas, and water-induced disasters occurring on a frequent and devastating basis. Furthermore, frequent and extended power cuts result from the lack of installed power generation and water storage facilities. Water is Nepal's primary resource; the country will not experience significant economic growth or poverty reduction without improvements in its management. The key to such improvements is, to a large extent, improved management and utilization of water resources for productive purposes and disaster prevention. Furthermore, properly targeted and carefully designed investments in improved water management can have significant positive impacts on gender equity and social inclusiveness. Such investments can mitigate or prevent negative impacts of environmental degradation and climate change manifested through increased flooding and increased occurrence and severity of drought.

2. Government's Sector Strategy

8. The 2002 Water Resources Strategy⁹ and the 2005 National Water Plan (NWP)¹⁰ recognize the need for comprehensive management and development of water resources relying on IWRM principles. The Water and Energy Commission Secretariat (WECS) is the apex body for water resources planning and management. The NWP provides a sound framework to put IWRM into operation through key actions, including (i) preparing an integrated water resources policy, (ii) amending the 1993 Water Resources Act to include the introduction of water use allocation and entitlement systems, (iii) restructuring and strengthening the WECS including the provision of powers to approve projects, (iv) establishing river basin organizations, (v) preparing basin plans, and (vi) strengthening water resources information and decision support systems. However, it has not been effectively implemented because of (i) limited political awareness and commitment, (ii) insufficient incentives or clear mandate for concerned line agencies to

⁸ Financed and developed under the Kathmandu Valley Urban Environment Improvement. ADB. 2011. *Technical Assistance to Nepal for Preparing the Kathmandu Valley Urban Environment Improvement Project*. Manila (TA 7936-NEP), later renamed the Kathmandu Valley Wastewater Management Project.

⁹ Government of Nepal. 2002. *Water Resources Strategy*. Kathmandu.

¹⁰ Government of Nepal. 2005. *National Water Plan*. Kathmandu.

implement specified actions, (iii) ambitious targets without priorities, and (iv) inadequate knowledge base to support decision making.

9. While the Water Resources Strategy, the NWP, and other recent policy documents recognize IWRM as a guiding principle for water resources planning and management, the legal and institutional framework has not been harmonized to operationalize IWRM. The Water Resources Act takes a sector approach and does not specifically consider IWRM. Other draft acts, such as the High Powered Committee for Integrated Development of Bagmati Civilization Act and the updated Water Resource Act, have not been ratified due to the absence of a sitting Parliament. Any effort to operationalize IWRM without a strong enabling environment, including legal framework and institutional structure, will fail. However, the government is considering approval of a water policy based on the principles of IWRM.

10. The Bagmati Action Plan (2009–2014) sets a vision of “a clean, green and healthy river system that is full of life and valued by all,” and provides an overall vision for restoration and conservation of the Bagmati River system with defined goals, objectives, and activities for each zone.⁴ While the High Powered Committee for Integrated Development of Bagmati Civilization is the key coordination and leading agency to implement and monitor the plan, progress is limited. Civil society organizations have demonstrated strong support for the river basin improvement initiatives, but are disorganized; past interventions have failed to mobilize this important resource. Any river basin management intervention will not succeed without stakeholder participation involving the government, civil society, and the private sector.

3. ADB Sector Experience and Assistance Program

11. ADB, the main development partner in the sector, has experience with subsectors such as hydropower, irrigation, flood management, water supply, and wastewater management with an emphasis on physical infrastructure and capacity building. Since 1994, ADB has supported five irrigation investment projects and components in two other projects focusing on rehabilitation and expansion of medium-sized and small irrigation schemes, and management transfer to and empowerment of water user associations. The \$13.8 million Water Resources Project Preparatory Facility⁵ will finance detailed design of irrigation projects to be considered for subsequent ADB financing, and thereby enhance project readiness at loan signing. This will also streamline implementation and sector planning.

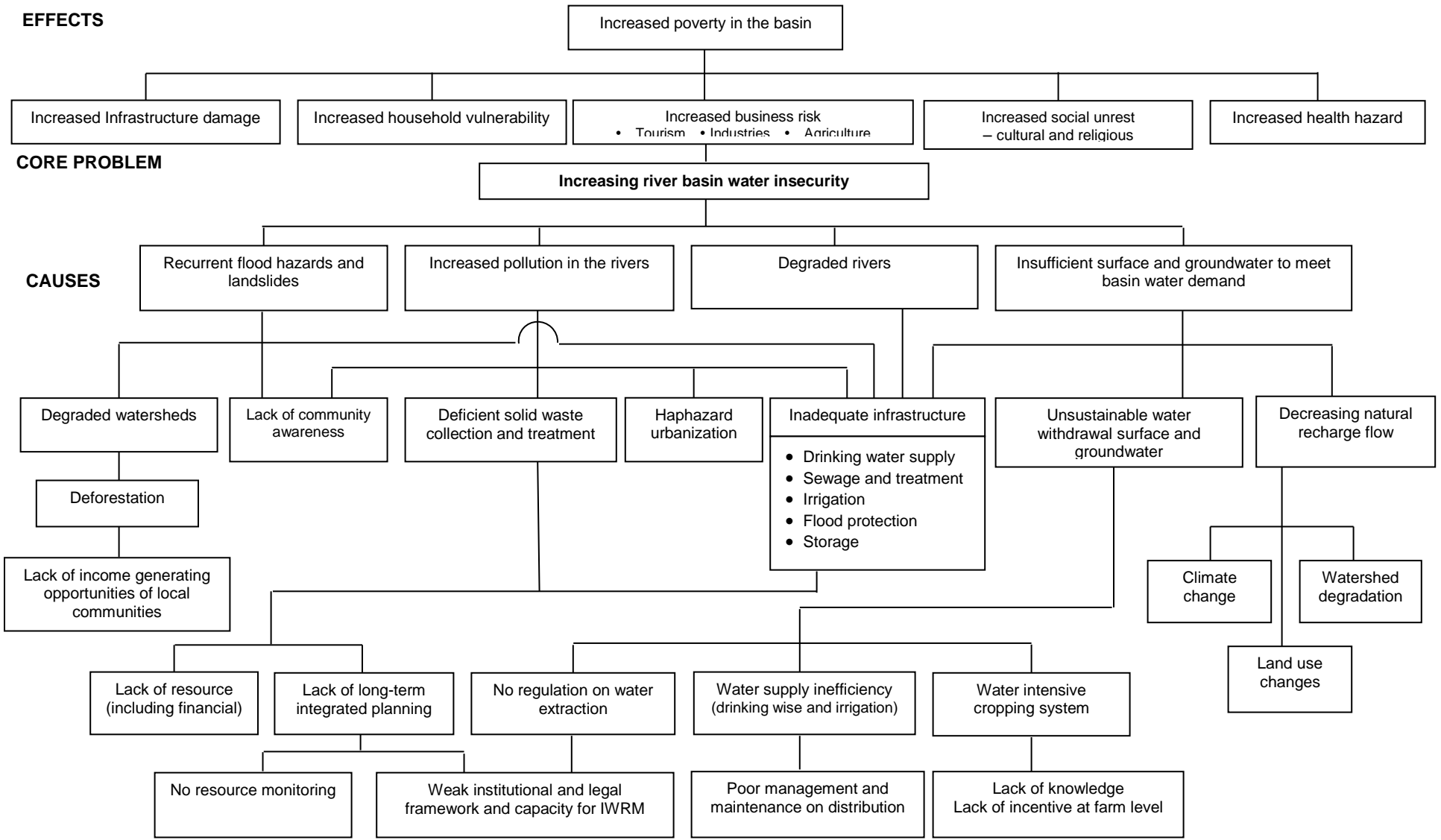
12. In the 2013–2015 pipeline, ADB’s strategic direction focus is water system development and conservation, surface and groundwater irrigation, irrigation system management, flood-risk management, and IWRM through (i) the Building Climate Resilience of Watersheds in Mountain Eco-Regions Project⁶ to identify and construct suitable water storage infrastructure, and develop upstream and downstream arrangements for payment for ecological services; and (ii) the Bagmati River Basin Improvement Project, phases 1 and 2 (2013 and 2015) to support the establishment of national and basin water management systems. Lessons strongly recommend considering IWRM as a process rather than a finite intervention. Projects trying to address all basin issues on their own have often proven too complex to implement and hence the Bagmati River Basin Improvement Project will focus on implementing stakeholder selected priority interventions.

⁴ Government of Nepal. 2009. *Bagmati Action Plan, 2009–2014*. Kathmandu.

⁵ ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to Nepal for the Water Resources Project Preparatory Facility*. Manila (G0299-NEP).

⁶ ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Administration of Grants to Nepal for Building Climate Resilience of Watersheds in Mountain Eco-Regions*. Manila.

Problem Tree for Water Resources



Sector Results Framework (Agriculture and Natural Resources, 2013–2017)

9

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Sector Outcomes with ADB Contribution	Indicators with Targets and Baselines	Sector Outputs with ADB Contribution	Indicators with Incremental Targets	Planned and Ongoing ADB Interventions	Main Outputs Expected from ADB Interventions
Agricultural production, productivity, and food security are increased.	<p>Agricultural GDP per capita increased Baseline (2012): NRs9,866 Target (2016): NRs12,660</p> <p>Cropping intensity: Baseline (2012): 198% Target (2016): 226%</p> <p>Area used for commercial crops increased Baseline (2012): 822,664 ha Target (2016): 929,610 ha</p> <p>High-value-crop production increased Baseline (2012): 5.6% per annum Target (2016): 6.5%</p> <p>Proportion of population generally food secure increased Baseline (2009): 60% Target (2016): 65%</p> <p>Export of agricultural products increased Baseline (2011): NRs14.54 billion Target: Baseline + 16%</p>	<p>Year-round irrigated area increased</p> <p>Rural connectivity increased</p> <p>Agricultural production diversified and commercialized</p> <p>Resilience to impacts of climate change and disaster risks increased</p> <p>Efficient and inclusive extension services expanded</p>	<p>Area with year-round irrigation increased Baseline (2012): 1.3 m ha Target (2016): 1.5 m ha</p> <p>All-season rural road network expanded Baseline (2012): 10,200 km Target (2016): 14,000 km</p> <p>Proportion of households within 30 minute walk of nearest market increased Baseline (2011): 45% Target (2016): 55%</p> <p>Climate screening and proofing tools, and environmental assessment applied Baseline: noncompliant Target: compliant</p> <p>Representation and participation of women in executives of farmer groups, cooperatives, and water user associations increased Baseline (2012): not available Target (2016): 33%</p>	<p>Planned areas Irrigation, drainage, and flood protection (irrigation system management, flood protection) Water-based natural resource management (water system development and conservation) Agriculture and rural sector development (rural infrastructure)</p> <p>Pipeline projects with estimated amount Bagmati River Basin Improvement Project (\$30 million) Building Climate Resilience of Watersheds in Mountain Eco-regions Project (\$23.5 million) Community-Managed Irrigated Agriculture Sector, Additional Financing (\$30 million) Second Bagmati River Improvement Project (\$30 million)</p> <p>Ongoing projects with approved amount Community-Managed Irrigated Agriculture Sector Project (\$20 million) Commercial Agriculture Development Project (\$18 million) Rural Reconstruction and Rehabilitation Sector Development Project (\$50 million) Community Irrigation Project (\$26.4 million) Raising Income of Small and Medium Farmers Project (\$20.1 million) High Mountain Agribusiness and Livelihood Improvement Project (\$20 million) Decentralized Rural Infrastructure and Livelihood, Additional Financing (\$25 million) Water Resources Project Preparatory Facility Project (\$11 million)</p>	<p>Planned areas Irrigation systems improved Development of hill agriculture accelerated through improved efficiency of irrigation systems Rural and remote areas connected with market and service centers</p> <p>Pipeline projects River riparian environment improved, water availability increased, and water-induced disasters reduced through integrated water resources management in the Bagmati River Basin Water-induced disasters reduced, and loss of life, crops, and property decreased Access by rural residents to markets, social services, and income opportunities increased Availability and reliability of water for mountain communities enhanced in western development regions</p> <p>Ongoing projects 111 irrigation schemes constructed and/or rehabilitated 840 km of rural roads and 366 rural water supply schemes constructed and/or rehabilitated 290 trail bridges constructed About 13,000 ha of land irrigated High-value crops worth \$20 million produced per year 7,500 jobs created About 7,500 ha of high-value crops (64,500 tons worth \$44.5 million with gross margin of \$9.5 million) 200 km new and 60 km upgraded rural roads constructed</p>

ADB = Asian Development Bank, GDP = gross domestic product, ha = hectare, km = kilometer, NRs = Nepalese rupees.
Source: Asian Development Bank.