

## SIGNATURE PAGE

**Project Title:** *Energy Efficiency and Renewable Energy for Sustainable Water Management in Turkmenistan*

**UNDAF Outcome(s)/Indicator(s):**

Outcome 2.2 – Environmentally sustainable use of natural resources contributes to effectiveness of economic processes and increased quality of life

**CPAP Outcome(s)/Indicator(s):**

**Output 3.2.1 – National authorities better plan, manage, and monitor the environment sector**

Indicator 2. Number of laws revised to align national legislation with international standards

Indicator 3. Number of sectoral plans/strategies revised to integrate respective environmental priorities and concerns, and incorporate strategic adaptation measures

Indicator 5. Number of municipalities apply improved waste disposal and better water/sanitation management

**Output 3.2.2 – Local communities contribute to and benefit from sustainable use of natural resources**

Indicator 3. Number of laws and policies revised and aligned internationally for better water governance

Indicator 4. Number of pilot areas practice integrated water resource management

**Output 3.2.3 – Government introduces carbon reduction and energy saving technologies.**

Indicator 1. Comprehensive policy framework is in place regulating long-term measures for sustainable use of energy resources and promotion of alternatives/renewables

Indicator 5. Number of pilot projects are in place promoting alternative and renewable sources of energy

**Country:** Turkmenistan

Programme Period:	<u>2015-2021</u>
Atlas Award ID:	<u>00080840</u>
Project ID:	<u>00090400</u>
PIMS #	<u>4947</u>
Start date:	<u>Aug 1, 2015</u>
End Date	<u>July 31, 2021</u>
Management Arrangements	<u>NIM</u>
PAC Meeting Date	<u>13 June 2015</u>

Total resources required:	<u>US\$ 78,285,000</u>
Total allocated resources:	<u>US\$ 78,285,000</u>
Regular UNDP (TRAC)	<u>US\$ 100,000</u>
Other:	
GEF	<u>US\$ 6,185,000</u>
Other Cash	<u>US\$ 72,000,000</u>

**Executing Entity/Implementing Partner:** United Nations Development Programme

**Implementing entity/Responsible Partner:** Ministry of Water Economy of Turkmenistan

**Agreed by Ministry of Water Economy**

NAME

SIGNATURE

Date/Month/Year

**Agreed by UNDP:**

NAME

SIGNATURE

Date/Month/Year





**United Nations Development Programme**

**Country: Turkmenistan**

**PROJECT DOCUMENT**

**Project Title:** *Energy Efficiency and Renewable Energy for Sustainable Water Management in Turkmenistan*

**UNDAF Outcome(s):**

Outcome 2.2 – Environmentally sustainable use of natural resources contributes to effectiveness of economic processes and increased quality of life

**UNDP Strategic Plan Outcome:** 1. Growth and development are inclusive and sustainable

**Expected CPAP Output(s):**

Output 3.2.1 – National authorities better plan, manage, and monitor the environment sector;

Output 3.2.2 – Local communities contribute to and benefit from sustainable use of natural resources;

Output 3.2.3 – Government introduces carbon reduction and energy saving technologies.

**Executing Entity / Implementing Partner:** Ministry of Water Economy of Turkmenistan

**Implementing Entity/Responsible Partners:** UNDP

**Brief Description**

Water management is a defining aspect of the economy and environment in the hot, arid conditions of Turkmenistan. Irrigated agriculture accounts for 90 percent of total water consumption, supplied by aging, energy-intensive infrastructure. About 50 percent of water is lost between withdrawal and ultimate delivery. Water management also plays a direct role as both a cause and a potential remedy for extensive and often severe problems of land degradation in Turkmenistan. Through technology transfer, investment, and policy reform, this project will seek to promote an integrated approach to water management that is energy and water efficient, reduces root causes of land degradation, and enhances local livelihoods and public service delivery.

Programme Period:	<u>2015-2021</u>
Atlas Award ID:	<u>00080840</u>
Project ID:	<u>00090400</u>
PIMS #	<u>4947</u>
Start date:	<u>Sep 1, 2015</u>
End Date	<u>Aug 31, 2021</u>
Management Arrangements	NIM
PAC Meeting Date	<u>tba</u>

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**Agreed by Ministry of Water Economy of Turkmenistan:**

NAME	SIGNATURE	Date/Month/Year
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**Agreed by UNDP:**

NAME	SIGNATURE	Date/Month/Year
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## LIST OF ABBREVIATIONS

<b>CACILM</b>	Central Asian Countries Initiative for Land Management (completed UNDP/GEF/GTZ project)
<b>CCM</b>	Climate change mitigation
<b>CO<sub>2</sub>eq</b>	CO <sub>2</sub> equivalent
<b>CPAP</b>	Country Programme Action Plan (for UNDP in Turkmenistan)
<b>DISO</b>	District irrigation system operator
<b>DPMA</b>	District production management agency
<b>EE</b>	Energy efficiency
<b>EU</b>	European Union
<b>EUWI EECCA</b>	European Union Water Initiative in Eastern Europe, the Caucasus and Central Asia
<b>FA</b>	(GEF) Focal Area
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>GDP</b>	Gross domestic product
<b>GEF</b>	Global Environment Facility
<b>GHG</b>	Greenhouse gas
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit
<b>GTZ</b>	Deutsche Gesellschaft für Technische Zusammenarbeit
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IRH</b>	UNDP Istanbul Regional Hub for Europe and the CIS
<b>IWRM</b>	Integrated Water Resource Management
<b>LD</b>	Land degradation
<b>M&amp;E</b>	Monitoring and evaluation
<b>MoA</b>	Ministry of Agriculture of Turkmenistan
<b>MoE</b>	Ministry of Economy of Turkmenistan
<b>MWE</b>	Ministry of Water Economy of Turkmenistan
<b>NAP</b>	National Adaptation Plan
<b>NCCS</b>	National Climate Change Strategy of Turkmenistan
<b>NIM</b>	National Implementation Modality
<b>NLEDP</b>	National Low Emission Development Plan
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>PB</b>	Project Board
<b>PIR</b>	Project Implementation Review
<b>PMU</b>	Project Management Unit
<b>PPG</b>	Project Preparation Grant
<b>PSC</b>	Project Steering Committee
<b>QPR</b>	Quarterly Progress Report
<b>RTA</b>	Regional Technical Advisor
<b>SIWMD</b>	State Institute of Water Management Design
<b>SLM</b>	Sustainable land management
<b>STAP</b>	Scientific and Technical Advisory Panel of GEF
<b>TNA</b>	Technology Needs Assessment
<b>WB</b>	World Bank
<b>UNDAF</b>	United Nations Development Assistance Framework
<b>UNDP</b>	United Nations Development Programme
<b>UNDP CO</b>	UNDP Country Office (Ashgabat, Turkmenistan)
<b>UNECE</b>	United Nations Economic Commission for Europe
<b>UNEP</b>	United Nations Environment Programme
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change

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## 1. SITUATION ANALYSIS

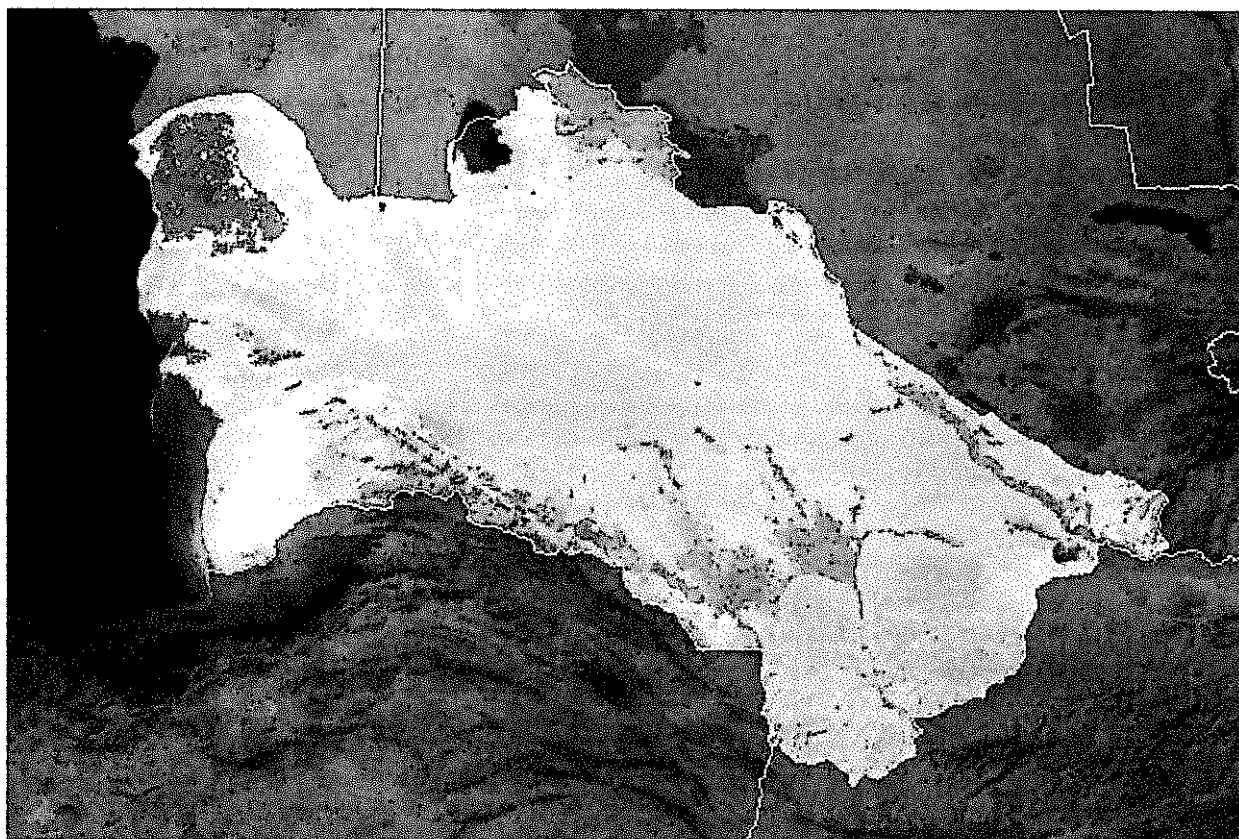
### 1.1. Water management in Turkmenistan

#### *Geographic context*

A nation of approximately 5 million citizens, Turkmenistan is located in southwestern Central Asia, between the Caspian Sea and the Amu-Darya River. Turkmenistan is bordered by Kazakhstan to the north, Uzbekistan to the northeast and east, Afghanistan to the southwest, and Iran to the south. The Karakum Desert makes up about 80 percent of Turkmenistan's 491,000 square kilometers of territory.

The climate across most of Turkmenistan is extremely hot and dry. Northern desert regions receive only about 80 mm of precipitation per year. Rainfall levels increase to the south, with the highest annual amounts up to about 380 mm in the mountains along Turkmenistan's southern border. In the desert, semiarid grasslands, and settled areas where almost all the country's population lives, precipitation occurs mostly in winter, with little or no rainfall in summer. Low rainfall and high winds across most of Turkmenistan leaves the soil, deposited long ago by ancient rivers, subject to wind erosion.

Figure 1.1. Satellite map of Turkmenistan<sup>1</sup>



From cities to remote desert, across the nation's entire territory, water management plays a defining role in all aspects of life in Turkmenistan. Water management encompasses a wide range of natural and human-managed features, including rivers, other water sources, dams, 15 reservoirs, irrigation networks, interdistrict and interfarm canals, drainage collectors, and a far-flung complex of built structures for diverting and pumping water.

Water resources of Turkmenistan come mostly from four transboundary rivers – the Amu-Darya, the Murghab, the Tejen, and the Atrek – with volumes based on shares negotiated with other countries

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<sup>1</sup> Derived from satellite imagery from NASA. Licensed under public domain via Wikimedia Commons.  
[http://commons.wikimedia.org/wiki/File:Turkmenistan\\_satellite\\_photo.jpg#mediaviewer/File:Turkmenistan\\_satellite\\_photo.jpg](http://commons.wikimedia.org/wiki/File:Turkmenistan_satellite_photo.jpg#mediaviewer/File:Turkmenistan_satellite_photo.jpg)

through which these waterways pass. The Amu-Darya, which is Central Asia's longest river, provides about 88 percent of Turkmenistan's water for human use. Water is distributed throughout Turkmenistan via networks of canals, extending over 42,500 km, as well as a collector-drainage network over 35,000 km. The longest among these is the Karakum Canal (known also in the country as the Karakum River), which extends over more than 1300 km across almost all of Turkmenistan's length and nearly reaching the Caspian Sea.

Withdrawal volumes from transboundary rivers are negotiated within the Interstate Commission for Water Coordination, which includes Turkmenistan, Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan. Under current agreements, total diversion volume at medium and high water levels from the Amu-Darya and other sources is about 27 billion m<sup>3</sup> per year, while in dry years, the volume is significantly reduced. In recent decades, available water resources in Turkmenistan have been fully utilized. There are no surpluses.

***Irrigated agriculture is by far the dominant consumer of water in Turkmenistan, accounting for about 90 percent of total water consumption (See Text Box 1), or about 24 billion m<sup>3</sup> per year.*** In addition, though its quantitative share is relatively low, direct water consumption for industrial and household use is also a very high priority for the Government. Managed waters are also used for watering livestock and pasture irrigation, fisheries, energy and transport, recreation, greening of urban areas, environmental needs, and other uses. The drainage network, whose main function is to remove water and facilitate the reclamation and arability of irrigated land, also provides water for watering desert pastures. Mains and spillways, as well as lakes formed on the basis of drainage water, provide habitat for aquatic and semiaquatic birds.

**Text Box 1: Agricultural Sector in Turkmenistan**

Turkmenistan's agricultural sector represents 19 percent of the country's GDP; the country also has a high share of rural population (58 percent) and agricultural labour (48 percent of the total labour force). Moreover, as Turkmenistan, like other Central Asian economies, has been unable to generate sufficient jobs outside of agriculture, rural population and agricultural employment have increased. Agricultural land accounts for more than 80 percent of Turkmenistan's total territory. However, Turkmenistan is an arid country and most of its agricultural land is desert pasture with very little cultivable land. Its agriculture is highly dependent on irrigation. In fact, Turkmenistan is the only Central Asian country where the irrigated area in 2007 to 2008 was substantially above the 1990 level. Unlike other CIS countries, Turkmenistan has almost no large agricultural enterprises engaged in primary production. The large structures of the Soviet period were transformed into peasant associations consisting of individual leaseholders. Peasant associations are subjected to state orders, however: they are obliged to sell their output and buy their inputs through state channels. This is particularly true for crop production (predominantly cotton and wheat), which is heavily controlled by the state, while the livestock sector operates on a more private basis.

Source: Turkmenistan: Agricultural Sector Review, FAO Investment Centre, February 2012

Fresh groundwater, where available, is a preferred source of drinking water. Groundwater originates in the nation's mountain ranges – the Kopet-Dag, Great Balkan, and Koytendag – as well as foothill plains, river valleys, and along the routes of major irrigation canals due to channel losses. There are more than 100 active groundwater springs in Turkmenistan. But groundwater of high quality is scarce and unevenly distributed. In a number of districts in the Balkan and the Akhal velayats,<sup>2</sup> there is an acute shortage of drinking water. In Dashoguz along the lower reaches of the Amu-Darya, there is shortage of drinking water due not only to low quantity, but also low quality.

Further development of water-consuming economic activity, including expansion of irrigated lands and fulfillment of municipal supply needs, will be possible only via increasing efficiency, improving water resource management, recycling wastewater, using unconventional water sources, and introducing new

<sup>2</sup> There are five velayats, or administrative regions, in Turkmenistan – Akhal, Balkan, Dashoguz, Lebap, and Mary.



irrigation technology. Therefore, all these areas are a high priority of the Government of Turkmenistan, and specifically the Ministry of Water Economy (MWE).

The significance of these priorities is magnified by expected effects of climate change. By 2040, it is forecasted that air temperature will rise in all of Turkmenistan by 2°C. The rate of change will accelerate after 2040. Calculations predict an increase from 2-3 °C up to 6-7 °C by the year 2100. By 2020, an insignificant increase is expected in precipitation, then a steep decline. The rate of decline of precipitation will become more noticeable after 2040, and by 2100, the quantity will be reduced by 8 to 17 percent. According to forecasts of the Hydrometeorologic Center of Uzbekistan, the flow of the Amu-Darya will be reduced by 10 to 15 percent by 2050. The flow of the smaller rivers of Turkmenistan – the Murghab, Tejen, and Atrek – will be reduced by 5-8 percent by 2030.

### ***Administrative framework of water management in Turkmenistan***

Management of water resources of Turkmenistan is implemented in three administrative tiers. The Ministry of Water Economy of Turkmenistan (MWE) oversees water management across the country. The Ministry of Nature Protection (MNP) is responsible for implementing state policy in protection and rational use of natural resources, also at the national level. Both Ministries operate under the general authority granted to them by the Constitution and the national Water Codex and Land Codex, as overseen by the President and the Cabinet of Ministers.

Water management in Turkmenistan is centrally planned and implemented by the Government via MWE, largely in isolation from market dynamics. MWE owns essentially all water management infrastructure from canals to pumps, from the source all the way to the farmer or other end user. The state budget is the source for all investment funds for new and upgraded infrastructure. Water is supplied within approved limits free of charge to both agricultural and residential consumers as a benefit contributing to overall social welfare. There are therefore essentially no financial incentives for end users to conserve water within their approved quotas.

At the second tier of the hierarchy, both MWE and MNP have five regional agencies to carry out their work, one in each velayat. Within MWE, each regional agency in turn oversees a third level of water management consisting of local district water management agencies. These third-tier agencies include district irrigation system operators (DISOs) or district production management agencies (DPMAs), and generally operate within the boundaries of administrative districts known in Turkmen as etraps. In all, MWE oversees 119 affiliated organizations and enterprises at the various levels nationwide.

Because there are no water surpluses in Turkmenistan, MWE must strictly define allocations of water to regions, districts, and end-users. Water use for agriculture is planned and organized by district water management agencies in consultation with consumers. DISOs develop water use plans, develop schedules and allotments for water delivery in accordance with irrigation standards and technologies, and establish limits for irrigation water, which are formalized in contracts with end-users. Actual management of water use at the farm level is carried out by farmers, with assistance from specialists of the district irrigation system managers. There are no agencies for internally-governed local associations of water users in Turkmenistan.

The current water management system of Turkmenistan serves its essential purpose of supplying water to end users. But Turkmen officials and scientists note deficiencies. Distribution of water is inequitable over the hydrographic network, with shortages at the ends of canals in water-stressed years. Both within watersheds and in parts of the system that interconnect among various sources, disagreements emerge about management solutions for lack of a sufficiently clear and rational legal framework. Deficiencies in the legal and policy framework also lead to gaps among various levels of government agencies and resource management water users. Greater clarification and integration are needed.

### ***Irrigated agriculture in Turkmenistan***

Agricultural lands account for 40.2 million hectares, or more than 80 percent of Turkmenistan's total land surface area. The vast majority of agricultural land in Turkmenistan (about 38 million hectares) is semiarid desert grassland for free-ranging livestock, mostly sheep and camels. Agriculture is the nation's largest employer, providing livelihood for hundreds of thousands of citizens – about 49 percent of the workforce.

About 2.0 million hectares of Turkmenistan's lands are arable and fully irrigated. Four types of crops are subject to special Government production quotas and sales support – wheat (55 percent of total sowed area), cotton (35 percent), sugar beets (1 percent) and rice (also 1 percent). Melons, grapes and other fruits, as well as vegetables and other crops, account for the remaining portions. Approximately 15 million more acres are considered suitable for cultivation but are currently not used for agriculture for lack of sufficient irrigation infrastructure and water supply.

Most elements of irrigation infrastructure in Turkmenistan – intake facilities, pumps, canals, reservoirs, and so on – were put in place during the Soviet era starting about 60 years ago. The system remains mostly based on unlined open channels for both interdistrict and intrafarm distribution. Much on-farm irrigation is gravity-driven. There has been some recent progress in research and development of new irrigation technology in Turkmenistan, led by the Ministry of Water Economy and the State Institute for Water Management Design (SIWMD). But still, **SIWMD estimates that nearly 50 percent of irrigation water – approximately 12 billion cubic meters per year – is lost between withdrawal and ultimate delivery to the farmers.**

While water for agriculture within contracted limits is delivered free of charge, overuse beyond contracted allotments does trigger high charges. Official annual limits for irrigation vary by soil type. For medium and heavy-loam soils, norms are 6700 m<sup>3</sup>/ha for cotton; 4500 m<sup>3</sup>/ha for winter wheat; and 29,000 m<sup>3</sup>/ha for rice.

Technical servicing of intrafarm irrigation is carried out by DISOs by contract, with payment deducted from renters or land users at the district level. Agreements for various broader facilities and services to multiple end-users, including cleaning of irrigation and drainage systems, repair of technical structures and pumps, etc. are commonly negotiated between farmer unions and DISOs or their subunits.

## **1.2. Energy consumption for water management**

Moving billions of cubic meters of water over thousands of kilometers requires vast inputs of energy. Turkmenistan's networks of canals and drainage collectors, as well as its wells, are served by approximately 3500 pumping stations with a total installed electric power capacity in excess of 250 MW.<sup>3</sup> Most of this powered infrastructure dates back to the Soviet era and has not been replaced. Due to its sheer size, but also inefficiencies resulting from age, insufficient maintenance, and other factors **water management is the second largest power-consuming sector in Turkmenistan, accounting for about 25 percent of total power consumption.**

In addition, in remote areas not connected to the electric grid, especially in the Dashoguz velayat, diesel fuel is used to run approximately 1179 pumps. This equipment varies widely in water-pumping capacity and energy consumption rates, with most consuming about 14 liters of diesel fuel per hour of operation. Based on a conservative estimate of 700 hours of operation per year per pump, the project team estimates that diesel-powered water pumps in Turkmenistan collectively consume about 15 million liters of fuel per year.

Consequently, irrigation and water supply is responsible for a large and growing share of national GHG emissions. **Approximately 6.9 MtCO<sub>2</sub>/year,<sup>4</sup> or 27 percent of all energy-related CO<sub>2</sub> emissions and 11 percent of all GHG emissions (in CO<sub>2</sub> equivalent)<sup>5</sup> come from energy use in water management.**

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<sup>3</sup> Inventory data from the Ministry of Water Economy for both electric and diesel-powered pumps are presented in full in Annex 6, Tables A.6.5 and A.6.6.

<sup>4</sup> Estimated based on IEA data on electricity consumption. Sources: CO<sub>2</sub> emissions from fossil fuel combustion. IEA 2012; IEA. Energy Balances for Non-OECD Countries 2012.

<sup>5</sup> 2<sup>nd</sup> National Communication to UNFCCC.

There are three major ways to raise energy efficiency, reduce energy consumption, and curtail associated GHG emissions from the water management sector. The first is to reduce water losses and consumption, thereby reducing pumping volumes and pumping energy consumption throughout the system. The second is to increase the efficiency of pumps and other energy-using infrastructure. The third is to replace pumps and other infrastructure with more efficient or renewable technology. The proposed UNDP/GEF project will pursue all three of these paths.

### **1.3. Land degradation: Problems and potential solutions from water management**

Serious land degradation problems have emerged in Turkmenistan over the past several decades as a result of agricultural and water management practices. The most serious of these problems is related to soil salinization.

#### ***Salinization***

Soil salinization results from the application of water to soil. In the absence of sufficient drainage, evaporation from the soil surface leaves salts behind. This problem is most common in arid lands, such as those in almost all of Turkmenistan, which do not receive enough rainfall to flush away the salts. Soil salinization is made worse by high groundwater levels, which results in water staying at the surface instead of percolating down away from the evaporative influences of solar radiation and wind.

Table 1.3.1 shows the extent of the problem of salinized land in Turkmenistan. Nearly 70 percent of Turkmenistan's irrigated lands are at least moderately salinized, and 11 percent are severely salinized. In Dashoguz province, which comprises the northern desert portions of the country, 90 percent of irrigated land is moderately to heavily salinized. Nationwide, salinization has caused declines in crop yields by some 25 per cent.<sup>6</sup> Salinization is also prevalent around open unlined canals and drainage collection bodies, where water infiltrates into surrounding soil and then evaporates, leaving salts behind.

**Table 1.3.1<sup>7</sup>**  
Salinization of irrigated land of Turkmenistan  
(thousands of hectares)

<b>Velayat (region)</b>	<b>Irrigated land area</b>	<b>Not salinized</b>	<b>Weakly salinized</b>	<b>Moderately salinized</b>	<b>Severely salinized</b>
Akhal	513,757	9,342	101,648	332,992	69,775
Balkan	82,273	480	7,698	70,643	3,452
Mary	437,457	42,799	179,590	160,958	541
Lebap	282,250	17,803	130,504	123,798	10,145
Dashoguz	407,167	-	47,632	297,489	62,046
All of Turkmenistan	1,722,904	70,424	467,072	985,880	199,528

Solutions to salinization lie in two main areas. The first is avoidance of waterlogging and surface evaporation. In croplands, this means judicious application of water only where and when plants can take it up immediately, without extra water left to evaporate from the top layer of soil. Around canals, waterlogging can be remedied by canal linings, which keep water in the canal and out of surrounding

<sup>6</sup> UNECE. Environmental Performance Review for Turkmenistan, 2012.

<sup>7</sup> Turkmenistan: Environmental Performance Review. UNECE 2012

soils.

A second area for remedying salinization, including reclamation of already salinized land, is to apply large quantities of water to fields outside the growing season, thus leaching away deposited salts. This practice requires not only available water, but also sufficient drainage of fields, because without it, leachates remain in place, groundwater levels rise, and the conditions for salinization persist or worsen. In fact, the most important barrier to desalinization of land in Turkmenistan over the past two decades has not been water availability, but rather deficient drainage infrastructure. The normative requirement in Turkmenistan is 40 linear meters of drainage channels per hectare of irrigated land, but the actual average is only around 20 meters per hectare.

Measurement of volumes of drainage water are generally not carried out among end users, but rather only by state water management agencies at the level of entire farmer associations, and further, according to escalating hierarchies of collector-drainage systems. Though even more drainage is needed in fields, the current overall volume of collector-drainage flows from Turkmenistan is already enormous, exceeding 7 cubic kilometers per year.

Leaching and drainage can resolve the problem in the fields, but then drainage waters, now with dissolved mineral content themselves, must be discharged somewhere else. If drainage enters groundwater basins, then over time the salinization problem can be shifted or expanded or exacerbated, and groundwater itself becomes less useful as a source for consumption.

Until recently, most drainage water in Turkmenistan has been directed from farms via channels to hundreds of unlined open drainage collectors in natural depressions in desert or rangelands, with some return of drainage water to the Amu-Darya only from the Lebap velayat. Most drainage collector bodies are rather small. Severe salinization of land around such collectors is widespread. Drainage collectors and canals also often require maintenance for weed suppression, including application of herbicides.

The centerpiece of Turkmenistan's long-term strategy with regard to drainage is the construction of the Altyn Asyr Lake (known in English as the Golden Age Lake, and also commonly as the Turkmen Lake) in the Karashor Depression in the northern part of the country. The stated objective is that the lake will provide a huge reservoir of water that will be recycled for irrigation after partial desalination treatment. The floor of the depression is about 25 meters below sea level. This new lake is to be truly vast. It will receive drainage waters from around the country, eventually filling to a maximum depth of 69 meters, covering more than 2000 square kilometers, and holding about 130 cubic kilometers of water.

Construction was begun in 2000. In 2008, a 385-km drainage outlet canal was completed from the Dashoguz velayat to the lake site, and waters began to accumulate in the lake. It is estimated that the lake will take at least 15 years to fill to capacity, at a projected expanded rate of about 10 cubic kilometers per year. Total projected costs are estimated at US \$4.5 to 6 billion.

Consolidation of drainage waters into one huge central site instead of countless scattered drainage collector ponds may have a major ameliorative effect on Turkmenistan's problem with degraded land. Because the collective surface area for both evaporation and infiltration will be reduced, drainage waters will accumulate instead of being lost. This means that significantly less land will be subject to eventual salinization. Less drainage water will seep into groundwater, thus better preserving groundwater quality and helping ensure that the water table will not rise. Ultimately, however, the lake is not a stand-alone solution to problems of salinization. Further integrated measures are needed to reduce water losses and increase efficiency throughout the water management network, both for supply and drainage, and not just at its end point.

#### **1.4. Non-energy GHG emissions from agriculture in Turkmenistan**

Agricultural activity in Turkmenistan contributes GHG emissions not only from energy use, but also from livestock, nitrogen-fertilized soils, and anaerobic decomposition in rice fields. Using national data and methodologies defined by the Intergovernmental Panel on Climate Change (IPCC), national specialists estimate that the agricultural sector of Turkmenistan accounted for about 8.7 MtCO<sub>2</sub>eq in 2011 or about 11 percent of the total national GHG emissions. This figure should be considered highly uncertain,

however, because of inconsistencies between local conditions in Turkmenistan and assumptions of the IPCC methodology.

Most of the country's non-energy GHG emissions are methane; agricultural emissions of methane constitute about a third of the country's overall methane emissions, with the balance coming from the energy industry. The predominant share of agricultural CH<sub>4</sub> originates from enteric fermentation in livestock (mostly cattle, but also sheep, camels, and others). Manure management, a major GHG contributor in developed countries, is relatively less significant in Turkmenistan because most livestock is free-ranging and manure is widely scattered under aerobic conditions for decomposition, minimizing methane production. The contribution of rice farming is very small but significant relative to the total amount of land devoted to this crop.

**Table 1.4.1**

Key sources and estimated quantities of annual non-energy GHG emissions  
from agriculture in Turkmenistan  
(2011)

Source	Type of GHG	Quantity of GHG emissions (tonnes)	Emissions in tonnes CO <sub>2</sub> equivalent
Livestock	CH <sub>4</sub>	333,350	7,000,000
Rice fields	CH <sub>4</sub>	900	20,000
Fertilized soils	N <sub>2</sub> O	5,200	1,600,000

### **1.5. Barriers**

The challenges of efficient water management and sustainable land use in Turkmenistan are fundamentally defined by the country's extreme climatic and geographic conditions, as well as the sheer scale and limitations of its vast but outdated infrastructure.

Various other institutional, informational, and other barriers further complicate these challenges.

- **Free water and energy largely eliminate consumer incentive for conservation.** Water and energy are provided without charge to farmers up to approved limits. Urban consumers also receive water and energy at highly subsidized tariff levels. Therefore consumers have essentially no financial motive to lower their water consumption. There is no market mechanism for end-users to recoup investment in water conservation. At present, direct incentives for farmers to conserve water lie only with the need to reduce and manage salinization.
- **Energy use is not taken actively into account in planning and implementation of water management.** Until very recently, Turkmenistan has devoted negligible attention to the vast potential for energy conservation in the water management sector. This inattention has arisen from both the conceptual newness of the linkage and Turkmenistan's wealth of fossil energy resources. Now Turkmenistan is placing strong priority on energy conservation and climate change mitigation in various sectors including water management, but still there remains a need for further clarifications of the linkage and emphasis of its importance among both technical specialists and decisionmakers. There is a specific need for clearer standards and procedures to ensure the efficient performance of pumps.
- **Limited availability and poor quality of data.** Measurement of energy consumption and water consumption among end users is essentially absent in Turkmenistan. Data on water losses in transit are available only at a highly generalized level. Without better data, it will remain very difficult to make fully informed technical, investment, and policy decisions on improving efficiency.

- **Policy and organizational gaps.** The existing water management system in Turkmenistan effectively serves its purpose of delivering water under very challenging conditions. But efficiency and water conservation are still relatively new priorities, not yet implemented on a wide scale in Turkmenistan. Policy and organizational reform is needed to create a fully integrated system of water management, in which the full technical potential for optimal water use can be realized.

Notably, with specific regard to conservation, neither the water management infrastructure nor the planning process is designed such that changes in the efficiency of upstream large-scale water management and downstream on-farm irrigation and drainage can readily be integrated with each other. There is therefore a prevalent need for policy reform for organizational integration, regular informational feedback, and alignment of incentives to support universally rational water use.

Turkmenistan has adopted both a Land Codex and a Water Codex, which provide a substantial legislative basis for needed reforms. The adoption of further regulations and sublegislative acts under both of these broad laws is needed for effective implementation.

- **Need for expanded and tailored technical knowledge.** The State Institute for Water Management Design has very strong experience and technical competency with water management, from large-scale infrastructure issues to on-farm irrigation. Several international agencies have delivered and continue to deliver valuable training and technical support. There remains a strong need, however, for expanded technical knowledge within SIWMD and especially among farmers.

Water management solutions almost always differ from site to site, depending on particularities of soil, topography, water sources, amounts to be managed, crop types, and local economic and administrative conditions. Therefore technology transfer is a special challenge in this sphere, requiring not only exposure to the technology but also an understanding of how best to apply it within local constraints. Such understanding is absent in most parts of Turkmenistan, requiring concerted training, research, testing, and evaluation in localities across the country.

- **Limitations of existing domestic production facilities for materials and technology for efficient water use and infrastructure.** MWE has established some manufacturing of equipment for efficient irrigation and canal linings (see Section 1.6 below), but there is a need for modernizing production lines and making the transition to new products.
- **Costs of environmental degradation are widely passed to others.** Salinization around canals, salinization around drainage collectors, and high groundwater tables fed by drainage are major problems. Most often, however, there is no stakeholder who directly suffers the costs of these problems and is motivated and empowered to remedy them. Technical solutions, education, policy mandates, and enforcement are all urgently needed to overcome this barrier.
- **Gaps in decision process for state investment in efficiency improvements.** The Government of Turkmenistan, under the leadership of President Gurbanguly Berdimuhamedow, has begun to make conservation and rational use of water and energy a national priority, as a means to support the fundamental goals of stable, secure water supply and sustainable, expanded agricultural production. These themes regularly appear in President Berdimuhamedow's public statements and in the mass media.

The articulation of these priorities in principle is a major first step. Now, the next steps for realization of these stated priorities require huge amounts of state investment in upgrading and integration of infrastructure. Already the Government has made an enormous commitment to the Altyn Asyr Lake. State budget commitments are also expected in support of lining canals, upgrading pumping stations and municipal supply, and development and deployment of low-water irrigation technology.

The challenge is deciding exactly where to allocate state investment in technology and infrastructure. Because efficiency and conservation have not been national priorities until recently, existing decision frameworks for state investment need to be expanded, with

assessment processes and criteria revised to account for new objectives and more complex technologies. Technical and financial justification will be needed for all proposed investments; in the near future, MWE and the Government need to gain experience in carrying such justifications out.

#### **1.6. Baseline activity of the Government and international organizations**

Recognizing the needs of the country, President Berdymuhamedow has set forth a far-reaching agenda for improvement of water supply and reclamation of irrigated lands, as well as creation of new irrigated land in the country. He has issued special decrees at sessions of the Cabinet of Ministers of Turkmenistan and has also given concrete instructions on urgent measures to be taken. The national program “Fundamental Directions of Economic, Political, and Cultural Development of Turkmenistan in the period up to 2020” calls for MWE to implement major programs for sustainable land use in agriculture, as well as rational use of water. Most notably with regard to water management, the National Program for the Social Development of Rural Areas addresses the improvement of fertility of cultivated land and the modernization of equipment and technology for agricultural irrigation. As shown in the co-financing letter appended to this document, the Government plans to commit more than \$403 million to upgrading and maintaining the efficiency of water management and large-scale irrigation systems in Turkmenistan for the period 2015-2020.

The Ministry of Water Economy is carrying out measures for the accumulation and distribution of water resources, rational use of water, construction of water management facilities, and assurance of their good working condition, correct operation, and timely maintenance and repair where needed. For development of water management infrastructure of the country, significant volumes of capital are allocated: from MWE’s own funds, funds of the state budget, the state hard-currency fund, the state fund for development of the oil and gas industry and mineral resources, and other sources. The Ministry has created a specialized department called “Damja” for the development and production of efficient irrigation technology. In the Rukhabat district of the Akhal velayat, a factory has been built for the production of drip irrigation equipment. MWE also operates factories for production of canal materials and pipes in the Akhal, Dashoguz, and Mary velayats.

Also by order of the President, the Academy of Sciences of Turkmenistan annually finances scientific projects for the modernization of existing systems of irrigation, use of innovative technology in production, and economical use of irrigation water. SIWMD is also widely involved with research and development projects, often with the participation of international agencies.

This political will and financial commitment are very important first steps, but there remains a strong need to develop new administrative processes, detailed technical and financial justifications, and regulatory frameworks to direct this political energy and money in an optimal manner.

Reforms since independence have also had profound impacts specifically on the agrarian sector, as reflected in national programs («Wheat», «The New Village», «10 Years of Prosperity» and so on), along with policy and investment support for the whole range of stakeholders in the sector – production units in the fields, processing enterprises, suppliers of material and technical resources, financial and banking institutions, and other organizations. Sustainable land use is a major national priority, as reflected in the following ongoing state-supported activities.

- Implementation of new forms of agriculture in cultivated areas, taking account of optimal water supply for fields and implementation of new means of irrigation of agricultural crops;
- Creation of the Altyn Asyr Lake, with associated creation and maintenance of new and existing collector-drainage networks
- Expanded crop rotation
- Renovation and planting of new shelterbelts and woodlands, as measures to conserve soil and moisture;

- Development and implementation of standards for use of fertilizer and other chemicals;
- Measures for conservation and qualitative improvement of land, with implementation of new technologies for afforestation of desert and revision of structures for cultivated areas of agriculture.

Thanks to reforms, special conditions are now provided such that specialized equipment may be purchased directly by agricultural producers. In all state banks in Ashgabat and in their branches in the regions and districts of the country, open credit lines are available for them.

Specialists in water resources are trained in higher and intermediate educational institutions (Turkmen Agricultural University and Niyazov University). The Ministry of Water Economy and SIWMD conduct local seminars several times annually for farmers on efficient use and management of water resources. MWE estimates that approximately 78 specialists and 36 farmers receive training on water management annually.

#### *National Climate Change Strategy*

Finally and not least, in 2012, the Government also adopted the National Climate Change Strategy (NCCS), which was developed with UNDP support. The NCCS is intended to give substance to Turkmenistan's commitments to both climate change mitigation and adaptation, while supporting the nation's continued economic growth through modernization, diversification, and strengthening global competitiveness.

The NCCS sets forth the following principles:

- Addressing climate change challenges should contribute to sustainable development of the country's economy.
- Promoting innovative technologies, transfer of technology, scientific and technological progress are the basis for advances in climate change mitigation and adaptation.
- Addressing climate change challenges shall be based on a comprehensive/integrated approach.
- Measures to reduce GHG emissions shall be coordinated with adaptation measures.
- The UNFCCC, the Kyoto Protocol, and associated decisions of the Conference of Parties reflect the common understanding of international community, including Turkmenistan.
- Combating climate change shall involve collective effort of all of Turkmen society.

UNDP is currently supporting the Government in developing national plans on climate-change mitigation and adaptation, which will become key tools to implement the strategy. The national implementation plan for climate-change mitigation, in turn, will directly feature the new UNDP/GEF project on energy efficiency and water management as a core element. The proposed new project has been designed specifically for consistency with the above principles, especially the first three. (See Section 1.7 below for further details on UNDP's strategic directions in the country.)

#### *Programs of international agencies*

##### ○ **UNDP/Adaptation Fund:** *Addressing Climate Change Risks to Farming Systems in Turkmenistan*

This project focuses on strengthening water management practices at the community level and developing integrated water management policies at the national level. It is being carried out in three different climatic areas: 1) the Karakum Desert (Bahardok); 2) the mountain villages of Nohur; and 3) an irrigated area of the Sakarchaga region. The project is supporting implementation of water harvesting and saving techniques, community-based well and watering point management measures, and improved local irrigation services.

The project also delivers training to farmers via their local cooperative associations, including a five-day seminar in April 2013 in conjunction with the National Institute for Desert, Flora, and Fauna. The project seeks institutional strengthening at the community level, by defining clear mandates and institutional functions for local water supply system operations and management. It also provides input into the preliminary development of national policies on measurement and tariffs for water consumption.



The UNDP/AF project does not specifically target energy management associated with water management, nor large-scale infrastructure. (Though part of the baseline of the proposed UNDP/GEF project, the UNDP/AF project is not included as a source of co-financing.)

- o **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ): *Transboundary Water Management in Central Asia***

This project, now in its third phase, has provided training for water management staff in all five Central Asian countries on river basin planning and management. It also facilitates dialogue among officials in the countries, as well as exchange of best practices within Central Asia and also including Europe. In conjunction with the UNECE (see item immediately below), the GIZ project participated in the development of a multilateral plan, to which all of the five countries have agreed, on improving water management in the Aral Sea basin, which includes the Amu-Darya. To support its work at the policy level, the GIZ project has conducted demonstration projects in all of the countries, including Turkmenistan, where efficient irrigation and reuse of drainage water have been piloted.

GIZ supports a long-term project active in all five countries of Central Asia on sustainable pasture management. Since its inception in 2002, this project has supported the development of locally-based pasture management solutions at two sites in Turkmenistan, one in the Kopet-Dag mountains and the central Karakum Desert.

- o **European Union Water Initiative in Eastern Europe, the Caucasus and Central Asia (EUWI EECCA)**

The EUWI EECCA project, jointly implemented by the Organisation for Economic Co-operation and Development (OECD) and the United Nations Economic Commission for Europe (UNECE), contributes to the implementation of the EUWI National Policy Dialogues on Integrated Water Resources Management (IWRM) and water supply and sanitation in ten EECCA countries, including Turkmenistan. Phase I (2008-2012) supported the achievement of the water-related Millennium Development Goals in the region and the improvement of water supply and sanitation services that are delivered to the population, as well as the management of water resources.

During phase II (2012-2015) the project is supporting participant countries in the following areas:

- Policy strategies and legislation based on IWRM and Water Framework Directive (WFD) principles.
- Intersectoral co-operation to improve water and health and implement the UNECE/WHO Protocol on Water and Health.
- National policies on transboundary waters in accordance with the UNECE Water Convention and other international environmental instruments.
- Economic instruments in water policies, and facilitate investment in water infrastructure and services.

Three priority areas of work for 2014-2015 are:

- Managing water for inclusive green growth;
- Water-energy-food-ecosystems security nexus;
- Transboundary water diplomacy.

Specifically in Turkmenistan, EUWI EECCA has provided assistance to MWE and other relevant ministries in analysis of national legislation on water, and in sharing best practices from Europe and Central Asia on IWRM in a seminar in 2011. Since then, EUWI EECCA in Turkmenistan has conducted seminars on transboundary water accidents and on water as it relates to health issues. Another seminar on water and health is planned for April 2015. EUWI EECCA has also conducted well-attended annual meetings of the Steering Committee of the National Policy Dialogues on water management, which have included presentations from experts from Europe and Central Asia.

As EUWI EECCA in Turkmenistan draws to a close, the proposed UNDP/GEF project is poised to build upon the momentum it has created, particularly with regard to policy development. See Component

4 of Section 2.2 for more details. At the same time, the new UNDP/GEF project will pursue new technical areas and heretofore unexplored linkages with energy and other issues.

- **UNEP/GEF: Global Technology Needs Assessment**

Turkmenistan is one of the countries targeted by UNEP for preparation of a Technology Needs Assessment (TNA) in accordance with the UNFCCC. UNEP work on the Technology Needs Assessment will include detailed market and barrier analysis for prioritized climate change mitigation technologies in the water sector. This new UNDP-GEF project, for its part, will build upon TNA findings by supporting the implementation of Technology Action Plans at the district level in all five velayats of Turkmenistan. Coordination will be ensured by UNDP CO in Turkmenistan and UNDP-GEF Regional Coordination Unit for Europe and CIS, on one side, and UNEP DTIE and the UNEP DTU Partnership, on the other side. See Section 2.2, Output 3.1 for more information.

- **The U.S. Agency for International Development (USAID)** runs various initiatives in Turkmenistan pertaining to water management, especially with regard to training and technology transfer. Most recently, in June 2014, USAID's Agriculture Technology Program and the State Agricultural University of Turkmenistan conducted a joint seminar on low-water irrigation with support from the Ministry of Foreign Affairs and the Ministry of Agriculture of Turkmenistan. Dr. Robert Richardson, an expert in irrigation technology, presented best practices in water conservation and discussed recommendations that take into account the geographic particularities of Turkmenistan.

- **UNDP/GEF/GTZ: Central Asian Countries Initiative for Land Management (CACILM): Multicountry Capacity-Building Project.**

This project ended in early 2013, and is therefore not a baseline activity as such, but is noted here. A transnational effort involving all five Central Asian countries, this project sought to build capacity and coordination at national and multilateral levels in support of sustainable land management in Central Asia. In Turkmenistan, the project facilitated the inclusion of SLM principles, projects, and activities into official national strategies and programs. It also supported training for more than 290 people on land-use planning and enhancement of agricultural productivity, including 14 who were trained to become trainers themselves.

This project experienced only limited success in Turkmenistan and throughout all five countries. Many of its problems arose from the administrative complexities of a regional project involving five countries. Such problems are not anticipated for the proposed new UNDP/GEF project, with its single-country focus. The CACILM project did yield some real results in building an enabling environment for SLM and providing useful information to stakeholders. The UNDP/GEF project is well positioned to build upon this previous progress, by introducing new technical SLM approaches specifically linked with water management, further developing region-specific SLM solutions throughout the country, and promoting investment and policy for widespread practical replication.

### **1.7. Strategic directions of the United Nations and UNDP in Turkmenistan**

The United Nations in Turkmenistan is developing a new five-year Development Assistance Framework (UNDAF), covering 2016 through 2020. Climate change mitigation and adaptation will constitute two of the five targeted outcomes of this framework, in accordance with the National Climate Change Strategy.

With specific regard to mitigation, one UNDAF outcome will be the implementation and monitoring of a **National Low Emission Development Plan (NLEDP)** to reduce GHG emissions, with strengthened legislation and regulations for energy efficiency and the use of renewables, in line with international standards. UNDP is currently assisting the Government of Turkmenistan in developing this plan. This proposed new UNDP/GEF project on energy efficiency in water management will be a core element in implementation of the NLEDP.

The UNDAF outcome involving climate-change adaptation calls for implementation of a **National Adaptation Plan (NAP)**, as well as the integration of disaster risk reduction and climate risk management practices in key sectoral policies and regulations. Again, UNDP is currently working closely with the

Government on development of the NAP. Water management is expected to be among the most important focus areas of this plan.

In addition, UNDP in Turkmenistan is working on its own Country Programme Document for 2016-2020. This plan has four focus areas:

- Energy efficiency, energy management, and implementation of the National Low Emission Development Plan
- Environmental protection and resource management, especially water management and implementation of the NAP
- Strengthening the rule of law
- Increasing accessibility, quality, and reporting of data, for more effective use in research and evidence-based policymaking

The proposed new UNDP/GEF project deals directly with all four of these core focus areas, with activities in energy conservation, water management, strengthening implementation of the Water Codex, and monitoring/measurement of water consumption, energy consumption, pump performance, drainage, and other key parameters for which data quality needs improvement.

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## 2. PROJECT STRATEGY

### 2.1. Project objectives and strategic approach

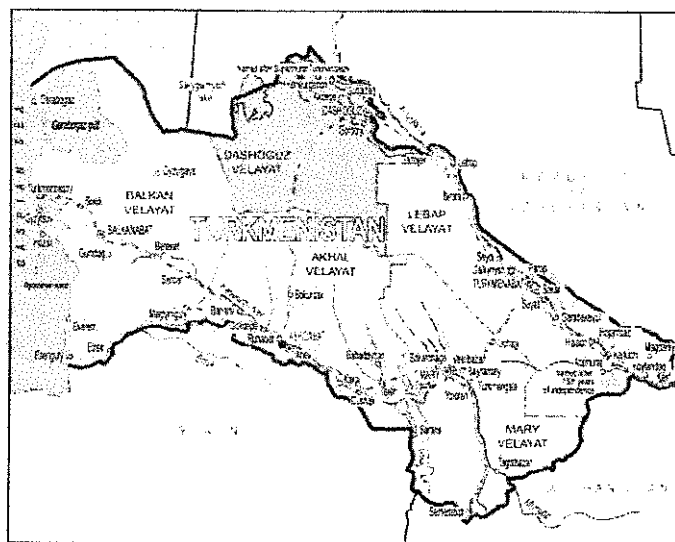
The objectives of this UNDP/GEF project are:

- Development objective: Provide for sufficient and environmentally sustainable water supply to support and enhance social conditions and economic livelihood of the population of Turkmenistan.
- Environmental objectives:
  - Reduce GHG emissions associated with water management
  - Prevent and remediate salinization of lands

#### *Project strategy*

As problems of water management, energy consumption, land degradation (salinization), and agricultural productivity are all closely intertwined in Turkmenistan, so too are potential solutions. The project will address these problems through integrated activities, with a goal toward achieving multiple benefits in different areas. Thus improved water management will lead not only to greater water availability, but also to significant energy savings, avoided GHG emissions, and reduced salinization. Application of new renewable-energy solutions in water management will lead not only to avoided GHG emissions, but also to greater water availability in remote populated areas. This integrated approach will be practically applied and technically proven first at specific sites in the Akhal velayat (Figure 2.1), then replicated across the country through region-specific planning and outreach, as well as supporting policies and investment at the national level.

Figure 2.1: Map of Turkmenistan and the Akhal Velayat



The project's activities are organized into four components.

- Component 1 will introduce ***new technologies in irrigated agriculture and pumping for energy efficiency, water conservation, and sustainable land management (SLM)***.
- Component 2 will scale-up investment in ***new and expanded efficient water-management infrastructure***.
- Component 3 will deliver ***local and region-specific planning and educational outreach*** for IWRM and SLM among farmers and water-sector designers and managers
- Component 4 develops and supports implementation of ***policy reform for IWRM***.

The first two components will constitute the technical foundation of the project. For agriculture and infrastructure, respectively, these components will identify, verify, and document the most promising ways to save water, increase energy efficiency, and reduce water-related root causes of land degradation in Turkmenistan. The components will generate technical and financial performance data and practical experience to be used to plan and provide necessary justification to scale-up public investment and technology deployment nationwide.

While the first two components define the technical opportunity and priorities for replication, the second two components will seek to carry actual replication out on a national scale. The third component supports replication from the bottom up via development of action plans at the regional and district levels across the country, as well as educational outreach and capacity-building among farmers and local water-management personnel. The fourth component will work from the top down, defining and implementing policies, programmes, and investment plans for integrated water management and SLM at the national level.

This project embodies the notions of integration and integrated water resource management (IWRM) in an unusually wide variety of senses. Its most narrow technical meaning applies in the project's vertical integration of end-use irrigation needs with upstream planning and management, as well as with drainage. The project also reflects integration in a more general sense pertaining to project design, with individual investment projects integrated with strategic approaches for scale-up, and local planning integrated with national policy and investment. Most fundamentally, the project integrates various environmental and social goals of critical importance to Turkmenistan – water availability, water conservation, reduction of land degradation, agricultural productivity, and energy efficiency – with each other, and with the broader goals of sustainable national economic development and protection of the global environment.

## **2.2. Project components: outcomes, baseline conditions, and incremental activities of the UNDP/GEF project**

The project's four components are elaborated in detail below. For each, we provide a summary of targeted outcomes, baseline conditions, and planned activities. This material is also summarized in the Project Results Framework in Section 3.

### **COMPONENT 1**

#### **Technology transfer and knowledge development in support of innovation in EE water management and SLM in agriculture**

The first project component is designed to achieve three targeted outcomes.

- **Enhancement of the national knowledge base and delivery of new technical information on appropriate technology** for irrigation, pumps, and solar-powered water pumping and purification to water management agency staff and farmers
- **New processes established and implemented for planning, deployment, and financial assessment** both before and after deployment of integrated water resource management, pump audits and maintenance, and solar-powered water pumping and purification
- **Direct energy savings, water savings, and reduction of land degradation** from the selected projects

#### ***Summary of baseline conditions for this component***

- The Government of Turkmenistan and various international partners continue to conduct research on best practices in water management, but there remains a need for further applied knowledge development and transfer of relevant international expertise in various areas.
- The Ministry of Water Economy and its affiliates operate and maintain pumps, but there is a strong unaddressed need for updated procedures and norms for pump auditing, maintenance, and replacement.
- Nearly 1200 diesel pumps continue to operate in the country, with some potential for replacement of these pumps with electric pumps, with associated emissions reductions.
- Land salinization is recognized as one of Turkmenistan's most pressing problems. At present, the main thrust of Government efforts to alleviate the problem is to expand drainage throughout the country and to consolidate drainage flows into the Altyn Asyr Lake. Billions of dollars of state budget support have been allocated for this purpose. This work on drainage is also supported by limited research and deployment of efficient irrigation systems, planning, and scheduling.
- Starting more than three decades ago, the "Sun" Institute of the Academy of Sciences of the Soviet Union (now of Turkmenistan) conducted research and testing on renewable energy installations in the desert. Regarding water management, this work especially involved water purification using the very simple but effective technology of solar stills, combined with efficient collection and storage. The "Sun" Institute also has extensive experience with photovoltaics and solar-powered and wind-powered pumps. But this work never led to significant deployment or replication beyond the research sites.
- Since then, according to national experts, photovoltaic technology throughout the world has fallen by at least 75 to 80 percent compared to levels prevailing at the time of peak activity of the "Sun" Institute's solar-energy facilities. At the same time, given the rapid expansion of livestock husbandry in Turkmenistan, there is increasing need for potable water for animals, as well as for human needs in Turkmenistan's desert pastures. In many areas of need, both water and electricity are unavailable.

### ***Incremental activities of the UNDP/GEF project***

The first project component will build upon baseline conditions via the following activities.

#### ***Output 1.1: Technology proving site and educational platform for low-water irrigation and SLM in agricultural croplands developed and implemented***

This project, conceived by MWE and SIWMD, will be carried out in the Akhal velayat. SIWMD will be the lead partner, in conjunction with local farm associations. The work will be carried out on a 170-hectare plot owned by SIWMD, and already confirmed as available for this purpose. Here, SIWMD and the project will deploy and evaluate various types of low-water irrigation, including drip, rotating sprinkler, portable sprinkler, and other irrigation. A portion of the site will also be devoted to simple improvements to furrow irrigation, using pipes to deliver water to sections of furrows, thereby reducing water losses and increasing uniformity of yields at very little cost.

It is expected that innovations at this site will dramatically reduce water losses, reduce energy consumption for pumps, increase yield per hectare, and also thereby reduce the labor, material, and energy needed per unit of crop yield. The new water management approaches will dramatically reduce salinization and practically eliminate the need for drainage.

This activity goes beyond previous efforts to demonstrate efficient irrigation in Turkmenistan in several respects. First, it would be the first major water-efficiency demonstration for agriculture in the Akhal velayat, which is the nation's largest in terms of population and most affected in terms of salinized land

area (see Table 1.3.1). Second, it would expand the scope of previous efforts by testing various types of irrigation technology at one site. Perhaps most significantly, this activity offers a new opportunity for full integration of supply, delivery, and end use of water, involving not just irrigation but also on-site pumps and distributional infrastructure such as channel linings or piping in place of open canals.

Moreover, because the land is owned by MWE, it will be conveniently open to education and study visits, unlike the handful of other irrigation efficiency projects in Turkmenistan, which involve privately-owned land. The relative proximity of the site to Ashgabat and to major institutes of research and learning – including SIWMD itself – is another advantage.

The demonstration will involve not only physical equipment, but also planning techniques and soil monitoring so that water would be delivered only where and when it is needed. Informational feedback from “smart” systems will allow for reduced pumping when irrigation needs are low, thus lowering consumption of both water and electricity.

The entire process of planning, budgeting, and interagency administration for technology implementation will be documented. Financial performance, water consumption, energy consumption, and other technical parameters will be monitored throughout at least two growing seasons. Reduction of land degradation and increased crop yields will also be documented and compared with analogous sites with traditional irrigation schemes. Based on collected evidence cost-benefit analysis of demonstrated technologies will be performed. Then the UNDP/GEF project team and national partners will compile and disseminate results as a written report, and as material for training seminars for water district officials, system designers, and farmers. (See Output 3.2.) Specific technical information and specifications for integrated system design will be compiled in addition to the written report and seminar material as needed.

*Output 1.2: Audits and servicing of pumps of various sizes in both interdistrict water networks and on farms in all velayats of Turkmenistan*

The UNDP/GEF project will carry out audits of at least 100 pumps, including at least 25 diesel pumps, across the whole range of sizes and levels within the water management system, from large water intake facilities to farms. These audits will assess pump efficiency and energy consumption, as well as operating schedule, overall operating condition, and will provide recommendations for repair or replacement as warranted.

This activity will include not only the audits, but also servicing and replacement of pumps where most needed. Remedial measures may include the following:

- adjustment of impellers
- repair or replacement of worn pumps
- changes in the operating schedules of pumps, especially where improved pump efficiency means that needed volumes of water are delivered in less time
- replacement for correct sizing
- replacement for increased motor efficiency
- replacement of diesel pumps with electric pumps where possible
- use of advanced irrigation methods with informational feedback, with or without variable-speed pumps, to deliver water only in needed amounts

A second audit will be conducted for each serviced pump or its replacement. The project will provide investment funding for the replacement of approximately 10 pumps of various sizes, with the intention not only of achieving direct energy savings of at least 25 percent, while also providing a basis for technical assessment and replication via state or private investment.

These audits, which go beyond existing routine monitoring and maintenance, will serve several purposes. They will identify opportunities for efficiency improvements. They will form the basis of a

quantitative baseline against which to compare pump performance after efficiency improvements from project activity. They will also create a procedural basis for a national program of pump auditing and maintenance. (See Output 4.1.)

*Output 1.3: Renewable-energy applications of water pumping and purification in remote pasture areas*

The project will carry out one small demonstration project to create high-quality water supply in a desert area via use of solar energy. This project will be located in the central Karakum Desert, near the village of Byori in the Darvazin district of the Akhal velayat on land owned by the “Sun” Institute. The village’s population of about 1100 people is employed mostly in the raising of sheep and camels. To water their livestock, the local population collects atmospheric condensation and transports water by car. Rainwater is also collected from rooftops, accumulating in special receptacles near each home. The prolonged storage of water leads to the deterioration of its hygienic quality, which over time negatively affects human health. There are difficulties in electric supply over the whole settlement, with operation of a diesel generator only three hours per day.

The “Sun” Institute of the Academy of Sciences of Turkmenistan, the NGO “Tebigy Kuwwat,” and local authorities in Byori and the Darvazin district will join UNDP in designing and managing the project. This project will integrate several local end uses for local shepherds: pumping from wells and sardobs (underground rainwater storage bodies), purification, and provision of electricity for up to a few small service buildings. It is expected that weakly mineralized water, unsuitable for use without purification, will be made available as a source. The total expected electric capacity of the installation is expected not to exceed 5 kW.

The design, physical installation, and operation of the demonstration project will be supplemented by hands-on training of local residents on the use and maintenance of the new technology. The installation will be modular and easily applied elsewhere within the locality. With modest modifications, the installation will also be suitable for use elsewhere in the country. Technical design and economic performance assessments will be documented and presented to interested ministries (including MWE, the Ministry of Agriculture, and the Ministry of Energy) as the possible basis for expanded state investment and installation.

## **COMPONENT 2**

### **Scaling-up investment in improved water management infrastructure to reduce water losses, energy use, and land degradation**

The second project component focuses on scaling-up investment in improved water management infrastructure. It is intended to achieve two related outcomes.

- Reduction of water losses and associated energy consumption via direct investment in a large-scale infrastructure project on municipal water supply
- Technical, environmental, and financial justification to scale-up investment in canal linings and/or other widespread infrastructure improvements to reduce water losses, associated energy consumption, and land degradation

### ***Summary of baseline conditions for this component***

The Government of Turkmenistan has committed significant budget resources to construction and maintenance of water management infrastructure, including for the project period of 2015-2021. Even so, however, the amount of state investment falls far short of what is needed to achieve the full technical potential to reduce water losses in the country.



Most canals in the country are unlined, including those that serve farms but also those that serve the municipal water supply system of the town of Kaakhka and other municipalities across the country. There is no immediate prospect for a major program to line canals.

MWE operates three factories that produce materials such as concrete pipes and plates. Modernization of products and production lines could lead to a dramatic increase in installation of canal linings and pipes nationwide, significantly reducing water losses, salinization, and other problems throughout the system. Such modernization in turn requires research and investment.

### ***Incremental activities of the UNDP/GEF project***

*Output 2.1: Installation of pipeline and/or channel linings for municipal water supply in Kaakhka, replacing unlined channels and wells, with documentation of results and presentation of recommendations and cost analysis for replication*

The town of Kaakhka (also sometimes transliterated as Kaka) is a district center in the Akhal velayat in the Kopet-Dag foothills in the southern portion of the country. The town has grown rapidly since independence to a present population of approximately 35,000, including adjacent villages.

The current consumption rate of municipal water in Kaakhka is approximately 14,000 m<sup>3</sup> per day, or about 165 liters per second. About 40 percent of Kaakhka's water supply comes from groundwater extracted from 41 wells with electric pumps that run around the clock 365 days per year. The remaining share of water is taken directly from the Layinsuv River via a separate canal approximately 20 km long. Infiltration losses through the canal's gravel bed are very high – approximately 50 percent, by MWE estimates. Therefore, while about 200 liters are withdrawn from the river per second, only about half is delivered to the purification facility, with the rest entering groundwater.

MWE proposes to replace this inefficient system with a pipeline directly from the river, thus nearly completely eliminating infiltration losses and replacing electric wells with the simplest form of renewable energy – a gravity-based system with water flowing downhill. Installation of the pipeline would obviate the need for continued operation of the wells for at least 10-15 years, by MWE forecasts, thus leading to huge electricity savings from avoided operation of pumps. Furthermore, MWE foresees that the concentrated kinetic energy from the water at the end of the pipeline could be converted to electricity via a small hydropower installation, which could power the pumping station that directs water from the purification facility to the municipal distribution network. (The change in elevation from the withdrawal point to the purification facility is about 400 meters.)

In addition to material costs for the pipeline, UNDP will also provide in-country and international technical assistance in overall design and evaluation. MWE would cover a share of the cost of installation, plus any and all expenses associated with the hydropower addition. (The project is expected to merit the investment even without hydropower.)

The UNDP/GEF project team and MWE recognize that investment of project funds in a municipal project needs to be carefully justified given that agriculture accounts for much more water use in Turkmenistan and indeed is the project's main focus. This investment/demonstration project in Kaakhka is attractive for several reasons.

- It addresses one of MWE's urgent priorities.
- It has a greater potential impact in terms of affected population per dollar spent, in comparison with agricultural projects.
- At the same time, the project is still relevant to agriculture because approximately 70 percent of Kaakhka's population works in this sector.

- It taps a very clear and well-understood technical opportunity for efficiency improvements in terms of both water and energy. Notably, by completely removing well pumps from operation, the project is expected to generate potentially much greater energy savings than possible with many agricultural projects. If hydropower proves feasible, then of course even more benefits in terms of avoided fossil energy use and GHG emissions will be possible.
- It embodies perhaps the simplest form of renewable energy (water flowing downhill), plus the potential for small-scale hydroelectric generation. Project linkages with hydroelectricity have been recommended as an area of potential interest during project review by the GEF Scientific and Technical Advisory Panel (STAP).
- The project lends itself well to quantitative evaluation of energy and water savings.
- It offers an opportunity for innovation completely without precedent in Turkmenistan.
- There are more than 30 other communities in the Kopet-Dag foothills, with a total population of nearly 150,000 people, which could replicate results from this project.
- Lessons learned from the pipeline could be applicable also to large-scale water management and agricultural applications nationwide.

Immediately upon project inception, project design and cost estimation for this investment project will be elaborated in detail. Construction is projected to begin by the start of the second project year, and should require no more than a few months after first sections are laid.

Throughout design and installation of the Kaakhka project, the project team will document technical decisions and procedural steps. Then after entry into operation, the team will prepare a full report on technical performance, environmental benefits, and overall financial results, with recommendations and lessons learned for replication at other similar sites in Turkmenistan. This report will be presented to MWE for distribution to decisionmakers dealing with municipal water supply across the country, including those responsible for the 30 sites that MWE cites as most promising for replication. The project team will support distribution of the report with at least one seminar presentation to interested parties.

*Output 2.2: Lining of interdistrict canals for reduction of water losses and land salinization, using various technologies*

The need to reduce water losses and associated land salinization from canal infiltration extends across the entire country, at all levels of the water management system, from long-distance distribution to farms. The cost and effort required to line 42,000 km of supply and drainage canals is truly vast.

The greatest potential for the project to generate rapid, cost-effective, large-scale results with canal linings lies on the domestic production side, where there are urgent untapped opportunities to update materials, increase output, and raise efficiency. MWE currently operates three factories – one each in the Akhal, Mary, and Dashoguz velayats. These facilities produce mostly reinforced concrete pipes and plates for canals. UNDP and the State Institute for Water Management Research have identified several areas in which production at these plants could be effectively expanded, redirected, or made more efficient and cost-effective.

- Reducing the material input and cost of reinforced concrete plates for canal linings
- Possible use of synthetic cables instead of iron rebar in reinforced concrete plates
- Production of durable plastic sheets for canal linings (not currently produced or used at all in Turkmenistan)
- Production of non-pressure concrete or plastic pipe for both water supply and drainage (currently, only thick concrete pipe for high-pressure applications is produced in Turkmenistan).

This component will include some investment in needed equipment and facility upgrades. Its main focus, however, will be on technical assistance in formulating the products, preparing production lines, conducting field research and testing, and then planning and implementation of expanded production and installation. The UNDP/GEF project and MWE will work jointly on field testing and demonstration of all new products.

New canal lining products will be documented with regard to production processes, technical performance, environmental benefits, and cost. Results and analysis will be compiled into a report, including recommendations and cost estimation by national and international experts for the most promising prospects for further investment at all three factories and installation in canals nationwide. This report will be presented to MWE for consideration as a basis for budget proposals to the Cabinet of Ministers. Approval and implementation of such proposals is a major focus of Component 4.

### **COMPONENT 3**

#### **Planning and capacity-building at the regional and local levels, plus evaluation and compilation of lessons learned**

Meaningful uptake of new technology and practices on the ground requires direct connection with the actual stakeholders who will apply them, under real conditions. The project's third component supports nationwide implementation of IWRM and SLM via planning and training at the regional and district level in all five velayats. It seeks to achieve two related outcomes.

- Technologies and investments for IWRM and SLM approved according to new Technology Action Plans in all five velayats
- Institutional/human capacity for implementing IWRM and SLM utilized and sustained among farmers and local/regional water management officials in all five velayats via training on best practices as well as compilation and delivery of lessons learned.

#### ***Summary of baseline conditions for this component***

MWE and its affiliates develop and carry out interdistrict and district-level plans for delivery of water, as well as maintenance and updating of infrastructure. For their part, the Ministry of Agriculture and the Ministry of Nature Protection and other agencies are in the process of developing land inventories and local area land-use plans across the entire country. But these plans are not well integrated with each other, nor do they yet reflect the advanced technology and practices to be introduced by this project.

MWE and SIWMD conduct local seminars several times annually for farmers on efficient use and management of water resources. MWE estimates that approximately 78 specialists and 36 farmers receive training on water management annually. Various international initiatives, including those of the UNDP/Adaptation Fund, GIZ, EU EECCA, and CACILM, have also provided regular training of stakeholders by national and international experts.

#### ***Incremental activities of the UNDP/GEF project***

##### ***Output 3.1: Technology Action Plans, including consideration of SLM, developed and implemented at regional and local levels***

The project team has considered the potential value of developing national-level standards or specifications for irrigation and water management, but recognizes that design of irrigation and water

management systems depends directly on local geography, water sources, and end uses. Therefore, whereas work on pumps can be generalized into national policy (See Output 4.1 below), the project proposes to develop updated specifications for other elements of water management at the district level.

The UNDP/GEF project will develop at least five district-level Technology Action Plans, one or more in each velayat. Expanding upon plans already created by MWE and district water management agencies, as well as information from the Technology Needs Assessment performed by UNEP, these action plans will cover both supply and drainage canals, irrigation, and other on-farm water management practices such as irrigation scheduling. They will contain technical proposals on system design, as well as analysis of benefits in terms of water conservation, energy conservation, and land reclamation.

The UNDP/GEF project will assist MWE, the Ministry of Agriculture, the Ministry of Nature Protection, and others in adding broader land-use sustainability indices and measures to these area plans, taking account of the input of their regional and district-level affiliates. The project will provide overall coordination and technical assistance from national and international experts in development of the SLM recommendations. To create a sound basis for these recommendations, the project will organize comprehensive research on water and soil conditions; human factors leading to degradation; and best practices and opportunities for increasing sustainability, especially involving water management.

The plans will include financial justifications and proposed budgets as well; ultimately, the action plans are intended to serve as both a technical and policy justification for state investment in each chosen district. Action plans may also be linked to each other across districts or regions, where interdistrict flows of water and other geographic conditions warrant.

*Output 3.2: Education and direct training provided to water-management system designers, local water management staff and farmers in all regions of Turkmenistan on pump maintenance, irrigation, and other aspects of efficient water management and SLM*

All of the results of the demonstrations and technical work of Components 1 and 2 will be compiled and delivered in seminars and in-the-field training to water management staff and farmers in all five velayats. Such seminars and training sessions should be organized in conjunction with already-planned training efforts of MWE and international agencies, but may be arranged separately as needed.

The topics of this training will include monitoring, maintenance, and selection of pumps; design, monitoring, and maintenance of irrigation systems; irrigation scheduling; integration and “smart” systems; and particular elements of relevant new policies and adopted action plans. Other relevant subject matter, including international best practices not directly reflected in the investment projects of Components 1 and 2, may also be delivered. Seminars and field training will be delivered annually after the first project year in each velayat.

This output will also include new educational outreach to students of agriculture and water management. The project will work with the Ministry of Education and with key institutions of higher education, including the Turkmen Agricultural University, the Dashoguz Agricultural Institute, and the Institute of Energy in Mary, to enhance, newly develop, and implement materials and instruction modules on relevant subjects, including low-water irrigation and integrated water resource management.

*Output 3.3: Project evaluation and compilation of lessons learned*

In addition to the site-specific technical evaluation of energy savings, water savings, and land melioration conducted under specific outputs as described above, the project will also conduct regular evaluation of its overall effectiveness and results. These efforts will begin with a full inventory of GHG emissions from the pilot sites. This output will also include Mid-Term and Terminal Evaluations conducted by independent national and international efforts.

All these evaluations will form the basis not only of routine reporting, but also of adjustments to the other planning and outreach outputs of this third component. Lessons learned from the project will be compiled into audience-specific documents for dissemination to decisionmakers, teachers, and other interested parties in Turkmenistan, as well as the international community.

#### COMPONENT 4

##### **National policy and regulatory framework established for integrated water resource management**

Scaling up the technical and planning innovations of the project's first three components will require three essential elements: political will, large-scale logistics, and financial support. In Turkmenistan, the Government is the fundamental source of all of these elements for both its own agencies and the entire population of the country. Therefore, implementing integrated water management and replicating technical best practices on a wide scale in Turkmenistan requires that the Government define a strong policy and regulatory framework reflecting new priorities and providing a practical basis for their realization.

The Water Codex and Land Codex of Turkmenistan provide the legislative foundation for this framework, but the details remain to be worked out and reflected in official implementing regulations. The Government recognizes the need for these regulations to reflect not only the revision of its own agencies' roles and priorities, but also the gradual transition to tariffs for end use of water.

The project's fourth component seeks the following outcomes.

- Regulations on pump performance and maintenance adopted and enforced
- Operational system established for measuring end-use water consumption
- Regulations adopted for the staged onset of tariffs for end use of water
- Policies and budget allocations adopted in support of expanded investment in improved irrigation and water infrastructure

##### ***Summary of baseline conditions for this component***

The Water Codex of Turkmenistan entered into force on November 1, 2004. It defines various aspects of the management, conservation, and use of water resources, including the authority and functions of state agencies; ownership of water and water resources; procedures for siting, design, and construction of water management facilities; types of water use and categories of end-users; conservation and pollution prevention, including the establishment of protective zones; monitoring and documentation; participation of nongovernmental organizations; and other areas.

The Water Codex is a sound basis for water management in Turkmenistan, but there are some key deficiencies.

- There continues to be a need for development of sublegislative acts (regulations and other official implementing conditions for the Codex) in various areas.
- There is a need for administrative reform to allow for integrated water resource management.
- Water volumes delivered through interdistrict canals are measured, ***but there is no measurement at all of end use among individual farmers.*** There is a clear need for implementation of metering and accounting of water consumption, in order to create a basis for incentivizing and evaluating water conservation, and also for eventual implementation of a tariff system for water use. The UNDP/Adaptation Fund project has contributed input into the initial stages of policy discussions

in these areas, but adoption of official policies remains remote and requires much further analysis and drafting.

Similarly, a broad Land Codex is also in force in Turkmenistan. This law defines land relations in the country, as well as the conditions for efficient use of and protection of land, improvement of soil fertility, conservation and improvement of the environment, and equitable development of all forms of farming on the land. Government officials widely note the need for sublegislative regulations for this codex as well, to provide the substantive details necessary to implement the broad principles of each law.

### ***Incremental activities of the UNDP/GEF project***

#### ***Output 4.1: Standards and regulations for pump performance and maintenance adopted and enforced***

To facilitate and “lock in” widespread replication of the UNDP/GEF project’s audits and demonstrations of pumps in Output 1.2, the project will develop standards and regulations to be applied to pumps nationwide. These will include performance standards for pumps, as well as specifications for regular audit and maintenance of existing pumps, with full instructions on the timing and content of data collection, steps for visual inspection and repair, and documentation requirements. Specifications will also be developed for operating schedules and for selection of new pumps where needed. Specifications for replacement will emphasize decommissioning of diesel pumps wherever possible. The specifications for new pumps will also focus on integration with end use needs, including correct sizing and use of variable-speed pumps in order to optimize efficiency.

This output will result in the creation and implementation of mandatory performance regulations as well as agency enforcement assignments and official technical guidance manuals by the end of the project.

#### ***Output 4.2: Policy framework for measuring water consumption, monitoring energy consumption in the water sector, and making the transition to end-use tariffs developed and adopted***

The UNDP/GEF project will provide technical support to MWE in the development of justification, regulations, and procedural details for staged implementation of tariffs for end use of water. This work will require significant new analysis of water supply and scarcity in specific areas, the economic condition of end users, and MWE’s current and projected costs of managing its infrastructure. It will also require creation of entirely new systems for measurement of water consumption. Implementing measurement on the needed scale and at required levels of precision will be a major organizational challenge, as it would require not only the installation of new devices (flumes and weirs for open channels, meters for pipes), but also the creation of processes and institutions for checking the devices and generating bills. Integrated planning would also be needed so that as the country makes the transition to low-water piped irrigation, measurement could be planned and implemented accordingly.

In addition, this output will include development of regulations or internal norms for MWE for monitoring energy consumption and compliance with applicable energy-related norms in the water sector.

This output will result in fully operational systems of measurement of water consumption and energy consumption in the water sector across Turkmenistan by the end of the project period, as well as adopted regulations with a defined timetable for staged implementation of tariffs.

#### ***Output 4.3: Policy and state budget framework for widespread deployment of efficiency improvements to irrigation and water infrastructure adopted and implemented***

The project will assist MWE and other ministries in developing a policy framework under the Water Codex to support widespread deployment of low-water irrigation, canal linings, and enhanced drainage nationwide. This framework will define numerous elements, including procedures for technical assessment; criteria for financial justification; and targets for investment and deployment. In developing all these parts of the policy framework, UNDP and MWE will draw heavily upon the experience gained from the technical field-testing, planning processes, and financial justifications generated via the first three components of the project. The framework itself will be an important vehicle for replicating the results achieved in these first three components.

This output will result in the adoption of regulations, state programmes, and budget allocations. This output will also establish voluntary incentives for farmers to deploy low-water irrigation and other technologies and practices for water efficiency and sustainable land use. Such incentives could be linked to tariffs, but could also include linkages with state purchases of harvested crops, or with subsidies for purchases of equipment.

*Output 4.4. Administrative reform for implementation of integrated water resource management and sustainable land management adopted and implemented*

The project will assist MWE and other ministries in developing sublegislative acts under the Water Codex and Land Codex for overall administrative reform in support of integrated water management and sustainable land management. Such reform will focus largely on redefining agency roles and planning targets to emphasize integration, optimization, and sustainability of water resource management, not just water delivery and agricultural output. Integration will involve not only the matching of downstream efficiency improvement with upstream investment and management in the water system, but also improved coordination among various ministries.

This output will result in the adoption of official regulations or other policy documents, supported by annual plans and budgets of respective ministries.

### **2.3. Changes in project formulation since PIF approval**

This project reflects various changes since it was preliminarily articulated on the Project Information Form (PIF). Several adjustments have been made in response to comments on the PIF from the GEF Secretariat and the GEF Scientific and Technical Advisory Panel (STAP). Please see Annex C for a full enumeration of these comments and responses. Other changes to the project reflect new research and assessment of opportunities, as well as the updated priorities of MWE and the Government, as enumerated below.

*Restructuring of components.* In order to maximize the cohesion of individual components and to better frame the overall project strategy, the components have been restructured from those shown in the PIF. The project's first two components now focus on defining and proving technical opportunities and priorities in irrigated agriculture and large-scale infrastructure, respectively. The final two components focus on achieving widespread replication via activities in regional planning, local outreach, and national policy. Whereas the components of the PIF reflected certain thematic groupings (for example, with all renewables and SLM work concentrated in Component 3), now the components are more integrated, accurately reflecting the true intertwined nature of energy consumption, water use, and land degradation, and the potential for unified solutions to these issues.

*Change in content and locations of pilot projects.* The PIF proposed demonstration project activities in various velayats, especially the region of the Mary oasis for irrigation, and three different regions for renewable solutions to sustainable land management. The content and locations of the projects have been changed based on MWE's recommendations, which in turn reflect various issues of timing, land availability, water sources, and so on. Now, the project's main activity for testing and disseminating technology for both irrigation and solar-powered water pumping and purification will take place in the Akhal velayat, where sites and projects are very well defined and previous demonstration work has been minimal. The consolidation of multiple sites into single sites for each technology type is consistent with a recommendation from the STAP.

*Inclusion of municipal water efficiency.* For reasons of strong quantitative potential for energy savings, replicability, and need in Turkmenistan, the project now includes work on municipal water infrastructure as well as irrigation. Please see the text of Section 2.2, Output 2.1 for more details and justification. Note also that the potential for linkages with hydroelectric generation is consistent with a recommendation of the STAP.

*Revolving financing mechanism for investment in large-scale water management infrastructure.* Because water remains essentially free of charge in Turkmenistan for agricultural end-users, there is no financial mechanism by which investors can recoup up-front costs of water-saving technology. In this light, the project has recast how it will seek to catalyze the investment necessary for scaled-up replication, with a focus directly on providing technical, environmental, and financial justification to the Government to support state budget allocations, as well as on the policy environment necessary to support eventual financial incentives. Creation of a revolving financial mechanism in itself is no longer foreseen as a project activity.

*Changes to activity on renewable energy.* The PIF called for the demonstration of renewable or other low-carbon technology for three applications in three regions: farm irrigation in Mary, pasture irrigation in the Karakum Desert, and water purification in the Balkan velayat. Upon further technical assessment, UNDP and its partners have determined that the most promising area for demonstrating renewable energy in relation to water is with pumping and purification of water in desert areas, not so much for pasture irrigation, but mainly for meeting humans' needs. The other areas are less likely to be technically expedient. This observation is consistent with several emphatic comments of the STAP.

So the project now calls for only one demonstration project on solar energy, focusing on improving water service to remote rural communities. Given this refocusing, as well as the confirmation of stronger opportunities in other areas of water management, the project's proposed scale of activity on renewables has been commensurately reduced.

*Removal of activity to reduce non-energy GHG emissions.* The PIF made vague mention of work to limit non-energy GHG emissions from agriculture. But the magnitude of technical opportunity seems limited given the free-ranging habits of livestock and the relatively small share of rice in overall cropland in Turkmenistan. As a result, this subject is difficult to form into clear action steps with foreseeable results. Given this, and also given its remoteness from water management as such, we have removed this theme from the project.

## **2.4 Project risks and assumptions**

The project has been designed to address known barriers and to tap well-understood opportunities. Still, as in all projects of this scope, there remain some risks and uncertain assumptions. The most important of these risks involve the following factors. (See the Project Results Framework in Section 3 and the Risk Log in Annex 1 for further discussion of project risks, assumptions, and proposed countermeasures.)

***Political will regarding national policies and state budget investment.*** In the absence of market drivers for water conservation, scale-up of efficiency improvements in water management and irrigation will depend on policies and state budget investment approved by the Government. Political will to support these policies and budget allocations can be foreseen given current Government positions and directions, but ultimately lie beyond the project's direct control.

***Climate change risks.*** Climate observations show that the air temperature is steadily increasing in Turkmenistan. Precipitation will become more variable, with increased frequency and intensity of drought and flood spells. Glacial retreat in Pamir-Altai will have significant impacts on water flows of the Amu Darya River<sup>8</sup>. As a result, significant decreases in water supply is expected: the average reduction in runoff rates in terms of surface water collected in national storage and distribution systems is expected to be 10 percent, whereas during vegetation periods the reduction in runoff rates will reach 30-40 percent. In summary, predicted climate change impacts include:

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<sup>8</sup> The First National Communication to UNFCCC, Turkmenistan, 1998



- An increase in average annual temperature of between 4.2 and 6.1°C by 2050<sup>9</sup>, which will include an increase in the number of extremely hot days (i.e. days over 40°C);
- A reduction in annual average rainfall of between 15 and 56 percent by 2050<sup>10</sup>;
- An increase in average regional evaporation rates of 48 percent by 2050<sup>i</sup>;
- An increase in the frequency and intensity of drought and flood<sup>11</sup> spells<sup>ii</sup>
- A 15 percent reduction in flow rates for the Amu Darya and a 30 percent reduction in flow rates for other river systems.

The planned project will still create meaningful benefits even if conditions tend to make the root problems worse. Indeed, while adaptation as such is not an explicit objective, the activities of the project could widely be viewed as having direct benefits in terms of climate change adaptation as well as mitigation.

**Cooperation of farmers and other stakeholders.** The efforts of project to introduce new technology and practice for low-water irrigation and SLM also depend directly on the support of farmers. Such support has been readily given in other projects on low-water irrigation, but the proposed work is newer and more complex and therefore may require greater efforts. The project will seek the support of farmers before and during the project via regular communication and outreach. It is also possible that the Government may create incentives or mandates to ensure that farmers implement needed technologies and practices.

**Local technical or environmental conditions affecting demonstration projects.** Demonstration projects almost always carry some uncertainty because of complexities involving contracting, scheduling, supplies, and so on. Such uncertainty may apply all the more with water-management projects because project designs depend directly on specific local environmental conditions such as water sources, month-to-month variability in water availability, terrain, broad local hydrologic impacts of water withdrawal and delivery, and so on. During the project, demonstration projects will undergo full assessments not only for cost and potential benefits but also for technical feasibility and environmental impact. Designs or even sites may have to be changed in response to these assessments.

**Replication and availability of materials and products.** Demonstration projects will emphasize the use of materials and products that are widely available in Turkmenistan. Still, it is possible that scaled-up replication of results could face challenges in terms of product availability in specific localities or on very large scales. The project will seek to anticipate potential supply problems as much as possible, identify viable alternatives, and work in conjunction with suppliers to try to ensure minimal disruptions.

**Reduction in end-use water consumption and increased pump performance does not automatically lead to energy savings and avoided emissions.** The relations among downstream water efficiency, reduction in overall water management volumes, and energy consumption are much more complex than they would seem at first glance. Reduction in end-use water consumption needs to be accurately forecasted, measured, and then coordinated with upstream water management and pumping schedules. This integration is a major emphasis of Output 1.1 (field testing of low-water irrigation in agriculture) and Output 4.4 (administrative reform in support of IWRM), but still some unforeseen technical challenges may be expected.

Similarly, improved pump maintenance might increase the efficiency of pump operation (that is, more liters of water pumped at higher head for the same amount of energy), but actual energy savings would be achieved only by reduction of the amount of *time* spent pumping. Such reduction in pumping time also requires strong information management and staff coordination.

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<sup>9</sup> These estimates are based on the findings of five general atmosphere and ocean circulation models (GCM) reported in Turkmenistan's Initial Communication on Climate Change (1998). The GCM with the most plausible results on temperature predictions was the UK89 model (equilibrium model of the United Kingdom Meteorological Agency). According to this scenario, temperature is predicted to increase by 5.5°C by 2050.

<sup>10</sup> The GDFL model scenario (equilibrium model of Geophysical Fluid Dynamics Laboratory, University of Princeton, USA), however, predicted no change in rainfall (Turkmenistan's Initial National Communication on Climate Change, 1998).

<sup>11</sup> Floods are uncommon in Turkmenistan but they do still pose a threat to communities and infrastructure (see: <http://www.preventionweb.net/english/countries/statistics/risk.php?cid=178>).

## **2.5 Expected global, national and local benefits**

The project will achieve very significant national and local benefits -- reduced water losses, increased water availability, better drainage, reduced land degradation, and reclamation of salinized land. All these benefits, in turn, should help Turkmenistan to increase its agricultural productivity while also better conserving vital ecosystems and natural resources. In addition, avoided energy use in the water sector means conservation of energy resources for future domestic use or for export.

The project will achieve global environmental benefits of two broad types, as enumerated among the focal areas of the Global Environment Facility: climate change mitigation and reduction of land degradation.

### ***GHG emissions reductions***

Climate change mitigation mainly involves reduction of energy consumption for water management in Turkmenistan, via reduction in overall volumes of water moved through the system and via increased efficiency of pump operations through maintenance and replacement. Use of solar energy in place of diesel fuel for remote pumps will have an additional small effect.

The UNDP/GEF project will increase energy efficiency in Turkmenistan's water sector in numerous related ways.

- **Reduction of water losses** in interdistrict and on-farm water management, thereby reducing volumes of water to be pumped, as well as associated energy consumption
- **Use of informational feedback**, with or without variable-speed pumps, to pump less water and use less energy when less water is needed in the field
- **Increasing yields of agricultural lands**, thereby fulfilling harvest targets on less land and reducing needed fuel inputs for heavy machinery.
- **Increasing pump efficiency via maintenance**, thereby reducing the number of needed hours of operation for the same volume of delivered water
- **Replacement of oversized pumps with appropriately-sized ones**, thereby allowing for operation at maximal efficiency, increasing performance and saving energy
- **Replacement of old pumps with modern pumps** that have more efficient motors
- **Replacement of diesel pumps with grid-connected electric pumps** where possible
- **Replacement of pump-driven water supply from wells in foothill areas** such as Kaakhka, via installation of gravity-driven water supply from mountain sources
- **Replacement of remote diesel or electric pumps with solar-powered or wind-powered pump**

Table 2.5.1 below summarizes the project team's quantitative projections of energy savings and emissions reductions, as calculated using the spreadsheet tool and methodology developed by the GEF Scientific and Technical Advisory Panel (STAP). Details of assumptions and calculations are presented in full in Annex 6. The spreadsheet itself will also be appended to this document as a supplement.

**Table 2.5.1**  
**Summary of Projected GHG Emissions Reductions from Planned Activities**

Activity	Type of energy saved	Annual energy savings (per unit as indicated)	Number of units completed during project period*	Number of "spillover" replication units after the project period	Total projected GHG emissions reduction (tonnes CO2)
<b>Low-water irrigation in agriculture</b> (Output 1.1 in this document, plus associated replication activities)	Electricity (pumps) and diesel (farm equipment)	5.4 MWh electricity and 0.34 GJ of diesel per hectare	170 hectares directly as pilot project, plus 10,234 hectares via replication	20,800 hectares	<b>809,000 (total)</b> 270,000 (direct); 539,000 (indirect bottom-up from spillover replication)
<b>Servicing and/or replacement of electric pumps</b> (Output 1.2)	Electricity	90 MWh electricity per serviced or replaced pump	243 pumps	486 pumps	<b>475,200 (total)</b> 158,400 (direct); 316,800 (indirect bottom-up from spillover replication)
<b>Servicing and/or replacement of diesel pumps</b> (Output 1.2)	Diesel	84 GJ per serviced or replaced pump	94 pumps	188 pumps	<b>26,400 (total)</b> 8,800 (direct); 17,600 (indirect bottom-up from spillover replication)
<b>Photovoltaic water pumping and purification for desert pasture areas</b> (Output 1.3)	Electricity	10 MWh per solar installation	6 installations (1 installed directly by project, the rest via replication)	6 installations	<b>872 (total)</b> 436 (direct) 436 (indirect bottom-up from spillover replication)
<b>Renewable gravity-driven municipal water supply, replacing wells and electric pumps</b> (Output 2.1)	Electricity	13.1 MWh per well pump taken out of operation	41 well pumps in Kaakhka pilot, plus 77 more in replication	188 well pumps	<b>22,500 (total)</b> 11,250 (direct) 11,250 (indirect bottom-up from spillover replication)
<b>Demonstration and deployment of canal linings</b> (Output 2.2)	Significant potential energy savings if reduced water losses mean less need for water withdrawal and associated pumping, but such savings are very difficult to project quantitatively with confidence because of various				

	technical factors, plus the fact that water levels are defined by international agreements.
<b>TOTAL</b>	<b>About 1.3 million tonnes of avoided CO<sub>2</sub> emissions, including replication (about 448,000 tonnes of direct reductions achieved during the project period)</b>

### ***Reduction of land degradation***

The project will reduce and reverse various problems of land degradation in Turkmenistan, especially salinization of soils, as well as degradation of water availability and quality. These problems negatively affect the livelihoods of about half of Turkmenistan's 5 million citizens.

The project will seek to remedy these problems through technical, informational, and policy interventions.

- Implementation of low-water irrigation, which will eliminate problems of waterlogging and salinization of soil, lower water tables, and make more water available for crops
- Expanded production and deployment of canal linings and other technologies to reduce water losses via infiltration and possibly evaporation as well. This will dramatically reduce salinization around canals.
- Development and implementation of regional plans for sustainable water management and land management
- Development and implementation of sublegislative acts in support of implementation of the Water Codex.
- Development of knowledge and capacity of stakeholders in connection with all of the above activities.

As noted in the discussion of project strategy in Section 2.1, the project will implement and document the land-related environmental benefits of its demonstration work in low-water irrigation and canal linings. The demonstration projects themselves will affect only a relatively small area (the 170-hectare polygon in Akhal, plus an estimated 800 hectares of area around canals and the area of municipalities such as Kaakhka where water will be made more readily available).

The major benefits of the project in the area of land degradation will come from replication of low-water irrigation, which will be achieved via work on planning, outreach, policy, and budget planning in Components 3 and 4. We estimate that low-water irrigation technology will be widely replicated, over approximately 10,200 hectares during the project period. (The replication factor of approximately 60 is consistent with that used to calculate GHG emission reduction for this activity.) Spillover replication after the project period is also estimated at 10,200 hectares. Thus the project team has defined a target of amelioration of the condition **over more than 21,400 hectares of land** across Turkmenistan. This total is

approximately one percent of total cultivated land area in Turkmenistan. Replication of land protection benefits around canals could greatly increase this number, but specific projections and targets are not presented here because more assessment is needed. Such assessment and possible new targets for melioration of land around canals will be developed during the project period.

GEF Tracking Tools have been completed for the pre-project stage for both climate change mitigation and land degradation. These tools will be presented as separate files accompanying the Project Document and the Request for GEF CEO Endorsement.

## **2.6 Project rationale and GEF policy conformity**

The goals of this project are to create global environmental benefits of avoided GHG emissions and to reduce land degradation by improving the efficiency of water management in Turkmenistan, mainly in the agricultural sector and in municipal water supply as well. These goals are squarely consistent with the focal areas of the GEF-5 replenishment. The table below summarizes the focal areas relevant to the proposed project, with specific intended outcomes and outputs as articulated by the GEF for each focal area.

**Table 2.6.1**

GEF-5 Focal Area Outcomes and Outputs of the Proposed Project

<b>GEF Focal Area Objectives</b>	<b>Expected Focal Area Outcomes</b>	<b>Expected Focal Area Outputs</b>
<b>CCM-1: Technology Transfer</b>  Promote the demonstration, deployment, and transfer of innovative low-carbon technologies	Outcome 1.1: Technologies successfully demonstrated, deployed, and transferred  Outcome 1.2: Enabling policy environment and mechanisms created for technology transfer	Output 1.1: Innovative low-carbon technologies demonstrated and deployed on the ground  Output 1.2: National strategies for the deployment and commercialization of innovative low-carbon technologies adopted
<b>CCM-2: Energy Efficiency</b>  Promote market transformation for energy efficiency in industry and the building sector	Outcome 2.1: Appropriate policy, legal and regulatory frameworks adopted and enforced  Outcome 2.2: Sustainable financing and delivery mechanisms established and operational	Output 2.1: Energy efficiency policy and regulation in place  Output 2.2: Investment mobilized  Output 2.3: Energy savings achieved
<b>LD-1: Agriculture and Rangeland Systems:</b> Maintain or improve flow of agro-ecosystem services sustaining the livelihoods of local communities	Outcome 1.2: Improved agricultural management  Outcome 1.3: Sustained flow of services in agro-ecosystems  Outcome 1.4: Increased investments in SLM	Output 1.2: Types of innovative SL/WM practices introduced at field level  Output 1.5: Information on SLM technologies and good practice guidelines disseminated

## **2.7 Country ownership: country eligibility and country-drivenness**

Turkmenistan is eligible for GEF funds because of its ratification of the UNFCCC and its status as a GEF member country. The proposed project has been endorsed by the GEF Operational Focal Point for Turkmenistan.

Water management, as noted in previous sections, is an issue of fundamental importance for the country and especially for the Ministry of Water Economy. More specifically, efficient irrigation, other water conservation efforts, and sustainable land management are prominent priorities of several state programs, including the broad "Fundamental Directions of Economic, Political, and Cultural Development of Turkmenistan in the Period up to 2020" and National Program for the Social Development of Rural Areas. These priorities are reflected in significant budget allocations for water management, research and development, and investment in new infrastructure.

Integrated water resources management and improvement of the legal and regulatory framework regarding water in Turkmenistan are both specifically noted as targets in the 2010-2015 Country Programme Action Plan (CPAP) jointly adopted by UNDP and the Government of Turkmenistan. The current UN Development Assistance Framework (UNDAF) jointly signed by the UN and the Government also prominently cites the need for joint activity on integrated water management and mitigation of land degradation. The next UNDAF will also prominently feature efficient water management as a priority.

Country ownership and country-drivenness applies not only to the issues, but to the project itself. The Ministry of Water Economy of Turkmenistan has participated actively in all stages of development of this project. All proposed demonstration projects originate from the Ministry and the State Institute for Water Management Design. All elements of the proposal have been developed in order to advance and lend concrete substance to the existing directions defined by MWE and the country, while also fulfilling GEF objectives. MWE is also committed to serving as the national implementing partner of the project, while other national agencies also offer their support. See the support letters in Annex 2.

## **2.8 Financial modality and cost-effectiveness**

The project is seeking US \$6.185 million in financial support from GEF. This sum covers both direct investment in demonstration projects (total \$3.3 million) and technical assistance, as well as project management expenses. Given the multidisciplinary and multifocal character of the project, UNDP is seeking GEF funds from two focal areas – climate change mitigation (\$4,771,290) and land degradation (\$1,413,710). See the Request for GEF CEO Endorsement for tables showing the full breakdown of requested funds and co-financing by component, assistance type, and focal area.

The budget for project management (\$289,560) amounts to about five percent of the budget for direct program expenses. This figure falls well within GEF requirements.

Demonstration projects have been chosen so as to minimize risk and to maximize benefits, facilitate replicability, and cover a diverse range of issues across water management in Turkmenistan. In a project of this type, in which the sheer scale of infrastructure is such a daunting challenge, achieving scale via direct investment of GEF funds is impractical. To maximize the scale of impact, the project emphasizes replication via educational outreach, planning, policy, and especially justification of further state investment. Notably in this light, project activity on demonstration and deployment of canal linings focuses on factory production in order to achieve scale via maximal leverage of GEF funds.

As noted in Section 2.5 and Annex 6, application of the GEF STAP methodology results in a projection of avoided direct and indirect GHG emissions of 1.3 million tonnes of CO<sub>2</sub>. Dividing the sum requested from GEF's climate change mitigation focal area by this estimated GHG reduction, we estimate **an abatement cost \$3.67 in GEF funds per tonne of avoided CO<sub>2</sub> emissions**. Similarly, we can divide the sum from GEF's land degradation focal area by the targeted 20,000 hectares, to receive an estimate of **about \$70 per hectare of protected or reclaimed land**.

## **2.9 Sustainability (including financial sustainability)**

This project will have far-reaching transformative effects on technology, practices, and infrastructure as well as the legal and regulatory basis of water management in Turkmenistan – effects that will last long after the completion of the project period.

Demonstration projects have been chosen in large part because of replicability and the opportunity and need for scaling up. Documentation, dissemination, training, and development of regional action plans will further secure sustainability by creating an enduring knowledge base throughout the regions of the country. Passage of sublegislative acts on various topics – including integrated water resource management, pump specifications, reduction of water losses in canals and irrigated fields, and so on – will help to confirm and “lock in” technical advances, backed by the strength of the Government’s authority.

The project will support the gradual transition of Turkmenistan’s water sector to a more market-driven basis, in which the costs of water supply and associated energy are borne by end-users, thus creating financial incentives for conservation. Such incentives are one key to long-term financial sustainability of investment in water conservation. For the foreseeable future, however, it is most reasonable to expect that the dominant financial force in large-scale water management and even irrigation in Turkmenistan will be the state budget. Therefore, the UNDP/GEF project also places strong emphasis on providing sound technical and financial justification for state budget investment in integrated water management, efficient irrigation, canal linings, drainage, and measurement, with the goal of making state budget investments maximally cost-effective and beneficial for Turkmen society as well as the global environment.

### **2.10 Replicability**

The unique geographic features and economic history of Turkmenistan make this project unique and unlikely to be replicated as a boilerplate in other countries. Nevertheless, in terms of both overall concepts (IWRM management itself, regional planning processes, and the linkage between water management and energy consumption) and key technologies/practices (smart irrigation systems, pump specifications, canal linings, and drainage), the project will yield experience applicable elsewhere, especially perhaps in other nations of Central Asia and the Middle East which also depend on large-scale water management and irrigated agriculture. In its final year, the project will develop a lessons-learned document for dissemination, and will also hold a closing conference to share its results with invitees from around the region and world as well as from within Turkmenistan.

### **2.11 Innovation**

The project seeks to support innovation in Turkmenistan’s water sector through the testing, demonstration, and replication of new technology and practices in four major areas: irrigation (including integrated “smart” systems), municipal water supply pipeline infrastructure in Kaakhka, interdistrict canal linings, and drainage. Some solutions for irrigation, canals, and drainage are already well understood among specialists in Turkmenistan, but are not widely implemented in practice for lack of infrastructure and investment. Other technical solutions will be completely new. Solutions for Kaakhka will be truly innovative, reflecting a wholly new approach and engineering design that could be adapted and then replicated widely. The project also expects to introduce new production processes and new actual materials for canal linings.

The project itself is also innovative for Turkmenistan and indeed for the UNDP/GEF portfolio of projects in its unusual integration of water conservation, energy efficiency, and sustainable land management issues. Though closely tied in all respects, these areas have not been addressed together by any international organization in a single project in Turkmenistan.

### 3. PROJECT RESULTS FRAMEWORK

<p><b>This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD:</b></p> <p>Environmentally sustainable use of natural resources contributes to effectiveness of economic processes and increased quality of life</p>					
<p><b>Country Programme Outcome Indicators (from CPAP):</b></p> <p><b>Output 3.2.1 – National authorities better plan, manage, and monitor the environment sector</b>  Indicator 2. Number of laws revised to align national legislation with international standards  Indicator 3. Number of sectoral plans/strategies revised to integrate respective environmental priorities and concerns, and incorporate strategic adaptation measures  Indicator 5. Number of municipalities apply improved waste disposal and better water/sanitation management</p> <p><b>Output 3.2.2 – Local communities contribute to and benefit from sustainable use of natural resources</b>  Indicator 3. Number of laws and policies revised and aligned internationally for better water governance  Indicator 4. Number of pilot areas practice integrated water resource management</p> <p><b>Output 3.2.3 – Government introduces carbon reduction and energy saving technologies.</b>  Indicator 1. Comprehensive policy framework is in place regulating long-term measures for sustainable use of energy resources and promotion of alternatives/renewables  Indicator 5. Number of pilot projects are in place promoting alternative and renewable sources of energy</p>					
<p><b>Primary applicable Key Environment and Sustainable Development Key Result Area: 1. Mainstreaming environment and energy</b></p>					
<p><b>Applicable GEF Strategic Objective and Program: CCM-1, CCM-2, LD-1</b></p>					
<p><b>Applicable GEF Expected Outcomes:</b></p> <p>CCM Outcome 1.1: Technologies successfully demonstrated, deployed, and transferred  CCM Outcome 2.1: Appropriate policy, legal and regulatory frameworks adopted and enforced  LD Outcome 1.2: Improved agricultural management</p>					
Project Objective	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
Provide for sufficient and environmentally sustainable water supply to support and enhance social conditions and economic livelihood of the population of Turkmenistan	Extent of change in energy efficiency ( <i>UNDP Integrated Results and Resources Framework indicator 1.5.2</i> ) – specifically, consumption of electricity and fossil fuels and associated emissions of CO <sub>2</sub> from	9 million GJ/year and approximately 6.9 MtCO <sub>2</sub> /year from water management, including non-agricultural uses	Direct energy savings of 3.4 million GJ and reduction of GHG emissions by 448,000 tonnes, not including indirect post-project reductions	Pump audits and other evaluation of energy consumption in water sector Measurements of water consumption	Baseline data are based largely on national-level statistics and estimates, but not on metering. Metering data at the level of end users are largely absent for both energy and water. More precise and better-substantiated definition of quantitative baselines may be needed at project inception.  Scaling up of project results depends directly on allocation of state budget investment in low-water irrigation.



<p>water management per hectare of irrigated land</p> <p>Consumption of water per hectare of irrigated land</p> <p>Hectares of land protected and/or reclaimed from salinization</p> <p>Implementation of national and sub-national plans for IWRM (<i>UNDP Integrated Results and Resources Framework Indicator 2.5.2</i>).</p> <p>State and private investment in new and efficient integrated water management</p> <p>Number of people benefiting from new and improved water management systems</p>	<p>24 billion m<sup>3</sup> per year of water consumption for agriculture</p> <p>2 million hectares of irrigated land</p> <p>69 percent of irrigated land is moderately to severely salinized; approximately 200 million hectares are severely salinized</p> <p>Water codex adopted in 2004, but no supporting regulations nor regional/local plans for implementation of IWRM or energy efficiency in the water sector</p>	<p>Reduction of water consumption per hectare by 40-50 percent relative to baseline in demonstration project on low-water irrigation</p> <p>Condition of 1 percent of salinized agricultural land in country, plus other land around canals and municipalities (total at least 21,400 hectares) is improved by the end of the project period</p> <p>National and 5 sub-national plans for IWRM approved and being implemented</p> <p>35,000 people benefiting directly from improved water management system</p>	<p>Official policy and budget documents</p> <p>Evaluation of demonstration projects and national statistics</p>	<p>drainage, canal linings, and infrastructure improvements. One major goal of this project is to provide technical and financial justification for such budget allocations.</p>
<p><b>Component 1:</b> Technology transfer and knowledge development in support of innovation in EE water management and SLM</p> <p><b>Outcomes:</b></p> <p>Enhancement of the national knowledge base and delivery of new technical information on appropriate technology for irrigation, pumps, and solar-powered water pumping and purification to water management agency staff and farmers</p> <p>New processes established and implemented for planning, deployment, and financial assessment both before and after deployment of integrated water resource management, pump audits and maintenance, and solar-powered water pumping and purification</p>	<p>Annual irrigation norms vary by soil type. For medium and heavy-loam soils, norms are 6700 m<sup>3</sup>/ha for cotton; 4500 m<sup>3</sup>/ha for winter wheat; and 29,000 m<sup>3</sup>/ha for rice.</p> <p>No national program for pump audits. Pump energy consumption varies widely, but averages 16.4 liters of fuel per hour for diesel-powered pumps and 200 kW for electric pumps.</p> <p>Demonstration project sites are subject to salinization and overgrazing if traditional water and land</p>	<p>Demonstration project achieves comparable yields with 40-50 percent less irrigation water consumption than specified by norms. Normalized energy consumption reduced by 30 percent relative to similar sites.</p> <p>At least 100 pump audits completed by project, including audits of 25 diesel pumps, with subsequent implementation of remedial measures resulting in average energy savings of 20 percent.</p> <p>436,750 tonnes of direct GHG emissions reductions from activities under this component, not including indirect post-project results</p>	<p>Tracking and evaluation of project activity on pump audits</p> <p>Measurement and evaluation of demonstration project on irrigated agriculture</p> <p>National budget data</p>	<p>Demonstration projects will require full assessment of costs, benefits, technical feasibility, and environmental impact. Matching of schedules, finalization of co-financing arrangements, and local stakeholder participation are also all necessary for the timely success of demonstration projects. Projects have been identified specifically because they appear most feasible and meet the needs of MWE and other key partners.</p> <p>Water availability may vary from year to year, affecting the performance of demonstration projects.</p>

Direct energy savings, water savings, and reduction of land degradation from selected projects	energy water supply in remote locations	management practices applied No renewable-energy water supply in desert pastures	Direct protection and/or reclamation of at least 300 hectares through demonstration projects  At least six small-scale renewable-energy installations implemented during the project period, including replication, with a total capacity of at least 0.03 MW, yielding 100 tonnes of direct GHG emissions reductions relative to gas-fired electricity from 2015 through 2021.  At least 20 remote communities benefit from improved renewable-energy based water supply		
<b>Component 2: Scaling-up investment in improved water management infrastructure</b> <i>Outcomes:</i> Reduction of water losses and associated energy consumption via direct investment in a large-scale infrastructure project on municipal water supply  Technical, environmental, and financial justification to scale-up investment in canal linings and/or other widespread infrastructure improvements to reduce water losses, associated energy consumption, and land degradation	Reduction of water losses and avoided energy consumption from Kaakhka municipal demonstration project  Scale of replication of Kaakhka-project innovations on municipal water supply (with financing secured)  Volume and cost of production of canal lining materials  Kilometers of canals newly lined	50 percent of water (about 100 l/s) lost to infiltration in Kaakhka municipal system; 41 electric-powered wells are active  No replication of innovations in municipal water supply.  Production and installation in Turkmenistan mainly of heavy reinforced concrete plates and heavy concrete pipes for canal lining and water delivery; no production of light concrete plates or plastic sheeting for canals, nor non-pressure plastic pipes for water and drainage	Less than 5 percent of water is lost between withdrawal and end use in Kaakhka. Water supply reliability is increased, while 41 wells can be decommissioned. Direct energy savings of 486 MWh per year, and reduction of associated GHG emissions by 240 tonnes.  Approval of replication of Kaakhka-project innovations in municipal water supply at additional sites (at least 90 additional wells decommissioned)  Testing of at least three types of materials for canal linings and pipes. Initiation of mass production of new materials and/or cost reduction by 20 percent of mass-producing existing materials, involving at least two types of products.	Measurement and evaluation of results from demonstration project in Kaakhka  Planning and budget data from national and regional governments  Measurement and evaluation of demonstration projects on canal linings	Demonstration projects will require full assessment of costs, benefits, technical feasibility, and environmental impact. Matching of schedules, finalization of co-financing arrangements, and local stakeholder participation are also all necessary for the timely success of demonstration projects. Projects have been identified specifically because they appear most feasible and meet the needs of MWE and other key partners.  Replication of the Kaakhka project innovations will require tailored technical plans, given particularities of water sources, terrain, and needed volumes in other areas.  Canal lining project demonstrations are very small in scale compared to overall water-management complex. Scaling up will require a major commitment of national budget resources. A defining goal of the canal lining demonstrations is to provide technical and financial justification for such further investment.

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improved irrigation and water infrastructure	measurement devices newly installed and regularly checked	Measurement of water is practically non-existent at the end use level	<ul style="list-style-type: none"> <li>• Implementation of pump audits, maintenance, and replacement (adopted and enforced by end of project period)</li> <li>• Deployment of low-water irrigation</li> <li>• Deployment of canal linings</li> <li>• Implementation of expanded drainage and measurement of drainage</li> <li>• Administrative reform for implementation of integrated water resource management</li> </ul> <p>State investment in identified technologies for efficient irrigation and water management infrastructure increased by 20 percent by project close</p> <p>National programme for measurement of water end-use adopted and made operational</p>		
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# SUMMARY OF OBJECTIVE, COMPONENTS, TARGETED OUTCOMES, AND PLANNED OUTPUTS

<b>Objective:</b> Provide for sufficient and environmentally sustainable water supply to support and enhance social conditions and economic livelihood of the population of Turkmenistan				
<b>Component 1:</b> Technology transfer and knowledge development in support of innovation in EE water management and SLM	<b>Component 2:</b> Scaling-up investment in improved water management infrastructure	<b>Component 3:</b> Planning and capacity-building at the regional and local levels, plus evaluation and compilation of lessons learned	<b>Component 4:</b> National policy and regulatory framework established for integrated water resource management	
<b>Targeted Outcomes:</b> <ul style="list-style-type: none"> <li>• Enhancement of the national knowledge base and delivery of new technical information on appropriate technology for irrigation, pumps, and solar-powered water pumping and purification to water management agency staff and farmers</li> <li>• New processes established and implemented for planning, deployment, and financial assessment both before and after deployment of integrated water resource management, pump audits and maintenance, and solar-powered water pumping and purification</li> <li>• Direct energy savings, water savings, and reduction of land degradation from selected projects</li> </ul>	<b>Targeted Outcomes:</b> <ul style="list-style-type: none"> <li>• Reduction of water losses and associated energy consumption via direct investment in a large-scale infrastructure project on municipal water supply</li> <li>• Technical, environmental, and financial justification of further investment in canal linings and/or other widespread infrastructure improvements to reduce water losses, associated energy consumption, and land degradation</li> </ul>	<b>Targeted Outcomes:</b> <ul style="list-style-type: none"> <li>• Region-specific technologies and investments for IWRM and SLM approved according to new Technology Action Plans in all five velayats</li> <li>• Institutional/human capacity for implementing IWRM and SLM utilized and sustained among farmers and local/regional water management officials in all five velayats, via training on best practices as well as compilation and delivery of lessons learned</li> </ul>	<b>Targeted Outcomes:</b> <ul style="list-style-type: none"> <li>• Regulations on pump performance and maintenance adopted and enforced</li> <li>• Operational system established for measuring end-use water consumption established</li> <li>• Regulations adopted for the staged onset of tariffs for end use of water</li> <li>• Policies and budget allocations adopted in support of expanded investment in improved irrigation and water infrastructure</li> </ul>	

<p><b>Output 1.1:</b> Technology proving site and educational platform for low-water irrigation and SLM in agricultural croplands developed and implemented</p> <p><b>Output 1.2:</b> Audits and servicing of pumps of various sizes in both interdistrict water networks and on farms in all velayats of Turkmenistan</p> <p><b>Output 1.3:</b> Renewable-energy applications of water pumping and purification in remote pasture areas</p>	<p><b>Output 2.1:</b> Installation of pipeline and/or channel linings for municipal water supply in Kaakhka, replacing unlined channels and wells, with documentation of results and presentation of recommendations and cost analysis for replication</p> <p><b>Output 2.2:</b> Lining of interdistrict canals for reduction of water losses and land salinization, including various technologies</p>	<p><b>Output 3.1:</b> Technology Action Plans, including consideration of SLM, developed and implemented at the regional and local levels</p> <p><b>Output 3.2:</b> Education and direct training provided to water-management system designers, local water management staff and farmers in all regions of Turkmenistan on pump maintenance, irrigation, and other aspects of efficient water management and SLM</p> <p><b>Output 3.3:</b> Project evaluation and compilation of lessons learned</p>	<p><b>Output 4.1:</b> Standards and regulations for pump performance and maintenance adopted and enforced</p> <p><b>Output 4.2:</b> Policy framework for measuring water consumption, monitoring energy consumption in the water sector, and making the transition to end-use tariffs developed and adopted</p> <p><b>Output 4.3:</b> Policy and state budget framework for widespread deployment of efficiency improvements to irrigation and water infrastructure adopted and implemented</p> <p><b>Output 4.4:</b> Administrative reform for implementation of integrated water resource management and sustainable land management adopted and implemented</p>
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#### 4. TOTAL BUDGET AND WORKPLAN

Award ID:	00080840	Project ID(s):		00090400									
Award Title:	Energy Efficiency and Renewable Energy For Sustainable Water Management in Turkmenistan												
Business Unit:	UNDP Turkmenistan												
Project Title:	Energy Efficiency and Renewable Energy for Sustainable Water Management in Turkmenistan												
PIMS no.	4947												
Implementing Partner (Executing Agency)	Ministry of Water Economy of Turkmenistan												
GEF Outcome/ Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Donor Name	Atlas Budget Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Amount Year 5 (USD)	Amount Year 6 (USD)	Total (USD)	See Note:
COMPONENT 1	MWE/UNDP	62000	GEF	71200	International consultants	42,000	42,000	52,500	42,000	14,000	24,500	217,000	1
				71300	National consultants	46,750	49,300	51,700	48,100	39,700	42,700	278,250	2
				71400	Contractual services-individual (Project Manager)	28,940	28,940	28,940	28,940	28,940	28,940	173,640	3
				71600	Travel	10,500	10,500	13,500	10,500	10,500	13,500	69,000	4
				72100	Contractual services-companies	22,500	23,350	24,150	22,950	20,150	21,150	134,250	5
				72200	Equipment	0	1,212,500	62,500	0	0	1,275,000	6	
				74200	Communications & publishing	3,200	3,500	3,500	3,500	3,500	3,500	20,700	7
				75700	Workshops and meetings	5,500	2,500	2,500	2,500	2,500	2,500	18,000	8
					Sub-total GEF	159,390	1,372,590	239,290	158,490	119,290	136,790	2,185,840	
					Total Outcome 1	159,390	1,372,590	239,290	158,490	119,290	136,790	2,185,840	
COMPONENT 2	MWE/UNDP	62000	GEF	71200	International consultants	35,000	35,000	38,500	17,500	14,000	3,500	143,500	1
				71300	National consultants	37,150	42,100	42,100	28,900	36,675	35,975	222,900	2
				71400	Contractual services-individual (Project Manager)	26,210	26,210	26,210	26,210	26,210	26,210	157,260	3
				71600	Travel	10,000	10,000	10,000	10,000	10,000	2,000	52,000	4
				72100	Contractual services-companies	19,300	20,950	20,950	16,550	8,775	8,675	95,200	5
				72200	Equipment	0	1,112,500	912,500	0	0	2,025,000	6	

COMPONENT 3	MWE/UNDP	62000	GEF	74200	Communications & publishing	1,200	2,100	2,100	2,100	1,200	1,200	9,900	7
				75700	Workshops and meetings	3,000	0	0	0	0	0	3,000	8
				Sub-total GEF									
				Total Outcome 2									
				71200	International consultants	131,860	1,248,860	1,052,360	101,260	96,860	77,560	2,708,760	
				71300	National consultants	131,860	1,248,860	1,052,360	101,260	96,860	77,560	2,708,760	
				71400	Contractual services-individual (Project Manager)	21,000	42,000	66,500	14,000	14,000	38,500	196,000	1
				71600	Travel	7,500	7,500	7,500	7,500	7,500	7,500	45,000	4
				72100	Contractual services-companies	2,350	2,350	6,150	4,350	3,350	4,350	22,900	5
				74200	Communications & publishing	15,000	25,000	25,000	25,000	15,000	15,000	120,000	7
COMPONENT 4	MWE/UNDP	62000	GEF	75700	Workshops and meetings	6,200	5,000	5,000	5,000	5,000	5,000	31,200	8
				Sub-total GEF									
				Total Outcome 3									
				71200	International consultants	63,195	92,995	132,695	72,995	58,995	87,495	508,370	
				71300	National consultants	63,195	92,995	132,695	72,995	58,995	87,495	508,370	
				71400	Contractual services-individual (Project Manager)	10,500	14,000	20,500	10,500	10,500	20,500	86,500	1
				71600	Travel	25,150	32,350	32,350	32,350	32,350	29,950	184,500	2
				72100	Contractual services-companies	12,395	12,395	12,395	12,395	12,395	12,395	74,370	3
				74200	Communications & publishing	0	3,000	3,000	3,000	3,000	3,000	15,000	7
				75700	Workshops and meetings	1,500	3,000	3,000	3,000	3,000	3,000	16,500	8
Project Management	MWE/UNDP	62000	GEF	Sub-total GEF									
				Total Outcome 4									
				71400	Contractual services-individual (Project Manager)	60,695	85,795	92,295	82,295	82,295	89,095	492,470	
				71600	Travel	60,695	85,795	92,295	82,295	82,295	89,095	492,470	
				71400	Contractual services-individual (Project support staff)	5,460	5,460	5,460	5,460	5,460	5,460	32,760	3
Project Management	MWE/UNDP	62000	GEF	71400	Contractual services-individual (Project support staff)	10,800	10,800	10,800	10,800	10,800	10,800	64,800	9
				71600	Travel	2,500	2,500	2,500	2,500	2,500	2,500	15,000	4
				Sub-total GEF									





3	<p>The project will engage three full-time staff members under individual service contracts: a Project Manager and two Project Specialists (one in water management and one in agriculture). Salary and benefits are projected at \$2275 per month for the Project Manager and \$1700 per month for the Project Specialists. The Project Manager's time is apportioned in this budget as follows: 20 percent to project management; 30 percent to Component 1; 20 percent to Component 2; 15 percent to Component 3; and 15 percent to Component 4. The Project Specialists' time are apportioned primarily to Components 1, 2, and to a lesser extent to Component 4. This line item also covers the time of support staff hired under UNDP individual service contracts, such as a driver (total \$750 per month).</p>
4	<p>International consultants will travel to Turkmenistan approximately once per year for major assignments. The home location of the consultant will have a very significant influence on travel costs. The budget also includes travel by the Project Manager and Project Specialists for all components in all project years, to monitor the extensive demonstration project activity throughout the country. Travel within Ashgabat and to most demonstration sites (Akhal Velayat including Kaakhka, and possibly as far as Mary) will be carried out by a car and driver. Costs of use and servicing of UNDP-owned motor vehicles, will be shared with other projects. Justification and logging of all motor vehicle travel will be carried out according to UNDP rules.</p>
5	<p>Contracted companies may be hired in Turkmenistan. Their work will be largely similar to that of individual national consultants, but administrative procedures for hiring may differ superficially. Depending on availability of suitable candidates, it can be expected that funds budgeted for national consultants might be used instead for contracted companies, or vice versa. This line item includes design and other technical services but does not include installation costs for major investment/demonstration projects. (Such costs are listed under "Equipment.")</p>
6	<p>Components 1 and 2 include the costs of equipment, materials, and installation associated with investment/demonstration projects. These projects include a) low-water irrigation and "smart" systems in the Akhal velayat; b) pump replacement; c) a municipal water-supply pipeline for Kaakhka; d) expanded production and laying of linings for canals; and e) renewable-energy pumping and purification in a desert pasture area. All equipment expenses are placed in the second and third project years. See Section 2.8 for a detailed discussion of costs of all these investment projects.</p>
7	<p>All four components include activity on communications and outreach via print and electronic media. This activity is greatest in Component 3, which includes the most direct outreach to farmers and water management agency personnel.</p>
8	<p>All components will include workshops and meetings for planning and outreach. This line item includes the direct costs of such meetings – space, special equipment, coffee, services, etc.</p>
9	<p>This item includes the salaries, benefits, and associated personnel costs of various administrative staff members, hired under individual service contracts, who will provide regular administrative support in management oversight, procurement, logistics, accounting, and other functions, each according to specialized areas of responsibility. This line item is assigned entirely to project management, not to components. UNDP co-financing will cover a share of this line item.</p>
10	<p>This line includes the cost of outside professional financial audits of program spending, to be conducted annually after project year 1. UNDP co-financing will cover a share of this line item.</p>
11	<p>Project funds will be used to pay for office equipment for the Project Manager and two Project Specialists, including three workstations, a printer, a modem and a wireless router, a photocopy machine, needed furniture, and other standard items of a modern office.</p>

12	This line includes expected charges for phone, mobile phone (including roaming within Turkmenistan), and Internet for the Project Manager and Project Specialists, as well as a partial share of such costs for project support staff based in the country office, based on known monthly charges issued by Turkmenistan's carriers. UNDP co-financing will cover a share of this line item.
13	Office space for the Project Manager and Project Specialists is to be provided by project partners free of charge. This line item represents a share of rent (\$200 per month) for one room in the UNDP country office, where four staffers in administrative support work. This share will be split between GEF funding (\$100 per month) and UNDP co-financing (\$100 per month).
14	Miscellaneous costs shown here are bank charges (0.7 percent for almost all banking transactions in Turkmenistan). UNDP co-financing will cover a share of these expenses.
15	Direct Project Costs (DPC) are the costs of administrative services (such as those related to human resources, procurement, finance, and other functions) provided by UNDP to the Government of Turkmenistan in relation to the project. Services and associated fees are to be formalized in a Letter of Agreement between UNDP and the Government. Please see Annex 9. Total projected Direct Project Costs amount to \$117,600.

#### Summary of Funds

Source of Funding	Amount Year 1	Amount Year 2	Amount Year 3	Amount Year 4	Amount Year 5	Amount Year 6	Total
GEF	467,400	2,847,700	1,564,100	462,500	404,900	438,400	6,185,000
UNDP*	15,000	17,000	17,000	17,000	17,000	17,000	100,000
Government of Turkmenistan (cash -- budget of Ministry of Water Economy)**	12,000,000	15,000,000	15,000,000	15,000,000	15,000,000	TBD	72,000,000
<b>TOTAL</b>	<b>12,482,400</b>	<b>17,864,700</b>	<b>16,581,100</b>	<b>15,479,500</b>	<b>15,421,900</b>	<b>455,400 or more</b>	<b>78,285,000</b>

\* In addition, UNDP will provide parallel co-financing for closely related work on development of a National Low Emission Development Plan, a National Adaptation Plan, and a Green Economy Strategy, all of which will emphasize water resource management and energy. Efficiency. Parallel co-financing for this work is expected to total approximately \$200,000 beyond the amounts shown in this table.

\*\* The co-financing letter of the Ministry of Water Economy (Annex 2) cites a figure of more than US \$403 million, which is the Government's commitment to investment and maintenance toward increasing the efficiency of large-scale irrigation systems, facilities and pump stations for the period 2015-2020. The \$72 million figure shown here will specifically cover investment and other support for replication of technical and practical solutions developed by the project, at the intersection of water management, energy efficiency, and SLM.

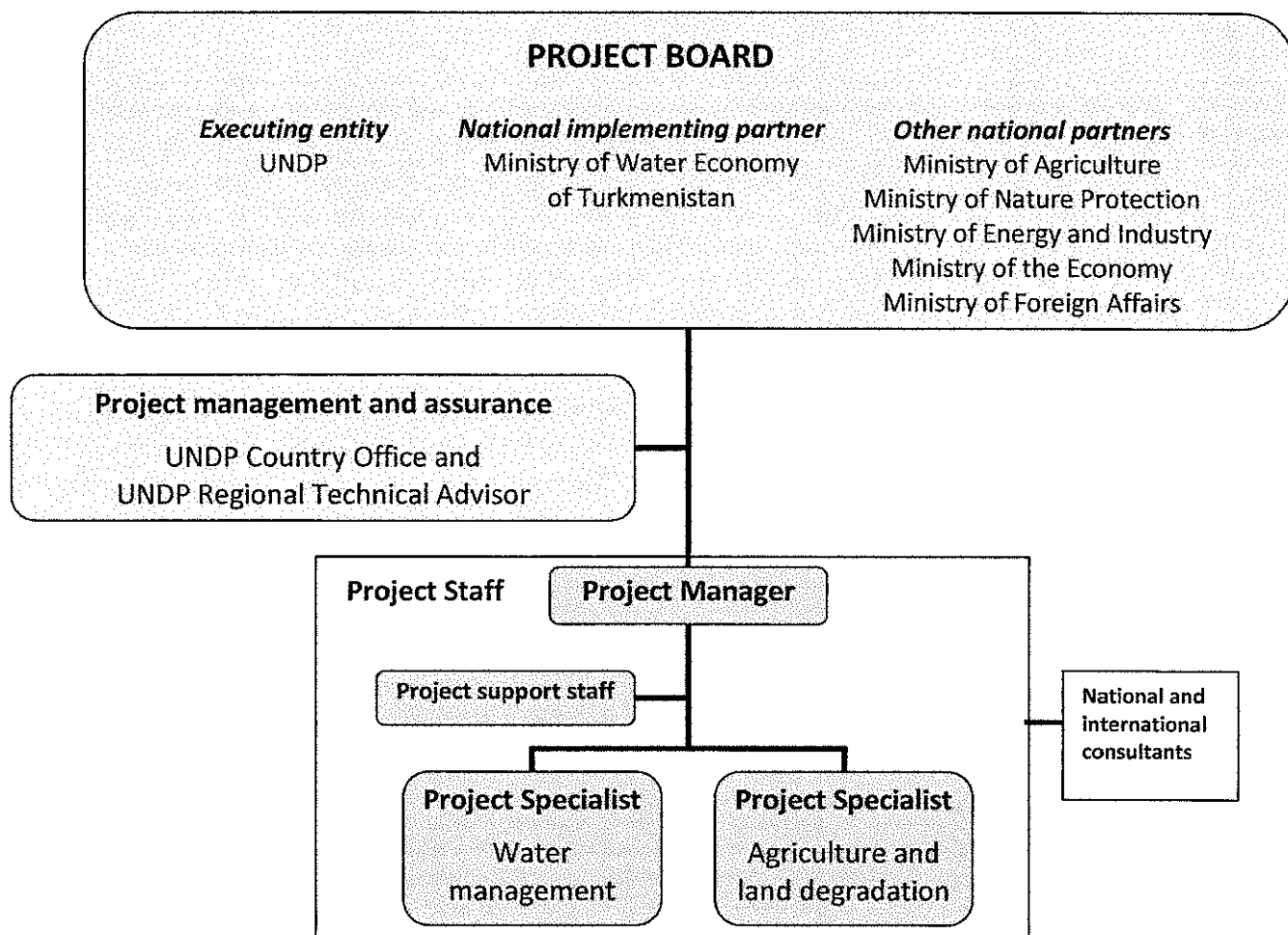
# SUMMARY OF PROJECT CO-FINANCING BY OUTCOME (IN USD)<sup>12</sup>

		Government of Turkmenistan Ministry of Water Economy	UNDP	TOTAL
Outcome 1	Cash	28,300,000		28,300,000
Outcome 2	Cash	35,000,000		35,000,000
Outcome 3	Cash	200,000		200,000
Outcome 4	Cash	8,300,000		8,400,000
Project management	Cash	200,000	100,000	300,000
	In-kind	To be determined; expected to include provision of office space for project staff		
TOTAL	Cash	72,000,000	100,000	72,100,000
Description		National budget allocations for upgrading and maintenance of large-scale irrigation, pumping, canals, and other elements will amount to approximately 200,000 in addition to amount shown here. The \$72 million figure shown to amount shown here will specifically cover investment and other support for replication of technical and practical solutions developed by the project, at the intersection of water management, energy efficiency, and SLM.	Parallel co-financing of related initiatives will amount to approximately 200,000 in addition to amount shown here. See footnote to table above.	
Co-financing letter #		1	2	

<sup>12</sup>All baseline activities and associated co-financing amounts presented in the table relate to the period after the approval of the project. Baseline expenditures for activities already undertaken or which are expected to be undertaken after the end of the GEF project are not included in this table.

## 5. MANAGEMENT ARRANGEMENTS

Figure 5.1. Management structure of the proposed UNDP/GEF project



The project will be carried out under a national implementation modality (NIM). As the national implementing partner, the **Ministry of Water Economy of Turkmenistan** will oversee all aspects of project implementation. This role is consistent with MWE's role as the national agency responsible for water management in Turkmenistan, in defining overall policy directions, implementing major new development initiatives, and operating existing water-management infrastructure. MWE will appoint a senior staff member to serve as the National Project Coordinator (NPC), who will be the lead individual responsible for overseeing the project.

Overall governance of the project will be carried out by the **Project Board**, which will include MWE, other national agencies including the Ministries of Agriculture, Nature Protection, Economy, Energy and Industry, and Foreign Affairs, and UNDP. The Project Board may invite other agencies to join as members, with the roster to be definitively set and approved no later than the project's inception period. The National Project Coordinator will serve as Chair of the Project Board, with assistance from UNDP in organizing and running all meetings and other exchanges of information. Meetings of the Project Board will take place at least once annually in time for approval of the following year's Annual Work Plan. Additional meetings may be called as needed by the NPC.

**UNDP** will join MWE in managing the project and providing quality assurance, in accordance with plans approved by the Project Board. Most of UNDP's work for the project will be based in its Country Office

(CO) in Ashgabat, under the supervision of the Programme Specialist for Environment and Energy and other senior programme staff, including the UNDP Resident Coordinator and Deputy Resident Coordinator as warranted. UNDP will also engage contractors to carry out Midterm and Final Evaluations of the project. The UNDP Regional Technical Advisor, based in the UNDP Regional Service Centre in Istanbul, will provide technical support, assistance with coordination, and overall project monitoring to ensure consistency with expectations from UNDP and GEF.

The day-to-day operations of the project will be carried out by three full-time project staff, headed by the **Project Manager**. The Project Manager will be responsible for carrying out the activities of the project as set forth in this Project Document and any revisions approved by the Project Board. At least one month in advance of the start of each project year, the Project Manager will prepare Annual Work Plans. These plans will be reviewed and approved by the Project Board and thereafter will be used by project staff as tools for planning, implementing, and tracking work flows. In addition, for each meeting of the Project Board, the Project Manager will prepare a full status report on project activity, including recent accomplishments, risks, and proposed mitigation measures. The Project Manager will also be responsible for preparing all required annual reports for UNDP and GEF.

The Project Manager will directly supervise two **Project Specialists**. The Project Specialists will be responsible for the implementation of the technical, policy-related, and educational aspects of all project components, including demonstration projects. It is expected that the specialists will include one person with strong technical expertise in engineering of efficient water-management systems, and one with expertise in agriculture and land degradation. Because the components are all so interdisciplinary and often deeply intertwined, it is expected that both specialists will work across Components 1, 2, 3, and 4, in close mutual support of each other. (Terms of Reference for these positions and the overall staff structure may be revised based on project needs and on availability of suitably-skilled candidates.)

UNDP will **engage national and international consultants** to provide focused technical assistance to the project staff as needed, especially regarding demonstration project design.

UNDP country office staff will assist the Project Manager in all the administrative work of the project, including logistics and clerical work. In addition, the country office will provide administrative support to the Government with regard to various specific administrative functions (such as those involving procurement and financial management). Costs associated with these latter functions will be billed as Direct Project Costs according to a formal Letter of Agreement between the Government and UNDP.

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## 6. MONITORING AND EVALUATION

The project will be monitored through the following M&E activities. The M&E budget is presented at the end of this section. See Section 2 for a discussion of M&E activities to be conducted within individual technical and investment outputs, as well as overall project evaluation to be conducted under Output 3.3.

### **Project start**

A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and programme advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

- a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis à vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
- b) Based on the project results framework and the relevant GEF Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
- c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.
- e) Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

### **Quarterly**

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc... The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

## **Annually**

- **Annual Project Review/Project Implementation Reports (APR/PIR):** This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements.

The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lesson learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

## **Periodic monitoring through site visits**

UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

## **Mid-term of project cycle**

The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation (insert date). The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.



### **End of project**

An independent Final Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation.

During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

### **Learning and knowledge sharing**

Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation through lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

### **Communications and visibility requirements**

Full compliance is required with UNDP's Branding Guidelines. These can be accessed at <http://intra.undp.org/coa/branding.shtml>, and specific guidelines on UNDP logo use can be accessed at: <http://intra.undp.org/branding/useOfLogo.html>. Amongst other things, these guidelines describe when and how the UNDP logo needs to be used, as well as how the logos of donors to UNDP projects needs to be used. For the avoidance of any doubt, when logo use is required, the UNDP logo needs to be used alongside the GEF logo. The GEF logo can be accessed at: [http://www.thegef.org/gef/GEF\\_logo](http://www.thegef.org/gef/GEF_logo). The UNDP logo can be accessed at <http://intra.undp.org/coa/branding.shtml>.

Full compliance is also required with the GEF's Communication and Visibility Guidelines (the "GEF Guidelines"). The GEF Guidelines can be accessed at: [http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08\\_Branding\\_the\\_GEF%20final\\_0.pdf](http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf). Amongst other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF

promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.

Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

## M & E WORKPLAN AND BUDGET

Type of M&E activity	Responsible Parties	Budget US\$ <i>Excluding project team staff time</i>	Time frame
Inception Workshop and Report	Project Manager International consultant UNDP CO, UNDP-GEF Regional Coordination Unit for Europe and CIS (UNDP-GEF RCU)	Indicative cost: \$9,000	Within first two months of project start up
Technical evaluation of demonstration projects and other project activity	Project Manager, Project Specialists, consultants under guidance of UNDP management	Indicative cost: \$104,000	Start, mid- and end of project (during evaluation cycle) and annually when required.
APR/PIR	Project Manager and team UNDP CO, UNDP-GEF RCU	None	Annually
Project Board meetings	Project manager and team, under oversight of Project Board	Indicative cost: \$6,000	Twice annually
Mid-term Evaluation	Project manager and team UNDP CO, UNDP-GEF RCU National and international consultants	Indicative cost: \$53,000	At the mid-point of project implementation.
Final Evaluation	Project manager and team, UNDP CO UNDP-GEF RCU National and international consultants	Indicative cost : \$49,000	At least three months before the end of project implementation
Financial audit	UNDP CO Professional financial auditor, hired by contract	Indicative cost: \$25,000	Yearly after first project year
Visits to field sites	Project Manager and Project Specialists UNDP CO UNDP-GEF RCU (as appropriate) Government representatives	Indicative cost: \$7,200	At least twice annually, varying by component
<b>TOTAL INDICATIVE COST</b> Excluding project team staff time and UNDP staff		\$253,200 (~ 4 percent of total budget)	

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## 7. LEGAL CONTEXT

1. This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA and all CPAP provisions apply to this document.
2. Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.
3. The implementing partner shall:
  - put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
  - assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.
4. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.
5. The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via <http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm>. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.
6. Audit Clause: The Audit will be conducted in accordance with UNDP Financial Regulations and Rules and applicable audit policies on UNDP projects.

ANNEXES

Annex 1. Offline Risk Log

#	Description	Date identified	Type	Probability & Impact (scale from 1 to 5, least to most)	Countermeasures / Mgt response	Responsible party
1	Government commits funds to water conservation and energy conservation at a level insufficient to achieve significant scaled-up effects	Project preparatory phase	Political and financial	P (Probability) = 3 I (Impact) = 3	Government spending is outside the ultimate control of the project itself, as spending decisions are taken by the Cabinet of Ministers. But the project is explicitly designed to be directly consistent with national objectives. One major goal of the project is to provide technical and financial justification to remove doubt and financial risk among decisionmakers. Further countermeasures could include targeted analysis for specific technologies; changes in focus to address matters of highest priority to Government, while still being consistent with project objectives; and intensified communication and outreach.	Project Board
2	Farmers and other stakeholders resist change, complicating efforts of project to introduce new technology, practices, and norms for low-water irrigation	Project preparatory phase	Institutional	P=2 I=2	Farmers already do widely understand the importance of water conservation, and have participated enthusiastically in past projects of international organizations. This project specifically seeks to reduce risk of stakeholder resistance through targeted outreach and training. Incentives or mandates may be included in policy efforts under Component 4.	Project Board and staff
3	Demonstration projects need to be significantly changed because of unforeseen local technical or environmental conditions	Project preparatory phase	Technological and Environmental	P=3 I=2	Water management projects require careful attention to many specific technical and environmental factors, including water sources; end uses; intervening terrain; and other conditions. Each demonstration project will undergo thorough assessment of cost, technical feasibility, expected benefits, and environmental and social impact. Design of projects will be adjusted as needed to account for conditions identified during	Project Board, staff, and technical consultants

#	Description	Date identified	Type	Probability & Impact (scale from 1 to 5, least to most)	Countermeasures / Mgt response	Responsible party
					these assessments. Timetables for demonstration projects will have some flexibility built into them, to allow for needed adjustments.	
4	Replication of demonstration project technology and practices lags because of insufficient availability of materials and products	Project preparatory phase	Institutional and economic	P=1 I=2	Efficient irrigation technology is under development in Turkmenistan, and scaling up domestic production is a priority of the Government. Canal lining technology is likely to be rather simple and not export-dependent. Demonstration projects will emphasize use of technologies and materials that are accessible in Turkmenistan. The project will assess the cost and supply flows of imported products such as pumps before recommending them for wide use.	Project staff
5	Reduction in end-use water consumption and increased pump performance does not automatically lead to energy savings and avoided emissions.	Project preparatory phase	Technical	P=3 I=3	Reduction in end-use water consumption needs to be accurately forecasted, measured, and then coordinated with upstream water management and pumping schedules. This integration is a major emphasis of the project.	Project staff, technical consultants, regional and local agencies of MWE
6	Climate change – specifically, increased average temperatures and reduced precipitation – exacerbates problems of water scarcity and land degradation, muting the benefits of the project	Project preparatory phase	Environmental	P=2 I=1	The Government of Turkmenistan recognizes that as a result of climate change water run-off provided by its major river, Amu-Daria, may further decrease (i.e. 65-75% of the total average amount) and therefore water saving programmes in agricultural sector are among the top of national priorities. The proposed project will help alleviate the risk of water shortage by introducing and promoting improvements in water and energy efficiency and an integrated water-energy management approach in irrigation thus leveraging win-win opportunities for climate change mitigation and adaptation.	Project Board and staff

## **Annex 2. Letters of co-financing**

The co-financing letters are included as separate attachments.

### **Annex 3. Summary of Responses to Review of PIF by GEF Secretariat and STAP**

This Project Document takes into account reviews prepared in 2013 by the GEF Secretariat and the GEF Scientific and Technical Advisory Panel (STAP) based on the Project Information Form (PIF). The table below enumerates comments from these reviews and summarizes the response reflected in the Project Document. (Most GEF Secretariat comments on the PIF have already been addressed and cleared. The table includes only those comments that have not previously been cleared.)

<b>GEF Secretariat</b>		
<b>Reviewer comment</b>	<b>Response</b>	<b>Relevant sections of Project Document</b>
<i>Please clarify how the project will support sustained resources devoted to improving EE in main irrigation systems beyond project duration. The proposed activities on standards and audit, enforcement are clear, but the PIF would need clarifications on the financing sustainability for the activities on EE improvement in the main irrigation systems.</i>	<p>At present, water management in Turkmenistan remains the purview of the state in terms of investment, ownership of infrastructure, and incentives to conserve water and energy. Therefore, under the current system, financial sustainability depends largely on the Government's willingness to invest needed resources in water conservation, both in interdistrict infrastructure and on-farm irrigation. Such willingness is evident from the Government's current and future financial commitments, as indicated in its co-financing letter. The project is committed to assisting the Government in justifying and optimally directing its financial commitments by field-testing and documenting the performance of various technologies.</p> <p>But the project and its partners are also looking at the longer term. Policy reforms under the existing Water Codex would lead to transition to a paid basis for water consumption, thus creating an array of new market-based and other financial mechanisms for reducing water use and investing in efficiency. Such reforms are a major focus of the project's fourth component.</p>	Section 2.2 (Outputs 4.2 and 4.3); Annex 2
<i>In search of sustainable financial means supporting changes in agricultural practices, please check if there are agricultural subsidies (or subsidies on fertilizers) since modifying those subsidies may prove very effective to get sustained incentives to further deploy low-GHG practices in agriculture.</i>	The Government guarantees purchases of staple crops and also provides financing for farmers for procurement of equipment. As noted in Output 4.3, these financial relationships will be considered as possible leverage points for incentives for water conservation and low-GHG practices in agriculture.	Section 2.2 (Output 4.3)



<i>The proposal of a prototype for RE incentive scheme under component 3 is very interesting. Please consider including something similar for the support provided to EE improvement in irrigation and N2O emission reduction in the main irrigation areas.</i>	Establishment of incentives for EE irrigation and N <sub>2</sub> O reduction as well as renewables will require policy reform and commitment of Government budget resources as a preliminary step. Such reform is the central focus of Outputs 4.3 and 4.4, which cut across various possible types of incentives and technologies, with linkages to Components 1, 2, and 3.	Section 2.2 (Outputs 4.3 and 4.4).
<i>Please clarify how the project will sustain the activities enabling to take into consideration water resources issues after project completion</i>	<p>As noted a few responses above and also throughout the Project Document, water resource issues already do demand significant priority of the Government, as reflected in its investment commitments as well as various policy statements from the President and state programmes. Given the geographic condition of Turkmenistan, water resource management will continue to be a centrally important issue long after the end of the project.</p> <p>On a more specific level, the project will assure the sustainability of its various activities after project completion through an integrated approach involving adoption of permanent policy reform, investment in lasting infrastructure, and technical and administrative capacity-building across all components.</p>	Section 1.1, Section 1.6, Section 2.2, Section 2.9
<i>Please clarify the complementarity of the PIF compared to the other considered co-financers.</i>	The Project Strategy section of the Project Document elaborates in great detail how GEF funding will be used for incremental project activity to enhance the plans and financial commitments of MWE and other agencies of the Government in water management, energy efficiency, and sustainable land management. Section 4 and Annex 2 present committed co-financing arrangements in detail, including breakdowns by source, by year, and by project component.	Section 2, Section 4, Annex 2
<b>STAP</b>		
<b>Reviewer comment</b>	<b>Response</b>	<b>Relevant sections of Project Document</b>
<i>There is a need for a better integration of the different</i>	Water efficiency, energy efficiency, land remediation, and agricultural productivity all	Sections 1 and 2 (see

<p><i>components of the proposed project to make it a truly multifocal area project. A project demonstrating an integrated "Food-Energy" concept will be highly valuable to demonstrate than a "Sustained food production-sustained water and nutrient management-GHG emission reduction/carbon sequestration".</i></p>	<p>remain defining focus areas of the project. Integration among these areas is thoroughly discussed in the situation analysis and project strategy and is reflected across all proposed activities. Efficiency of water delivery and use can be considered the central unifying issue, as it directly affects both energy consumption and agricultural yields. Land remediation is also directly affected by water management, on both the supply and drainage sides. We have also conducted new analysis indicating an unforeseen benefit of focal-area integration – reduction in energy consumption by heavy machinery as a result of increasing agricultural yield per hectare.</p> <p>Nutrient management will not be an area of emphasis in the project, but will be included in work on sustainable land management planning. Carbon sequestration will not be addressed at all.</p>	<p>especially Section 2.2), Annex 6</p>
<p><i>It is better to focus on one region and develop real integrated energy-crop management-pasture management-nutrient management-water management interventions. It may be better to focus on Sakar-chaga region where arable land exists and it's possible to implement irrigation, crop management, land reclamation, etc interventions.</i></p>	<p>The project will indeed focus on one region (in the Akhal Velayat) to develop and field-test integrated interventions in water management, energy efficiency, and agricultural practice. At the same time, the project will also reach other regions of the country via work on planning, policy, and educational outreach in these areas.</p>	<p>Section 2.2 (Outputs 1.1, 1.3, 2.1); Section 2.3</p>
<p><i>The project also appears complex and will be very hard to manage. Several projects are already underway – so the question is - where could a GEF project, designed as a manageable contribution to enhance what is already being done, best fit into the overall programme?</i></p>	<p>All project activities have been designed to fill gaps and to build upon existing activity without redundancy or conflict. The project is indeed broad and complex. Management arrangements, including the division of technical work among two full-time Project Specialists and a Project Manager, should alleviate management challenges.</p>	<p>Section 1.6, Section 2.2, Section 5</p>
<p><i>Integrated energy efficiency-renewable energy systems are casually mentioned. The rationale for selecting both energy efficiency-renewable energy or only energy efficiency or only renewable energy systems need to be developed.</i></p>	<p>Opportunities for renewable energy have been thoroughly evaluated and only the most promising among them have been targeted for project activity. These areas include gravity-driven municipal water supply for foothill areas and small-scale solar pumping and purification for remote areas. Integration with energy efficiency as such will not be a major focus of these renewable-energy projects, but of course energy</p>	<p>Section 2.2 (Outputs 1.1, 1.2, 2.2 for energy efficiency and Outputs 1.3 and 2.1 for renewable energy).</p>

	efficiency will be a major focus of other project components.	
<i>Use of solar energy for large scale pumping will be a very expensive option and may make crop production based on such a technology not feasible. It is not clear if the wind energy availability matches the seasonal irrigation requirements.</i>	The observation about large-scale solar-powered pumping is absolutely correct. Solar energy will therefore be deployed only for a limited number of small-scale pilot projects. Because of its technical limitations in Turkmenistan, wind energy is not foreseen as an area of project activity.	Section 2.2 (Output 1.3)
<i>Irrigation of pastures to promote grazing in low rainfall regions may not be a feasible option at all, that too using solar water pumping technology. Lands may not be suitable for irrigation and it will be a very expensive proposition to irrigate pasture lands for grazing.</i>	This is again correct. Solar water pumping and purification in pasture areas will focus on watering livestock and serving human needs.	Section 2.2, (Output 1.3)
<i>Pasture land management on three small areas totalling~2500 hectares will be too small to make any impact on halting land degradation, since livestock can move in and out of such a small area unless it is fenced.</i>	The project's efforts to reduce land degradation and facilitate land reclamation will low-water irrigation, drainage, and reduction of infiltration and salinization around canals, as well as overarching work on planning and policy at both regional and national levels. The spatial scale of this work will be much larger than just three sites and 2500 hectares.	Section 2.2 (note especially Outputs 1.1, 1.3, and 2.1)
<i>A renewable energy based desalinization facility for irrigation in a desert region will be a very expensive and impractical option.</i>	This is absolutely correct. Solar water pumping and purification in desert areas will focus on watering livestock and serving human needs, not irrigation.	Section 2.2 (Output 1.3)
<i>Sustainable water supply will be a challenge in low rainfall regions. Desalinization will be a very expensive proposition for crop production and even more difficult for pasture land.</i>	Within this project, efforts on desalinization (purification) of water will draw upon weakly mineralized groundwater and drainage as input material. Purification of water will require relatively little energy serve end uses of limited scale (livestock watering and human needs), not irrigation. Desalinization of <b>land</b> does remain a very important focus of the project, and will be achieved via both reduced water application and improved drainage.	Section 2.2 (see especially Outputs 1.1 and 1.3)
<i>The project managers must conduct some preliminary economic analysis of different technologies and interventions proposed in the project and select only those which can be financially sustainable.</i>	Assessing cost-effectiveness of efficiency projects in Turkmenistan differs from such assessment in other countries because water and energy are essentially free of charge. At least at present, therefore, efficiency investments do not pay themselves back via avoided costs and demonstrate financial sustainability in that sense.	Section 2.8

	Still, UNDP, an international consultant specializing in water management engineering, and experts from the State Institute for Water Management Design (SIWMD) of Turkmenistan have examined various possible technologies and interventions in terms of technical potential, replicability, and cost-effectiveness in terms of benefits per dollar of initial investment. See Section 2.8.	
<i>A good baseline scenario needs to be developed to assess the current GHG emissions, soil organic carbon status to enable assessment of global environmental benefits.</i>	The Project Document contains a full assessment of GHG emissions reduction potential based on known baseline conditions.	Section 2.5 and Annex 6
<i>The source of technology for the proposed modern efficient RE-based irrigation systems and renewable energy &amp; energy efficiency systems is not clear. Are such technologies nationally available or will the project involve technology transfer from other countries?</i>	To maximize feasibility and replicability, the project emphasizes use of technologies and materials that are already widely available in Turkmenistan. For canal linings, expanded domestic production is an explicit goal.	Section 2.2 (see especially Output 2.2)
<i>The concept of focusing on improved water management and reduced fossil fuel energy inputs (through efficiency and renewable energy substitution) is sound. This should involve demand side use of water – for example, by monitoring soil moisture content and applying only when needed, using innovative irrigators that sense how much water is needed for every square metre (using GPS technology for example <a href="http://www.precisionirrigation.co.nz/en/dealerships/index/?showdetails=true">http://www.precisionirrigation.co.nz/en/dealerships/index/?showdetails=true</a>) and continually vary water flows on each irrigator nozzle to suit. Avoiding excessive water use should be the first goal as this then saves water, energy and GHG emissions.</i>	This is absolutely correct. The application of “smart” systems that determine water needs and deliver only needed quantities is the defining aspect of Output 1.1. The use of GPS technology as indicated could be one part of this field testing an demonstration.	Section 2.2 (Output 1.1).
<i>Some of the water sources are in the mountains, yet hydro-power is not mentioned. Many examples exist of combining water for electricity</i>	This is quite correct. The new proposed Output 2.1 directly seeks to tap the potential of gravity-driven water supply from mountain areas, and also to explore the possibility of hydroelectric	Section 2.2 (Output 2.1)

generation and for irrigation. Even low-head turbines can be used on water channels to power water pumps ( <a href="http://www.irrigationnz.co.nz/assets/Uploads/poster-small-Graeme-Martin.pdf">http://www.irrigationnz.co.nz/assets/Uploads/poster-small-Graeme-Martin.pdf</a> ). This can be far cheaper than solar PV.	generation at the ends of pipelines running downhill.	
<i>Having three demonstrations to represent the coast, desert and oasis eco-systems is good in principle, but to overcome the complexities, perhaps just one area could be selected initially, then the others brought in at a later stage, once the methodology has evolved.</i>	This recommendation has been fully accepted. The project will create one polygon for testing and demonstrating irrigation technology, one demonstration for municipal water supply, and one for solar-powered water pumping and purification, instead of trying to conduct demonstrations at multiple sites for each technology type. All these sites are in the Akhal velayat. The project will seek to create replication in other regions via outreach, planning, policy, and justification of investment.	Section 2.2 (see especially Outputs 1.1, 1.3, 2.1)
<i>GEF financed activities (paragraph 25) should include monitoring the local renewable energy sources (solar radiation, mean annual wind speeds, hydro potential). This is a gap (as noted in point 3 above).</i>	All individual investment projects involving renewable energy will contain full technical assessments of energy potential, as well as post-installation monitoring, but are not expected to include wind power at all. On a broader level, Technology Action Plans for all five velayats of the country will also be developed, including assessment of renewable energy potential for water management.	Section 2.2 (See especially Outputs 1.3, 2.1, 3.1)
<b>Germany (at the 45<sup>th</sup> meeting of the GEF Council)</b>		
<b>Reviewer comment</b>	<b>Response</b>	<b>Relevant sections of Project Document</b>
<i>Regarding the global benefits, improved household income through intensified agricultural production is mentioned. Links to negative environmental impacts are not established and, more importantly, the current barrier to intensification, water shortage/ scarcity, is not addressed. Here the potential for and the importance of the mentioned use of drainage water should be defined.</i>	The project strategy (Section 2.1) has been refined in order to emphasize and clarify the integration of global environmental objectives in climate change mitigation and land degradation, as well as social and economic development objectives, all to be achieved together through activities in water management. The situation analysis goes into considerable detail about how irrational water use leads to negative environmental impacts, especially salinization of land, and how improved water use can improve land conditions.	Section 1.3 (situation analysis on land degradation connected with water management); Section 2.1 (introductory subsection on project strategy); Section 2.2

	<p>The project's work on low-water irrigation will significantly lessen problems of water scarcity because it will show how to use less water to achieve equal or greater crop yields for a given amount of land. Activities on solar water pumping and purification, municipal water supply in Kaakhka, and canal linings are all intended to expand available water supply. Activities on low-water irrigation and canal linings are also explicitly designed to reduce the negative environmental impacts of land degradation.</p> <p>The project will seek to use weakly mineralized drainage water as a source for solar water pumping and purification for livestock. Use of drainage water for the much larger volumes needed for irrigation has been assessed and determined not to warrant emphasis in the project.</p>	(outputs 1.1, 1.3, 2.1, 2.2).
<p><i>Crucial for the success of the proposed activity is the modification of the technical norms concerning irrigation equipment. Especially their prescriptive character is perceived as an inhibitor to modernization of equipment. Although the importance of this aspect, addressed in component 4, the risk of the policy level opposing any modification of the current norms is neither mentioned nor targeted by measures.</i></p>	<p>The risk of opposition to technical and policy reforms, including norms/standards, is discussed in Section 2.4 and included in the Risk Log of Annex 1. The project intends to manage these risks and reduce stakeholder resistance in several ways: 1) by demonstrating and documenting the technical feasibility and cost-effectiveness of new irrigation equipment and techniques; 2) by engaging stakeholders in the process of policy elaboration; and 3) by conducting educational outreach and advocacy among local, regional, and national officials and stakeholders</p>	<p>Section 2.2 (Outputs 1.1 and 3.1); Section 2.4; Annex 1; Annex 5.</p>
<p><i>The PIF remains silent on measures that fight the significant expansion of agricultural lands into other ecosystems like bush forests. Intensification of production is the only measure mentioned, but a thorough analysis of the problems seems to be missing. Further, measures against the increased salinization, blamed for yield decreases in the range of 20-30%, are undefined, but might already be covered by other existing activities. This seems to be a problem and also the relevant land code of</i></p>	<p>The focus of the project is on reducing water consumption, ameliorating land degradation, and increasing productivity of existing lands in Turkmenistan. Raising yields does indeed remain the most immediate and sustainable way to reduce pressure to create new cultivated land area. Further detailed analysis or measures to prevent expansion of future agricultural activity and land conversion in Turkmenistan would fall beyond the scope of the project.</p> <p>Strategies to combat salinization are now explained in detail in Section 1, and specific activities are elaborated in detail in Section 2.</p>	<p>Section 1.3, Section 2 (see especially Outputs 1.1, 2.2, and 4.4)</p>

<i>Turkmenistan is deemed to be weak on defining instruments against land degradation.</i>	Germany's observation of the lack of defining instruments to remedy land degradation in connection with the Land Codex is correct. The project explicitly seeks the creation of such instruments in Output 4.4.	
<i>Duplication of activities has to be avoided: For some activities, at least, duplication of activities cannot be excluded from the current state of the PIF. The BAU Summary describes that many activities aiming at energy efficiency, renewable energy, sustainable use of water, and land degradation are under way while it is stated that none had so far adopted an integrated approach to energy and water. As water is a major backbone of the Turkmen economy, it is hard to understand that activities targeting the energy sector should not already create a link between energy and water. °</i>	<p>Previous international program efforts on energy efficiency in Turkmenistan have focused on the buildings. International projects on water and SLM have not drawn a linkage with energy efficiency. So while scepticism is understandable, the proposed UNDP/GEF project's emphasis on integration of linkages between energy and water is indeed quite new for the country.</p> <p>Specific components and technical activities on pumps, municipal water supply, and canal linings are completely new. Work on efficient irrigation and solar water pumping and purification has been conducted by others in the past, but the Project Document elaborates in detail how activities in these areas will avoid duplication.</p>	Section 2.2 (especially Components 1 and 2)
<i>Duplication might also occur for the activity "Monitor SLM plan implementation" being part of component 3 and for the identification for the location of pilots being part of component 2, but already executed under UNDP/GEF/ GTZ Sustainable Land Management Project (paragraph 36).</i>	The Project Document describes activity already conducted in Turkmenistan by the cited project (CACILM), which ended in 2013. The new UNDP/GEF project will draw upon knowledge from the CACILM project in several ways related to tools and methodologies: 1) building upon existing materials to provide enhanced training; 2) building upon existing contact lists to ensure effective outreach; 3) building upon existing reports and analysis with regard to policy; and 4) involvement of the trainers in enhancement and delivery of training. The new project will avoid duplication via emphasis on new and previously unaddressed technology (such as "smart" irrigation and canal linings), as well as regional planning efforts. (CACILM's SLM planning and policy work was at the national level.)	Section 1.6; Annex 8 (Tracking Tool for Land Degradation, Tab II on Outcomes and Learning)
<i>Please clarify the requirement for pilots as the major barrier to adoption of more energy efficient irrigation infrastructure allegedly lies in the lack of human capacity and the existing norms. Both</i>	This assertion about the importance of human capacity and norms is correct. The structure of components has been recast, such that the first two components emphasize knowledge development and technology proving in irrigation, pumps, solar water systems, municipal	Section 2.2

<i>barriers cannot be tackled by piloting. 37</i>	water supply, and canal linings. The third and fourth component focus on capacity development and policy development (including norms), in direct recognition of their importance for scaled-up adoption of advanced technology and practice.	
<i>Costs must be incremental. With respect to the investment program for irrigation infrastructure under control of the Ministry of Water Resources in the extent of 100 mln US\$ it remains unclear if the mentioned co-financing by the same institution in the amount of 22 mln US\$ is on top of the existing investment program. In this context, Germany seeks also clarification in how far the mentioned co-finance by the European Union (1.0 mln US\$) and by Chevron (1.5 mln US\$) can be deemed incremental and are not already included in the baseline. ▫</i>	<p>We agree with the need to clarify what is baseline funding and what is co-financing for the project. MWE's co-financing letter cites a figure of \$403 million, including efficiency-related upgrades to irrigation systems and pumping stations. The Project Document shows \$72 million in co-financing from MWE, which reflects funding to be specially allocated to efficiency upgrades in connection with the project.</p> <p>Funds from the European Union and Chevron are no longer included as co-financing.</p>	Section 4; Annex 2
<i>Beyond the mentioned collaborations, collaboration with World Bank, ESMAP might be useful especially in the intersection area between modernization of irrigation infrastructure and identifying climate resilient infrastructure</i>	ESMAP has no projects in Turkmenistan in its database and is therefore not included in the Project Document's discussion of baseline activity, nor in the Stakeholder Involvement Plan. Water management projects in the ESMAP database do include some research and activities on water supply and wastewater, but these are more urban-focused and therefore not so pertinent to the core areas of the project. Nevertheless, the project team will keep channels of communication open in both directions.	N/A



## **Annex 4. Terms of Reference**

### **I. PROJECT BOARD**

#### **Duties and responsibilities:**

The Project Board governs the project and oversees project implementation. The main functions of the Board are:

- General monitoring of project progress in meeting its objectives and outcomes and ensuring that they continue to be in line with national development objectives;
- Strategic leadership and coordination of activities of all members;
- Assurance of access to required information;
- Resolution of conflicts that arise during project implementation;
- Support for broader institutional, legal and regulatory conditions within Government and Turkmen society, as needed to enable the success of the project;
- Review and approval of Annual Work Plans and progress reports;
- Approval of the project management arrangements; and
- Approval of any amendments to be made in the project strategy due to changing circumstances.

#### **Structure and Reimbursement of Costs**

To ensure proper coordination and involvement of key stakeholders, the Project Board will be co-chaired by UNDP and MWE. The MWE, as the key governmental agency in charge of management of water resources, will ensure that other governmental agencies are duly consulted and involved as per their mandate (such as the Ministry of Agriculture, Ministry of Nature Protection, Ministry of the Economy, Ministry of Energy and Industry, and Ministry of Finance). The Board may also include representatives of other national or local agencies. Other participants can be invited into the Board meetings at the decision of the Board.

The costs of the Board's work shall be considered as the Government's or other project partners' voluntary in-kind contribution to the project and shall not be paid separately by the project. Members of the Board are also not eligible to receive any monetary compensation from their work as experts or advisers to the project.

#### **Meetings**

It is suggested that the Board will have regular meetings, twice a year, or more often if required. A tentative schedule of the Board meetings will be agreed as a part of the annual work plans, and all representatives of the Board should be notified again in writing 14 days prior to the agreed date of the meeting. The meeting will be organized provided that the executing agency, UNDP and at least 2/3 of the other members of the Board can confirm their attendance. The project manager shall distribute all materials associated with the meeting agenda at least 5 working days in prior to the meeting.

## **II. NATIONAL IMPLEMENTING PARTNER AND NATIONAL PROJECT COORDINATOR**

The Ministry of Water Economy of Turkmenistan will serve as National Implementing Partner for the project. As a representative of the Government, the National Implementing Partner has the main responsibility to ensure that the project is executed in accordance with Government priorities, as well as with the Project Document and the UNDP guidelines. Expectations for the National Implementing Partner include:

- 1) Assurance of compatibility between the themes of the UNDP/GEF project and the authority of the leading Ministry;
- 2) Integration of the project into the plans and operations of the leading Ministry;
- 3) Taking the lead in solving problems and challenges for the project when they arise;
- 4) Establishment of a mechanism by which Ministry staff could be assigned to the project;
- 5) Taking the lead in helping the UNDP team in designing and implementing the project;
- 6) Provision of office space for the project team during implementation, such that Ministry staff and UNDP project staff can work closely and effectively together;
- 7) Leadership of a Working Group on project development and implementation, which would include all other interested agencies of the Government of Turkmenistan, including calling and chairing periodic meetings.

MWE will assign a senior staff member as National Project Coordinator to personally oversee the work of the Ministry as National Implementing Partner. The National Project Coordinator will work closely with UNDP and project staff in all aspects of planning and management of the project.

### III. PROJECT MANAGER

**Location:** Ashgabat

**Status and duration:** Full-time (40 working hours per week), for full duration of project period (2015-2021) subject to annual performance reviews

**Compensation:** Commensurate with experience and qualifications

**Summary of responsibilities:**

The Project Manager will be the lead full-time staff person responsible for day-to-day oversight of all program activity and fulfillment of outputs and outcomes elaborated in the Project Document.

**Specific duties and responsibilities:**

Operational project management in accordance with the Project Document and the UNDP guidelines and procedures for direct implemented projects, including:

- Management and supervision of project implementation and evaluation across all components. Assurance of successful completion of the project in accordance with the stated outcomes and performance indicators summarized in the Project Results Framework.
- Regular communication and coordination with the National Implementing Partner, members of the Project Board, and all other partners and interested stakeholders, with regard to all project activity. Organization of Project Board meetings at least once, or ideally twice, per year, subject to availability of members.
- Regular communication with senior UNDP management with regard to all project activity. Assurance of coordination with other UNDP projects and broad strategic initiatives.
- Preparation of Annual Work Plans, including monthly targets and deliverables as well as annual spending targets in accordance with the Project Document. Tracking of work outputs throughout the year in light of these Annual Work Plans.
- Tracking and managing of project spending in accordance with the project budget, as well as UNDP rules and procedures, to ensure transparency, responsibility, and timely fulfillment of both program targets and budget targets.
- Preparation and submittal of annual Project Implementation Reviews and other required progress reports to the Project Board, UNDP, and GEF in accordance with applicable requirements, in all required languages (English, Russian, and/or Turkmen, using outside translation as needed).
- Supervision of the experts working for the project, including both Project Specialists as well as international and national consultants.
- Supervision of regular data collection and analysis, as well as reporting and public outreach via the mass media, events, and other means, to disseminate the results of the project and to promote energy efficiency, sustainable water management, and sustainable land management in Turkmenistan.
- Oversight of the overall administration of the project office.

- Regular travel within Turkmenistan to organize and monitor project activity; possible travel outside the country for participation in directly relevant international meetings.
- Support of independent Midterm and Terminal Evaluations of the project.

**Expected Qualifications:**

- University degree in management, economics, water management, engineering, agriculture, natural resource management, or another field with direct relevance to the project
- At least 10 years of experience in managing large-scale projects on climate change mitigation, energy efficiency, water management, and/or sustainable land management in Turkmenistan
- Close familiarity with the roles, activities, and priorities of the Government of Turkmenistan, and particularly the Ministry of Water Economy and other national partners, with regard to energy efficiency, water management, agriculture, and sustainable land management
- Basic technical understanding of water management, irrigation, sustainable land management, and energy efficiency
- Demonstrated ability to work effectively with a broad range of stakeholders
- Demonstrated ability to work effectively under close supervision, as well as under minimal supervision
- Superior skills in organization and management, including past experience with planning, tracking, evaluation, and supervision of consultants and/or employees
- Strong skills in financial tracking and budget management
- Close familiarity with the operations and rules of UNDP is not a requirement but will be viewed with favor
- Fluency in Russian and English, in reading, writing, and speaking. Fluency in Turkmen will be viewed as a strong asset.

**Required application materials:**

Candidates should submit a full curriculum vitae, a brief statement of interest and qualifications, and a financial proposal.

#### IV. PROJECT SPECIALIST ON WATER MANAGEMENT

**Location:** Ashgabat

**Status and duration:** Full-time (40 working hours per week), for full duration of project period (2015-2021) subject to annual performance reviews

**Compensation:** Commensurate with experience and qualifications

**Summary of responsibilities:**

The Project Specialist on Water Management will serve as the project's leading expert on technical and issues in water management. Under the supervision of the Project Manager and with the assistance of various national and international consultants as well as project partners, the Project Specialist on Water Management will manage the following project activities, as elaborated in the Project Document, and will be responsible for timely and complete fulfillment of these outputs. For several activities, responsibility will be shared with the Project Specialist on Agriculture and Land Degradation.

- Output 1.1: Technology proving site and educational platform for low-water irrigation and SLM in agricultural croplands developed and implemented (*joint responsibility with the Project Specialist on Agriculture and Land Degradation*)
- Output 1.2: Audits and servicing of pumps of various sizes in both interdistrict water networks and on farms in all velayats of Turkmenistan
- Output 1.3: Renewable-energy applications of water pumping and purification in remote pasture areas (*joint responsibility with the Project Specialist on Agriculture and Land Degradation*)
- Output 2.1: Installation of pipeline and/or channel linings for municipal water supply in Kaakhka, replacing unlined channels and wells, with documentation of results and presentation of recommendations and cost analysis for replication
- Output 2.2: Lining of interdistrict canals for reduction of water losses and land salinization, including various technologies (*joint responsibility with the Project Specialist on Agriculture and Land Degradation*)
- Output 3.1: Technology Action Plans, including consideration of SLM, developed and implemented at the regional and local levels (*joint responsibility with the Project Specialist on Agriculture and Land Degradation*)
- Output 3.2: Education and direct training provided to water-management system designers, local water management staff and farmers in all regions of Turkmenistan on pump maintenance, irrigation, and other aspects of efficient water management and SLM (*joint responsibility with the Project Specialist on Agriculture and Land Degradation*)
- Output 3.3: Project evaluation and compilation of lessons learned (*joint responsibility with the Project Specialist on Agriculture and Land Degradation*)
- Output 4.1: Standards and regulations for pump performance and maintenance developed and adopted
- Output 4.2: Policy framework for measuring water consumption and making the transition to end-use tariffs developed and adopted

- Output 4.3: Policy and state budget framework for widespread deployment of efficiency improvements to irrigation and water infrastructure adopted and implemented
- Output 4.4. Administrative reform for implementation of integrated water resource management and sustainable land management adopted and implemented (*joint responsibility with the Project Specialist on Agriculture and Land Degradation*)

**Specific duties and responsibilities:**

- Development, execution, and tracking of plans for timely fulfillment of the activities and outcomes enumerated above. Detailed Annual Work Plans with monthly activities and targets will be the main tool for planning and tracking project activity.
- Participation in design, and then direct oversight and quality control over the implementation of demonstration projects enumerated above, including regular site visits
- Oversight of the technical content and design parameters of all project activity enumerated above, especially demonstration projects, to ensure that they fulfill quantitative targets for energy savings, avoided emissions, water savings, and other indices set forth in the Project Results Framework
- Very frequent communication with project partners and interested stakeholders to ensure mutual support, coordination, and timely fulfillment of all steps needed to complete activities.
- Collaboration with international and national consultants.
- Regular data collection and analysis, as well as reporting and public outreach via the mass media, events, seminars, in-field training, and other means, to disseminate the results of the project and to promote energy efficiency, sustainable water management, and sustainable land management in Turkmenistan.

**Expected Qualifications:**

- Technical expertise in the design and implementation of low-water irrigation systems, reduction of losses from canals, efficient operation of pumps
- Advanced university degree in water management engineering
- At least 10 years of working experience on water management in Turkmenistan, including some previous experience working with UNDP or other international agencies
- Basic technical understanding of energy efficiency, climate change mitigation, agriculture, and sustainable land management
- Close familiarity with the institutional processes and organizations involved with water management and irrigated agriculture in Turkmenistan
- Demonstrated ability to work effectively under close supervision, as well as under minimal supervision, and to meet deadlines
- Strong abilities in writing, as well as delivery of presentations and classroom instruction
- Fluency in Russian and Turkmen, in reading, writing, and speaking. Fluency in English will be viewed as an asset.

**Required application materials:**

Candidates should submit a full curriculum vitae, a brief statement of interest and qualifications, and a financial proposal.

## V. PROJECT SPECIALIST ON AGRICULTURE AND LAND DEGRADATION

**Location:** Ashgabat

**Status and duration:** Full-time (40 working hours per week), for full duration of project period (2015-2021) subject to annual performance reviews

**Compensation:** Commensurate with experience and qualifications

### **Summary of responsibilities:**

The Project Specialist on Agriculture and Land Degradation will serve as the project's leading expert on agriculture, reclamation of salinized land, productivity of pastures and irrigated croplands, and sustainable land management. Under the supervision of the Project Manager and with the assistance of various national and international consultants as well as project partners, the Project Specialist on Agriculture and Land Degradation will manage the following project activities, as elaborated in the Project Document, and will be responsible for timely and complete fulfillment of these outputs. For several activities, responsibility will be shared with the Project Specialist on Water Management.

- Output 1.1: Technology proving site and educational platform for low-water irrigation and SLM in agricultural croplands developed and implemented (*joint responsibility with the Project Specialist on Water Management*)
- Output 1.3: Renewable-energy applications of water pumping and purification in remote pasture areas (*joint responsibility with the Project Specialist on Water Management*)
- Output 2.2: Lining of interdistrict canals for reduction of water losses and land salinization, including various technologies (*joint responsibility with the Project Specialist on Water Management*)
- Output 3.1: Technology Action Plans, including consideration of SLM, developed and implemented at the regional and local levels (*joint responsibility with the Project Specialist on Water Management*)
- Output 3.2: Education and direct training provided to water-management system designers, local water management staff and farmers in all regions of Turkmenistan on pump maintenance, irrigation, and other aspects of efficient water management and SLM (*joint responsibility with the Project Specialist on Water Management*)
- Output 3.3: Project evaluation and compilation of lessons learned (*joint responsibility with the Project Specialist on Water Management*)
- Output 4.4: Administrative reform for implementation of integrated water resource management and sustainable land management adopted and implemented (*joint responsibility with the Project Specialist on Water Management*)

### **Specific duties and responsibilities:**

- Development, execution, and tracking of plans for timely fulfillment of the activities and outcomes enumerated above. Detailed Annual Work Plans with monthly activities and targets will be the main tool for planning and tracking project activity.



- Participation in design, and then direct oversight and quality control over the implementation of demonstration projects enumerated above, including regular site visits
- Oversight of the technical content and design parameters of all project activity enumerated above, especially demonstration projects, to ensure that they fulfill quantitative targets for energy savings, avoided emissions, water savings, and other indices set forth in the Project Results Framework
- Very frequent communication with project partners and interested stakeholders to ensure mutual support, coordination, and timely fulfillment of all steps needed to complete activities.
- Collaboration with international and national consultants.
- Regular data collection and analysis, as well as reporting and public outreach via the mass media, events, seminars, in-field training, and other means, to disseminate the results of the project and to promote energy efficiency, sustainable water management, and sustainable land management in Turkmenistan.

**Expected Qualifications:**

- Technical expertise in agriculture and land management, including both irrigated croplands and desert pasture, as well as other land affected by water management (land along canals and drainage facilities, etc.)
- Advanced university degree in agriculture and/or land management
- At least 10 years of working experience on agriculture and land management in Turkmenistan, including some previous experience working with UNDP or other international agencies
- Basic technical understanding of energy efficiency, water management, and climate change mitigation
- Close familiarity with the institutional processes and organizations involved with water management, irrigated agriculture, and pasture management in Turkmenistan
- Demonstrated ability to work effectively under close supervision, as well as under minimal supervision, and to meet deadlines
- Strong abilities in writing, as well as delivery of presentations and classroom instruction
- Fluency in Russian and Turkmen, in reading, writing, and speaking. Fluency in English will be viewed as an asset.

**Required application materials:**

Candidates should submit a full curriculum vitae, a brief statement of interest and qualifications, and a financial proposal.

## Annex 5. Stakeholder Involvement Plan

Stakeholder	Envisaged role and potential areas for co-operation during project implementation
Ministry of Water Economy of Turkmenistan	National implementing partner. A senior representative of this Ministry will serve as Chair of Project Board. Will provide overall project oversight and coordination with national initiatives and strategies regarding water management. Will join UNDP project team in leading design and execution of all project components at both national and velayat levels (including demonstration/investment projects for low-water irrigation, municipal water supply, and canal linings, as well as regional action plans and national policies).
Ministry of Agriculture of Turkmenistan	Member of Project Board. Will participate in design and delivery of all project activity at the farm level, as well as accompanying training for farmers. Will join UNDP, the Ministry of Water Economy, and other ministries in development of national, regional, and local action plans on sustainable land management. Will coordinate all connections between the project and local farmers' associations.
Ministry of Economy and Development of Turkmenistan	Member of Project Board. Water specialists from this Ministry will participate in design and delivery of all project activity. Ministry will provide support especially in projects related to infrastructure and scaling up of investment activity.
Ministry of Energy and Industry of Turkmenistan	Member of Project Board. Will join UNDP in leading monitoring and assessment of energy savings from all project activity. Will join UNDP and Ministry of Water Economy in development of pump specifications. Will join UNDP in identifying and supporting opportunities for scaling up energy-saving technologies and approaches demonstrated in pilot projects.
Ministry of Communal Services of Turkmenistan	Member of Project Board. Will join Ministry of Water Economy and UNDP in overseeing design and implementation of municipal water supply projects (Kaakhka pilot and replication).
Ministry of Nature Protection of Turkmenistan	Member of Project Board. Will provide support in design and assessment of all project activity with regard to climate change mitigation and sustainable land management. Will participate in drafting and review of sublegislative acts and other policies developed under the project. Will support UNDP and other ministries in development of regional action plans for both water management and sustainable land management.
Ministry of Education of Turkmenistan	Will be invited to membership in Project Board. All new curricular material on water management and sustainable land management developed by the UNDP project team and authorized national partners will be submitted to this Ministry for approval for official integration into national educational programs.

State Concern "Turkmengaz"	Will be invited to membership in Project Board. Will provide technical support for monitoring and evaluation of energy savings. Will provide overall coordination in conjunction with other national initiatives on energy efficiency.
"Sun" Institute of the Academy of Sciences	Will be invited to membership in Project Board. Will provide technical and logistical support in design and implementation of photovoltaic water supply demonstration project for desert pasture. Will provide further support in assessment and design of replication projects.
State Institute of Water Management Design (of the Ministry of Water Economy)	Will be invited to membership in Project Board. In conjunction with national and international consultants, will lead design and implementation of demonstration projects on low-water irrigation, municipal water supply in Kaakhka, and canal linings.
Local farmers' associations in all five velayats	The UNDP project team, with the support of the Ministry of Agriculture, the Ministry of Water Economy, and their local branches, will engage local farmers' associations at all stages of all activity related to agriculture, irrigation, drainage, and sustainable land management. This engagement will include initial briefings on the whole project and its components; invitations to provide feedback on demonstration project design and timetables; invitations to provide feedback on regional and local action plans for water management and sustainable land management; and delivery of training integrated into all aspects of program design and implementation. For demonstration projects, formal letters of understanding outlining mutual commitments will be jointly prepared and signed.
Turkmen Agricultural University	Will participate in the development of new curricular material on low-water irrigation and drainage. Upon approval by the Ministry of Education, will deliver this new material through existing and/or new specialties and degree programs.
Dashoguz Agricultural Institute	Will participate in the development of new curricular material on low-water irrigation and drainage. Upon approval by the Ministry of Education, will deliver this new material through existing and/or new specialties and degree programs.
Institute of Energy	Will participate in the development of new curricular material on low-water irrigation, drainage, and renewable energy systems. Upon approval by the Ministry of Education, will deliver this new material through existing and/or new specialties and degree programs.
Institute of Livestock Management	Will participate in the design, implementation, and evaluation of the demonstration project on solar-powered water supply for desert pasture, especially with regard to defining and assessing technical specifications for the water and forage needs of livestock.
Union of Industrialists and Entrepreneurs of Turkmenistan	Will be invited to participate in the design, implementation, and especially dissemination of demonstration projects, especially with regard to new technologies to be introduced in the areas of low-water irrigation, municipal water supply, canal linings, modern

	pumps, and solar-energy installations for water supply and purification.
NGO "Tebigy Kuwwat"	The primary elaborator of specific aspects of the proposed demonstration project on solar-powered water supply for desert pasture. In conjunction with UNDP, the "Sun" Institute of the Academy of Sciences, and other national and international contracted firms, will take the lead in design, implementation, and evaluation of this demonstration project, as well as modified versions for replication elsewhere.

## **Annex 6. Analysis of Reductions in GHG Emissions**

### **Introduction and Summary of Results**

The UNDP project team has estimated direct and indirect avoided GHG emissions using the spreadsheet tool and associated methodology developed by the Scientific and Technical Advisory Panel (STAP) of GEF. Please see the full spreadsheet presented separately along with this proposal.

GHG emissions reductions are projected to come from several kinds of activities in demonstration and dissemination, as shown in Table A.6.1 below. All activities below are assumed to have a measure lifetime of 15 years, which is the default value in the given methodology. Default values are also used for emissions factor for diesel fuel (0.0741 tonnes CO<sub>2</sub> per GJ) and for the assumed “dynamic baseline” adoption rate of 10 percent (that is, the baseline case assumes that technologies promoted by the project would have been adopted anyway, but at a rate one-tenth of the rate assumed under project activity).

Almost all of Turkmenistan’s electricity is from gas-fired thermal plants. These plants represent a variety of older steam-turbine plants and newer gas-turbine plants, with plans for addition of new combined-cycle power stations up to 2017 and beyond. The estimated emissions factors of these various types of power plants range from about 0.55 kg CO<sub>2</sub>/kWh for steam turbine plants to about 0.36 kg CO<sub>2</sub>/kWh for the most efficient combined-cycle plants in the world (not yet present in Turkmenistan). Given this range, we conservatively estimate the emissions factor for electricity at 0.44 kg CO<sub>2</sub>/kWh or 0.44 tonnes CO<sub>2</sub>/MWh.

The GEF STAP methodology defines direct GHG emissions reductions as those achieved via project activity during the project period. It defines indirect GHG emissions reductions as those achieved after the close of the project period via “spillover” replication. For most activities, values for spillover replication are set equal to the GEF STAP methodology’s default of twice the level achieved during the project period). For the photovoltaic water pumping and purification in desert pastures, spillover replication reflects half the default value.

**Table A.6.1**  
**Summary of Projected GHG Emissions Reductions from Planned Activities**

#	Activity	Type of energy saved	Annual energy savings (per unit as indicated)	Number of units completed during project period*	Number of “spillover” replication units after the project period	Projected GHG emissions reduction (tonnes CO <sub>2</sub> )
I.A and I.B	Low-water irrigation in agriculture (Output 1.1 in this document, plus associated	Electricity (pumps) and diesel (farm equipment)	5.4 MWh electricity and 0.34 GJ of diesel per hectare	170 hectares directly as pilot project, plus 10,234	20,800 hectares	809,000 (total)  270,000 (direct);

	replication activities)			hectares via replication		539,000 (indirect bottom-up from spillover replication)
II	<b>Servicing and/or replacement of electric pumps</b> (Output 1.2)	Electricity	50 MWh electricity per serviced or replaced pump	243 pumps	486 pumps	<b>475,200 (total)</b>  158,400 (direct);  316,800 (indirect bottom-up from spillover replication)
III	<b>Servicing and/or replacement of diesel pumps</b> (Output 1.2)	Diesel	84 GJ per serviced or replaced pump	94 pumps	188 pumps	<b>26,400 (total)</b>  8,800 (direct);  17,600 (indirect bottom-up from spillover replication)
IV	<b>Photovoltaic water pumping and purification for desert pasture areas</b> (Output 1.3)	Electricity	10 MWh per solar installation	6 installations (1 installed directly by project, the rest via replication)	6 installations	<b>872 (total)</b>  436 (direct)  436 (indirect bottom-up from spillover replication)
V	<b>Renewable gravity-driven municipal water supply, replacing wells and electric pumps</b> (Output 2.1)	Electricity	13.1 MWh per well pump taken out of operation	41 well pumps in Kaakhka pilot, plus 77 more in replication	188 well pumps	<b>22,500 (total)</b>  11,250 (direct)  11,250 (indirect bottom-up from spillover replication)
VI	<b>Demonstration and deployment of canal linings</b> (Output 2.2)	Significant potential energy savings if reduced water losses mean less need for water withdrawal and associated pumping, but such savings are very difficult to project quantitatively with confidence because of various				

		technical factors, plus the fact that water levels are defined by international agreements.				
	<b>TOTAL</b>					<b>About 1.3 million tonnes of avoided CO<sub>2</sub> emissions (448,000 tonnes of direct reductions during the project period)</b>

\* Net of "dynamic baseline," under which it is assumed that some units would have been implemented even without project activity

The calculations for each activity are based on further specific assumptions and methods as follows.

#### **I.A. Low-water irrigation in agriculture – reduction in pumping energy**

We assume an irrigation volume of 1.5 liters per second per hectare net of rainfall, in accordance with default values for arid climates defined by the Food and Agriculture Organization (FAO).<sup>13</sup> This figure multiplied by the 170 hectares of the Akhal demonstration site yields a scheme irrigation need of 255 liters per second.

The efficiency gains from this project arise from the difference between baseline and improved efficiency levels for conveyance and delivery of water. As shown in Table A.6.2, increased efficiency reduces the needed volume of water by approximately half, or by about 13 million cubic meters per year. (Conveyance efficiency values are estimated by the project team; application efficiencies are taken from FAO default values.)<sup>14</sup>

**Table A.6.2**

**Comparison of needed irrigation volumes with baseline and efficient systems**  
(170-hectare agricultural land parcel, Akhal Velayat)

<b>Type of irrigation scheme</b>	<b>Scheme irrigation need net of rainfall (liters/second)</b>	<b>Conveyance efficiency</b>	<b>Average application efficiency</b>	<b>Total efficiency</b>	<b>Total volume of water needed from interdistrict system (liters/second)</b>
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<sup>13</sup> <http://www.fao.org/docrep/u5835e/u5835e04.htm>

<sup>14</sup> <http://www.fao.org/docrep/t7202e/t7202e08.htm>.

<b>Baseline (furrow irrigation)</b>	255	0.5	0.6	0.3	<b>850</b>
<b>Efficient (drip and sprinkler irrigation)</b>	255	0.7	0.83	0.58	<b>439</b>

Reduced need for water, combined with informational feedback systems, means less energy needed for pumping that water to the farm. The baseline level requires operation of 47 kW of power delivered to water via each of eight electric pumps for 2000 hours per year, while the reduced water volume requires only four pumps. Accounting for inefficiencies of the pumps, we calculate that the reduced need for pumping energy would result in **a reduction of about 598 MWh per year in electricity consumption, or about 263 tonnes per year** for this one site.

Then, using the GEF STAP spreadsheet, we multiply these savings by measure lifetimes (15 years) and account for replication during the project period (analogous measures installed over about 10,000 hectares, or one half of one percent of Turkmenistan's irrigated agricultural cropland), as well as spillover replication after the project period. Such replication is the central goal of the project's supporting work on planning, outreach, and policy (Components 3 and 4). The final estimate for avoided emissions from saved water pumping energy from integrated water management on farms is **slightly above 725,000 tonnes of CO<sub>2</sub>**.

#### **I.B. Integrated water management in agriculture – reduction in operation of heavy farm equipment**

The project team also foresees that efficient water management on farms will result in a modest but meaningful reduction in diesel fuel consumption from the operation of heavy machinery in fields.

Table A.6.3 below shows normative figures on types of heavy equipment and associated diesel fuel consumption for various stages in the annual cultivation of cotton in Turkmenistan. The table shows a total of about 55 liters of diesel fuel consumed per hectare, or about 148 kg of CO<sub>2</sub> emissions per hectare, from various heavy equipment but not including harvesting.

**Table A.6.3**

#### **Normative figures for fuel consumption by heavy machinery in the cultivation of cotton in Turkmenistan**

Type of field work	Tractor model number	Hectares per shift	Average consumption of diesel fuel for tractor, l/ha	Average consumption of diesel fuel, l/ha
Plowing	K-701	10-14	22.5	<b>21.3</b>
	T-150	8-10	19	
	MTZ-80	4-5	22.5	
Harrowing	K-701	48-72	3.0	<b>2.6</b>



	T-150	41-64	2.65	
	MTZ-80	21-45	2.25	
Compacting of soil	T-150	46-70	2.05	2.15
	MTZ-80	26-46	2.25	
Layout of furrows and planted rows	K-701	30-34	7.3	6.1
	T-150	28-34	4.95	
Leveling	T-150	14-26	6.5	7.3
	MTZ-82	9.3	8.0	
	MTZ-80	9.3	7.4	
Sowing	T-150	22	3.6	3.5
	MTZ-82	14	3.5	
	MTZ-80	13	3.6	
First processing run, including application of fertilizer	MTZ-82	13	4.5	4.5
	MTZ-80	8-12	4.5	
Second processing run, including application of fertilizer	MTZ-82	20.2	2.9	3.1
	MTZ-80	14-18	3.25	
Third and fourth processing runs	MTZ-82		4.4	4.7
	MTZ-80		5.0	
<b>TOTAL, not including harvesting</b>				<b>55.25 liters of diesel per hectare</b>
<b>Estimated total, including harvesting</b>				<b>60.8 liters of diesel per hectare (2.21 GJ per hectare)</b>
<b>Associated CO<sub>2</sub> emissions, not including harvesting</b>				<b>About 149 kg CO<sub>2</sub> per hectare</b>
<b>Estimated CO<sub>2</sub> emissions, including harvesting</b>				<b>About 164 kg CO<sub>2</sub> per hectare</b>

The project team estimates that solutions to salinization, uneven watering, and other problems of water management in agriculture could result in an increase of crop yields by 25-35 percent, even with significantly less water consumption. According to top specialists at the State Institute for Water Management, such increased yields per hectare, in turn, could *decrease the amount of land to be cultivated because state quotas and price supports are based on gross yield, not land area*. Furthermore, according to the Government's five-year development plan for 2012-2016, production for the staple crops of wheat, cotton, and rice are expected to stay unchanged or even to drop slightly. Decreased cultivated land area, in turn, would mean less energy spent on cultivating the land in accordance with the above table.

If indeed land were to be taken out of cultivation in reverse proportion to increased yields, then the energy-saving effect could be quite large – much larger, indeed, than reflected in the rather conservative replication scenarios employed under the GEF STAP methodology. But conservatism is warranted for various reasons. Among these is the likelihood that increased yields would not universally lead to strictly proportional reductions in cultivated area; in the medium or longer term, land would remain in cultivation

and expanded harvests of staple crops or cash crops such as fruit would be sold without price supports on domestic or possibly international markets.

Note, in any case, that even if land remains in cultivation and associated energy expenditures remain unchanged, *the energy intensity of agriculture in terms of liters of fuel per unit of harvest yield would fall regardless.*

Table A.6.4 shows several scenarios for possible outcomes regarding increased crop yields and implications for gross energy consumption and energy intensity of agriculture. The table assumes an increase of 30 percent in yield per hectare, with varying levels of reduction of cultivated land.

**Table A.6.4**  
**Indicative scenarios for increased harvests and reduced GHG emissions intensity**  
**via improved irrigation**

	Hectares under cultivation	Tonnes of raw cotton harvested per year	Diesel fuel consumed by heavy field machinery per cotton yield (GJ/tonne)	Gross diesel fuel consumption by heavy field machinery (GJ)	Net annual fuel savings (GJ)
<b>Baseline</b>	170	255	1.473	376	N/A
<b>Increased gross harvest (30 percent)</b>	170	332	1.133	376	-
<b>Increased gross harvest (20 percent); partial reduction in cultivated area</b>	157	306	1.133	347	29
<b>Increased gross harvest (10 percent); partial reduction in cultivated area</b>	144	281	1.133	318	58
<b>Unchanged gross harvest; full potential reduction in cultivated area</b>	131	255	1.133	289	87

Assuming that a 30-percent increase in yield per hectare would be reflected in a 10-percent increased gross harvest (fourth row of Table A.6.5, bolded), we calculate that cultivated land area would be reduced by about 15 percent (26 hectares out of a 170-hectare site), and that diesel fuel consumption would be reduced by about 1600 liters, or 58 GJ for the site.

This figure, extrapolated via the measure lifetimes and replication multipliers explained above, suggests a reduction of about **84,000 tonnes of CO<sub>2</sub> emissions** as a result of reduced diesel fuel consumption by heavy farm equipment. Combining this number with our estimate for avoided emissions from saved pumping energy, we project a **grand total of about 809,000 tonnes of avoided CO<sub>2</sub> emissions as a result of project activity on integrated water management in agriculture.**

## II. Energy savings and associated emissions reductions from maintenance and replacement of water pumps (electric)

There is a great variety of water pumps in the water management system of Turkmenistan, representing all the water-management stages from first withdrawal to final delivery, as well as various sizes, locations, pumping capacities, rated horsepower, and operating times. Not only do pumps vary relative to each other, the operations of any individual pump also may vary from season to season and from year to year. Moreover, depending on its final destination and intervening topography, a given cubic meter of water may be pumped only once between its source and its final destination, or up to several times.

Table A.6.5 presents figures for energy consumption of the 2360 electric pumps owned by the Ministry of Water Economy and its regional and local affiliates. The weighted average electricity demand per pump is 200 kW. Given an estimated average operating time of 1800 hours per year per pump, we estimate that each pump consumes about 360 MWh of electricity per year. Assessment by national and international experts indicates that maintenance and replacement of equipment at outdated electric pumping stations should yield energy savings of approximately 25 percent. We therefore estimate typical annual energy savings of 90 MWh per pumping station per year, and have entered this figure into the GEF STAP spreadsheet.

The project team estimates that it will conduct audit, maintenance and replacement of pumps at 20 stations in the first project year, and that implementation of a national program for auditing, servicing, and replacement of pumps will analogously affect 250 additional pump sites by the end of the project. Accounting for these numbers, expected measure lifetimes, spillover effects according to the GEF STAP methodology and defaults, and GHG emissions factor from gas-fired electricity, we project that the project will achieve about **475,000 tonnes of direct and indirect CO<sub>2</sub> emissions reductions as a result of improved efficiency of electric water pumps.**

**Table A.6.5**

Energy consumption of electric pumps  
of the Ministry of Water Economy of Turkmenistan, including its affiliated and related organizations

	Pump model number and/or brand	Quantity of pumps	Factory-rated water pumping capacity (m <sup>3</sup> /hour)	Energy consumption rate (kW)
<b>Electric pumps</b>				
1	(SNPE-500/10) PG-50	1697	1800	108.36
2	(SNPE-75/100)	2	540	90

3	SN3000-197	9	3040	3200
4	SN400-210	7	432	315
5	D12500-10M	62	12500	500
6	CP3800-935 (FLYGT)	60	9000	450
7	D6300-80-2	23	5948	1600
8	D6300-27-3	62	4938	518
9	D5000-32 (D6300-27-3-1)	8	4000	320
10	D4000-95	19	3684	764
11	D3200-80	1	2500	800
12	D3200-75	25	2905	800
13	D3200-55	2	3240	800
14	D3200-33-2	131	2505	160
15	D2500-62-2	11	2220	393
16	D2000-100 (D2000-100-2)	15	1800	600
17	D2000-21-2 (2D2000-21)	88	1900	160
18	D1600-90 (1D1600-90)	5	1548	500
19	D1250-125 (1D1250-125)	5	970	378
20	D1250-65 (1D1250-63)	15	900	315
21	D630-90 (1D630-90)	2	630	146
22	D300-90	5	300	60
23	D200-30	2	200	32
24	EA300/35	4	1080	132
25	350D90	37	1260	182.5
26	300D90	16	1008	292
27	300D70	3	733.3	266.6
28	200D60A	6	810	152.5
29	RDL-1000-1125	6	1080	(figure not available)
30	RDL-700-70N <sub>e</sub>	11	5400	980
31	SIGMA AQT-1200	2	6480	630
32	OMEGA 3000-560A	4	1512	560
33	IPT 20C	10	3600	165
34	IPT20A	2	3600	800
35	CT302/6	3	144	315
	<b>Total quantity of electric pumps</b>	<b>2360</b>		<b>Average of 200 kW per pump</b>

### III. Energy savings and associated emissions reductions from maintenance and replacement of water pumps (diesel)

National experts from the Ministry of Water Economy and the State Institute for Water Management Design estimate that there are 1179 diesel pumps in the country, as shown in Table A.6.6.

**Table A.6.6**

Pumping volume rates and energy consumption of diesel-powered pumps of the Ministry of Water Economy of Turkmenistan, including its affiliated and related organizations

	Pump model number and/or brand	Quantity of pumps	Factory-rated water pumping capacity (m <sup>3</sup> /hour)	Energy consumption rate (l/hour of diesel fuel)
<b>Diesel-powered pumps</b>				
1	(SNP-500/10) PG-50	1146	1800	14.3
2	PNS-7.5	21	9000	57.65
3	SIGMA AQL-1200	12	6480	140.4
	<b>Total quantity of diesel pumps</b>	<b>1179</b>		<b><i>Average of 16.4 liters of diesel fuel per hour per pump</i></b>

On average, diesel water pumps in Turkmenistan consume about 16.4 liters of fuel per hour of operation. Conservatively assuming 700 operating hours per year, we find that the average diesel water pump consumes about 11,500 liters per year, or a total of about 420 GJ per year (the GEF STAP tool deals with diesel in gigajoules).

The project team will support the auditing of diesel pumps. It is expected that these audits will lead to recommendations for repair and maintenance in some cases, and outright replacement in others. We estimate here that about half of the audited pumps will be repaired or maintained (average savings of 10 percent, or 42 GJ per pump per year) and about half will be replaced (average savings of 30 percent, or 126 GJ per pump per year). Thus the average savings per audited and remediated pump is 84 GJ in diesel fuel. This value has been entered into the GEF STAP tool.

We project that the project will audit and service or replace 5 diesel pumps in the first full project year, and thereafter, replication will take place with auditing and servicing/replacement of 20 diesel pumps per year until the end of the project period. Taking account of measure lifetimes, spillover replication, and the default GHG emissions factor for diesel, the GEF STAP tool yields a projected result of **26,400 tonnes of avoided CO<sub>2</sub> emissions as a result of project activity in the auditing, maintenance, and replacement of diesel water pumps.**

#### **IV. Energy consumption and avoided emissions from municipal water supply**

The demonstration project in Kaakhka will result in energy savings from the decommissioning of 41 electric well pumps. These pumps have an average power of 1.5 kW and operate year-round. From this, it is straightforward to calculate their annual energy consumption.

$$1.5 \text{ kW per pump} \times 8760 \text{ hours/year} \times 41 \text{ pumps} = \text{about } 539,000 \text{ kWh per year}$$

At 0.44 kg of CO<sub>2</sub> per kWh, the estimated annual GHG emissions reduction is about 240 tonnes of CO<sub>2</sub>. Over a 15-year life cycle, the estimated total GHG emissions reduction is about 3600 tonnes of CO<sub>2</sub>.

The Ministry of Water Economy notes that in addition to Kaakhka, there are about 30 other communities in the Kopet-Dag foothills where existing water supply from wells could be replaced with gravity-driven pipelines. Assuming very conservatively that replication of the Kaakhka demonstration occurs so as to warrant the decommissioning of 90 other wells during the project period and 118 wells as spillover replication afterward, then we can use the GEF STAP tool to calculate a total of **about 22,500 tonnes of CO<sub>2</sub> emissions reductions as a result of implementation and replication of the Kaakhka municipal water-supply demonstration project.**

## **V. Demonstration and deployment of canal linings**

Seepage (infiltration) from interdistrict canals, along with excessive water use at farms, is one of the dominant root causes of water losses in Turkmenistan. Reduction of these losses via installation of canal linings holds great potential for saving water, as well as reducing salinization and land degradation. The project team plans to support the Ministry of Water Economy in streamlining and expanding production of the most promising materials, and testing and documenting their performance in the field, with the goal of accelerated implementation of such linings and related technologies across thousands of kilometers of Turkmenistan's interdistrict water management system.

Reduction of infiltration also holds significant potential for energy savings, if reduction of losses downstream are coordinated with less water withdrawal and pumping upstream. But this potential is very difficult to project quantitatively, given the lack of information on canal lining performance. Furthermore, the volumes of water withdrawn from primary transboundary sources including the Amu-Darya are defined by international agreements, whose terms are beyond the scope of this project.

Therefore, here we note simply the strong potential to link reduction of interdistrict water losses with reduction of energy consumption, but do not make any quantitative projections or state any targets in this regard. The project team will still seek to maximize such linkages and to maximally achieve and document results in energy savings and avoided emissions.

## **VI. Photovoltaic water pumping and purification for desert pasture areas**

The project will design and install a photovoltaic installation that will pump and purify water, and also provide electricity for supporting facilities in a desert pasture. This facility will be installed in an area where there is little or no existing electric infrastructure except a small diesel generator that serves an entire community. The photovoltaic installation can be considered as obviating the need either for more diesel generation or grid-supplied electricity.

Assuming capacity of 5 kW and operation 2000 hours per year, the installation will result in 10 MWh of renewable generation. The project team anticipates the completion of six replication projects during the project period, plus another six as spillover. Considering the project as an alternative to gas-fired electricity from the grid and using the associated GHG emissions factor, the GEF STAP methodology yields an estimate of about **872 tonnes of avoided GHG emissions as a result of project activity on photovoltaic water pumping and purification in desert pasture areas.**

The GEF CCM Tracking Tool (see Annex 8) includes a figure of 0.03 MW of installed renewable energy capacity, reflecting six 5-kW renewable installations to be implemented during the project period, including replication. The Tracking Tool also includes a figure of 100 tonnes of CO2 emissions reductions, which is taken from cell S122 of the GEF STAP EE calculation tool, reflecting expected results from the six installations from 2015 through 2021. Both of these figures are included as targets in the Project Results Framework.

#### **Annex 7. UNDP Social and Environmental Screening Report**

Please refer to separate file.

#### **Annex 8. GEF STAP GHG Calculation Spreadsheet and Tracking Tools**

GEF STAP Spreadsheet for Calculating Greenhouse Gas Benefits of GEF Energy Efficiency Projects

Tracking Tools for Climate Change Mitigation and Land Degradation

Please refer to files submitted separately.



**Annex 9. Direct Project Costs: Pending Letter of Agreement between UNDP and the Government of Turkmenistan**

**STANDARD LETTER OF AGREEMENT BETWEEN UNDP AND THE GOVERNMENT FOR THE PROVISION OF SUPPORT SERVICES**

**HOW TO USE THIS LETTER OF AGREEMENT**

- This agreement is used to provide appropriate legal coverage when the UNDP country office provides support services under national execution.
- This agreement must be signed by a governmental body or official authorised to confer full legal coverage on UNDP. (This is usually the Minister of Foreign Affairs, the Prime Minister /or Head of State.) The UNDP country office must verify that the government signatory has been properly authorised to confer immunities and privileges.
- A copy of the signed standard letter will be attached to each PSD and project document requiring such support services. When doing this, the UNDP country office completes the attachment to the standard letter on the nature and scope of the services and the responsibilities of the parties involved for that specific PSD/project document.
- The UNDP country office prepares the letter of agreement and consults with the regional bureau in case either of the parties wishes to modify the standard text. After signature by the authority authorised to confer immunities and privileges to UNDP, the government keeps one original and the UNDP country office the other original. A copy of the agreement should be provided to UNDP headquarters (BOM/OLPS) and the regional bureau.

Dear Seyitmurad Eyamberdiyevich,

1. Reference is made to consultations between officials of the Ministry of Water Economy of Turkmenistan (hereinafter referred to as "the Government") and officials of UNDP with respect to the provision of support services by the UNDP country office for nationally managed programmes and projects. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution designated in the relevant programme support document or project document, as described below.

2. The UNDP country office may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP country office shall ensure that the capacity of the Government-designated institution is strengthened to enable it to carry out such activities directly. The costs incurred by the UNDP country office in providing such support services shall be recovered from the administrative budget of the office.

3. The UNDP country office may provide, at the request of the designated institution, the following support services for the activities of the programme/project:

- (a) Identification and/or recruitment of project personnel;
- (b) Administration of project personnel (Payroll, banking administration, extensions, entitlements etc.)
- (c) Payments to vendors and project personnel;

- (d) Issue/Apply deposits;
- (e) PCA reports review and certification;
- (f) F10 Settlement;
- (g) Identification and facilitation of training activities;
- (h) Procurement of goods and services;

4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies and procedures. Support services described in paragraph 3 above shall be detailed in an annex to the programme support document or project document, in the form provided in the Attachment hereto. If the requirements for support services by the country office change during the life of a programme or project, the annex to the programme support document or project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.

5. The relevant provisions of the Standard Basic Assistance Agreement between the Government of Turkmenistan and the United Nations Development Programme signed on 05 October 1993 (the "SBAA"), including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its designated institution. The responsibility of the UNDP country office for the provision of the support services described herein shall be limited to the provision of such support services detailed in the annex to the programme support document or project document.

6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

7. The manner and method of cost-recovery by the UNDP country office in providing the support services described in paragraph 3 above shall be specified in the annex to the programme support document or project document.

8. The UNDP country office shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

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Signed on behalf of UNDP Turkmenistan

*Jacinta Barrins*  
*Resident Representative*

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For the Government  
Mr. Seyitmurad Taganov  
Minister of Water Economy of Turkmenistan

" \_\_\_\_\_ " \_\_\_\_\_ 2015

Attachment

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#### DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. Reference is made to consultations between UNDP office in Turkmenistan; the institution designated by the Government of Turkmenistan and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed project "*Energy Efficiency and Renewable Energy for Sustainable Water Management in Turkmenistan*", #00090400, "the Project".
2. In accordance with the provisions of the letter of agreement signed on \_\_\_\_\_ and the project document, the UNDP country office shall provide support services for the Project as described below.
3. Support services to be provided:

Support services	Cost to UNDP of providing such support services per case/person in USD	Number of case	Percent of UNDP FT staff involvement	DPC Total Amount in USD
1. Human Resources				
a) TOR review and post classification + creation	34.35	90	50	1,545.75
b) Advertisement	92.22	90	50	4,149.90
c) Short-listing (including long-listing)	184.44	90	50	8,299.80
d) Writing test preparation (questions)	53.57	90	50	2,410.65
e) Writing test arrangement and administration	91.40	90	50	4,113.00
f) Test Evaluation	88.83	90	50	3,997.35
g) Interviewing	184.44	90	50	8,299.80
h) Reference check	40.06	90	50	1,802.70
i) Review recruitment case	25.85	90	50	1,163.25
j) Contract issuance	72.22	90	50	3,249.90
k) Recurrent personnel management services: staff payroll & banking administration & management (for whole contract period)	353.27	90	50	15,897.15
l) <i>Payroll validation, disbursement</i>	123.64	90	50	5,563.80
m) <i>Extension, promotion, entitlements</i>	105.98	90	50	4,769.10
n) <i>Leave monitoring</i>	17.66	36	5	31.79
o) <i>Leave monitoring - Absence data management in Atlas only</i>	5.70	36	6	12.31
p) Staff HR & Benefits Administration & Management ( <i>one time fee, per staff. Services incl. contract issuance, benefits enrollment, payroll setup - this price applies to the separation process as well</i> )	160.80	12	5	96.48
2. Finance				
a) Issue check only (Atlas Agencies only)	12.82	900	30	3,461.40
b) Vendor profile only (Atlas Agencies only)	15.44	300	30	1,389.60
c) Journal Voucher or General Ledger Journal Entry (GLJE)	35.67	300	30	3,210.30
d) PCA reports review and certification	25.80	300	30	2,322.00
e) F10 Settlement	24.82	900	30	6,701.40

f) Issue/Apply Deposits Only	16.36	30	30	147.24
3. Procurement				
a) Procurement not involving CAP - below US\$ 50,000				
- Issue Purchase Order	41.95	480	25	5,034.00
- Follow-up	41.95	480	25	5,034.00
b) Procurement process involving CAP (and/or ITB, RFP, requirements) - above US\$ 50,000)		0		
- Identification & selection	489.45	26	40	5,090.28
- Contracting/Issue Purchase Order	104.07	26	25	676.46
- Follow-up	107.07	26	25	695.96
c) Consultant recruitment			25	0.00
- Advertising	36.11	270	25	2,437.43
- Contract issuance	72.22	270	25	4,874.85
d) Procurement involving RACP (goods, services & consultant > US\$150,000)				
- Contracting	60.67	40	25	606.70
- Issue PO	41.95	40	25	419.50
- Follow up	60.67	40	25	606.70
Asset disposal (without CAP)	28.77	40	25	287.70
Asset disposal involving CAP	229.40	40	25	2,294.00
4. Admin Support				
a) Issue/Renew IDs (UN LP, UN ID, etc.)_UPL	40.10	36	20	288.72
b) Registration for stay in TKM	71.83	60	20	861.96
c) Custom Clearance- Diplomatic cargo	332.46	60	20	3,989.52
d) Visa request (excl. government fee)	59.55	60	20	714.60
e) Transportation Arrangement	15.90	60	20	190.80
f) Hotel Reservation	17.63	30	20	105.78
g) Transportation Voucher Arrangement	10.14	36	20	73.01
h) Ticket request (booking, purchase)	71.79	30	20	430.28
i) Travel Authorization	27.12	30	20	162.72
j) Miscellaneous Letters	12.55	36	20	90.36
<b>Total DPC</b>				<b>117,600.00</b>

#### 4. Description of functions and responsibilities of the parties involved:

As the national implementing partner, the **Ministry of Water Economy of Turkmenistan** will oversee all aspects of project implementation. This role is consistent with MWE's role as the national agency responsible for water management in Turkmenistan, in defining overall policy directions, implementing major new development initiatives, and operating existing water-management infrastructure. MWE will appoint a senior staff member to serve as the National Project Coordinator (NPC), who will be the lead individual responsible for overseeing the project.

Overall governance of the project will be carried out by the **Project Board**, which will include MWE, other national agencies including the Ministries of Agriculture, Nature Protection, Economy, Energy and Industry, and Foreign Affairs, and UNDP. The Project Board may invite other agencies to join as members, with the roster to be definitively set and approved no later than the project's inception period. The National Project Coordinator will serve as Chair of the Project Board, with assistance from UNDP in organizing and running all meetings and other exchanges of information. Meetings of the Project Board will take place at least once annually in time for approval of the following year's Annual Work Plan. Additional meetings may be called as needed by the NPC.

**UNDP** will join MWE in managing the project and providing quality assurance, in accordance with plans approved by the Project Board. Most of UNDP's work for the project will be based in its Country Office (CO) in Ashgabat, under the supervision of the Programme Specialist for Environment and Energy and other senior programme staff, including the UNDP Resident Coordinator and Deputy Resident Coordinator as warranted. UNDP will also engage contractors to carry out Midterm and Final Evaluations of the project. The UNDP Regional Technical Advisor, based in the UNDP Regional Service Centre in Istanbul, will provide technical support, assistance with coordination, and overall project monitoring to ensure consistency with expectations from UNDP and GEF. The day-to-day operations of the project will be carried out by three full-time project staff, headed by the **Project Manager**. The Project Manager will be responsible for carrying out the activities of the project as set forth in this Project Document and any revisions approved by the Project Board. At least one month in advance of the start of each project year, the Project Manager will prepare Annual Work Plans. These plans will be reviewed and approved by the Project Board and thereafter will be used by project staff as tools for planning, implementing, and tracking work flows. In addition, for each meeting of the Project Board, the Project Manager will prepare a full status report on project activity, including recent accomplishments, risks, and proposed mitigation measures. The Project Manager will also be responsible for preparing all required annual reports for UNDP and GEF.

UNDP country office staff will assist the Project Manager in all the administrative work of the project, including logistics and clerical work. In addition, the country office will provide administrative support to the Government with regard to various specific administrative functions, whose costs will be billed as Direct Project Costs according to this Letter of Agreement.

Responsibilities of other entities of the Government are set forth in the table below

Stakeholder	Envisaged role and potential areas for co-operation during project implementation
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Ministry of Water Economy of Turkmenistan	National implementing partner. A senior representative of this Ministry will serve as Chair of Project Board. Will provide overall project oversight and coordination with national initiatives and strategies regarding water management. Will join UNDP project team in leading design and execution of all project components at both national and velayat levels (including demonstration/investment projects for low-water irrigation, municipal water supply, and canal linings, as well as regional action plans and national policies).
Ministry of Agriculture of Turkmenistan	Member of Project Board. Will participate in design and delivery of all project activity at the farm level, as well as accompanying training for farmers. Will join UNDP, the Ministry of Water Economy, and other ministries in development of national, regional, and local action plans on sustainable land management. Will coordinate all connections between the project and local farmers' associations.
Ministry of Economy and Development of Turkmenistan	Member of Project Board. Water specialists from this Ministry will participate in design and delivery of all project activity. Ministry will provide support especially in projects related to infrastructure and scaling up of investment activity.
Ministry of Energy and Industry of Turkmenistan	Member of Project Board. Will join UNDP in leading monitoring and assessment of energy savings from all project activity. Will join UNDP and Ministry of Water Economy in development of pump specifications. Will join UNDP in identifying and supporting opportunities for scaling up energy-saving technologies and approaches demonstrated in pilot projects.
Ministry of Communal Services of Turkmenistan	Member of Project Board. Will join Ministry of Water Economy and UNDP in overseeing design and implementation of municipal water supply projects (Kaakhka pilot and replication).
Ministry of Nature Protection of Turkmenistan	Member of Project Board. Will provide support in design and assessment of all project activity with regard to climate change mitigation and sustainable land management. Will participate in drafting and review of sublegislative acts and other policies developed under the project. Will support UNDP and other ministries in development of regional action plans for both water management and sustainable land management.
Ministry of Education of Turkmenistan	Will be invited to membership in Project Board. All new curricular material on water management and sustainable land management developed by the UNDP project team and authorized national partners will be submitted to this Ministry for approval for official integration into national educational programs.
State Concern "Turkmengaz"	Will be invited to membership in Project Board. Will provide technical support for monitoring and evaluation of energy

	savings. Will provide overall coordination in conjunction with other national initiatives on energy efficiency.
"Sun" Institute of the Academy of Sciences	Will be invited to membership in Project Board. Will provide technical and logistical support in design and implementation of photovoltaic water supply demonstration project for desert pasture. Will provide further support in assessment and design of replication projects.
State Institute of Water Management Design (of the Ministry of Water Economy)	Will be invited to membership in Project Board. In conjunction with national and international consultants, will lead design and implementation of demonstration projects on low-water irrigation, municipal water supply in Kaakhka, and canal linings.
Local farmers' associations in all five velayats	The UNDP project team, with the support of the Ministry of Agriculture, the Ministry of Water Economy, and their local branches, will engage local farmers' associations at all stages of all activity related to agriculture, irrigation, drainage, and sustainable land management. This engagement will include initial briefings on the whole project and its components; invitations to provide feedback on demonstration project design and timetables; invitations to provide feedback on regional and local action plans for water management and sustainable land management; and delivery of training integrated into all aspects of program design and implementation. For demonstration projects, formal letters of understanding outlining mutual commitments will be jointly prepared and signed.
Turkmen Agricultural University	Will participate in the development of new curricular material on low-water irrigation and drainage. Upon approval by the Ministry of Education, will deliver this new material through existing and/or new specialties and degree programs.
Dashoguz Agricultural Institute	Will participate in the development of new curricular material on low-water irrigation and drainage. Upon approval by the Ministry of Education, will deliver this new material through existing and/or new specialties and degree programs.
Institute of Energy	Will participate in the development of new curricular material on low-water irrigation, drainage, and renewable energy systems. Upon approval by the Ministry of Education, will deliver this new material through existing and/or new specialties and degree programs.
Institute of Livestock Management	Will participate in the design, implementation, and evaluation of the demonstration project on solar-powered water supply for desert pasture, especially with regard to defining and assessing technical specifications for the water and forage needs of livestock.



Union of Industrialists and Entrepreneurs of Turkmenistan	Will be invited to participate in the design, implementation, and especially dissemination of demonstration projects, especially with regard to new technologies to be introduced in the areas of low-water irrigation, municipal water supply, canal linings, modern pumps, and solar-energy installations for water supply and purification.
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## SIGNATURE PAGE

### **UNDAF Outcome(s)/Indicator(s):**

Outcome 2.2 – Environmentally sustainable use of natural resources contributes to effectiveness of economic processes and increased quality of life

### **CPAP Outcome(s)/Indicator(s):**

#### **Output 3.2.1 – National authorities better plan, manage, and monitor the environment sector**

Indicator 2. Number of laws revised to align national legislation with international standards

Indicator 3. Number of sectoral plans/strategies revised to integrate respective environmental priorities and concerns, and incorporate strategic adaptation measures

Indicator 5. Number of municipalities apply improved waste disposal and better water/sanitation management

#### **Output 3.2.2 – Local communities contribute to and benefit from sustainable use of natural resources**

Indicator 3. Number of laws and policies revised and aligned internationally for better water governance

Indicator 4. Number of pilot areas practice integrated water resource management

#### **Output 3.2.3 – Government introduces carbon reduction and energy saving technologies.**

Indicator 1. Comprehensive policy framework is in place regulating long-term measures for sustainable use of energy resources and promotion of alternatives/renewables

Indicator 5. Number of pilot projects are in place promoting alternative and renewable sources of energy

### **Country: Turkmenistan**

Programme Period:	<u>2015-2021</u>	Total resources required:	<u>US\$ 78,285,000</u>
Atlas Award ID:	<u>00080840</u>	Total allocated resources:	<u>US\$ 78,285,000</u>
Project ID:	<u>00090400</u>		
PIMS #	<u>4947</u>	Regular UNDP (TRAC)	<u>US\$ 100,000</u>
Start date:	<u>Sep 1, 2015</u>	Other:	
End Date	<u>Aug 31, 2021</u>	GEF	<u>US\$ 6,185,000</u>
Management Arrangements	NIM	Other Cash	<u>US\$ 72,000,000</u>
PAC Meeting Date	<u>tba</u>		

**Executing Entity/Implementing Partner:** United Nations Development Programme

**Implementing entity/Responsible Partner:** Ministry of Water Economy of Turkmenistan

### **Agreed by Ministry of Water Economy:**

NAME	SIGNATURE	Date/Month/Year
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### **Agreed by UNDP:**

NAME	SIGNATURE	Date/Month/Year
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<sup>i</sup> Turkmenistan: Initial National Communication on Climate Change, 1998.

<sup>ii</sup> Turkmenistan Country Analysis. United Nations, 2008.