FRESHWATER COUNTRY PROFILE

CHINA

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1 Regulation of Water Resource

1.1 Time-bound Targets and Commitments

The objectives of the Chinese government are:

- Promoting full, human-centered, coordinated and sustainable development of economy and society and human development.
- Building and improving upon a legal and regulatory system for water resource management.
- Promoting unified management of water resource and integrating management by catchment with management by geographical location.
- Drafting and implementing water resource allocation plans.
- Clarifying water right, establishing the water resource administration mechanism based on the water right and water market theory.
- Introducing an aggregate-control system for water resource of a particular catchment or region, coordinating water uses for residential, industrial and ecological purposes.
- Introducing a water licensing system, a water-use-at-cost system and hearings for water resource use in major construction projects in order to promote sustainable water usage and coordinated development of population, environment, economy and society.
- Creating a reasonable water pricing mechanism, implementing an integrated procedure combining aggregate controls with quota management, and introducing water-use auditing.
- Promoting water conservation, raising water efficiency, protecting water resource and maintaining a sound ecological environment.
- Improving operating procedures for water allocation to ensure supply for key cities and regions.
- Deepening reform of engineering and managerial systems for water-resource projects, so as to reinforce harnessing and development of rivers and boost anti-flood and drought capacities while maintaining and making good use of existing facilities.

The Chinese government plans to develop plans for water management and efficiency enhancement for the whole country, catchments and different regions by 2005.

1.2 Latest Progress

(a) Guidelines and policies have been formulated, aimed at promoting harmony between man and nature and supporting sustainable socioeconomic development with the sustainable utilization of water resource. Since 1998, the Chinese government has, in line with the requirements of sustainable development, summarized experiences in water management and pioneered modern practices in water conservation. In particular, it has crafted a strategy that meets China's national conditions – particularly those in water conservation – and the requirements of the times:

- Human-centered and promoting harmony between man and nature.
- Enhancing the allocation, conservation and preservation of water resource while emphasizing the development, utilization and harnessing of water resource.
- Establishing in a gradual manner a water-right system and water market.
- Establishing an investment and financing regime and project management procedure for water conservation works that is compatible with market economy practices.
- Establishing a unified system for managing water resource that combines management by catchment with management by region.
- Modernizing water conservation with information technology and supporting sustainable socioeconomic development with water sustainability.

(b) A preliminary legal framework regulating water sustainability and relevant policies has been established. By 2002, the Chinese government had revised, promulgated and enforced four

water resource laws: the Water Law of the People's Republic of China, the Anti-Flood Law of the People's Republic of China, Law of the People's Republic of China on Water and Soil Preservation, and the Law of the People's Republic of China on Prevention of Water Pollution. In addition, the government had promulgated and implemented 18 administrative regulations, including the Rules for Licensing Water Drawing, and enacted 88 administrative rules, including Guidelines for Planning Long-Term Water Supply. Furthermore, the government had developed an industrial policy for water conservancy and various technical standards. Local governments, on their part, had also enacted administrative regulations and policies in light of local conditions. Together, these regulations and policies provide a basic legal safeguard for regulating water resource.

(c) The government has introduced a licensing system and compensation system and advanced ownership management. To date, a total of 700,000 licenses have been issued nationwide for a capacity of more than 450 billion cubic meters, accounting for more than 80% of the total amount of water consumed. In 2002, the Ministry of Water Conservation and the State Development Planning Commission jointly promulgated and put in force the Administrative Rules for Conducting Water Resource Feasibility Studies for Construction Projects. These rules were aimed at ensuring the feasibility of water drawing, usage and discharge for capital construction projects, thereby improving the soundness of administrative licensing and approvals. The government has further improved the supervision and management of licensing, promoted planned water usage and water conservation, sped up the creation and improvement of a compensation system for water usage. To date, 28 provinces (autonomous regions, municipalities) have enacted local rules for the collection of water-resource fees in compliance with the Water Law.

(d) The country has achieved breakthrough progress in the unified management of water resource along major catchments. In the Yellow River, Heihe River and the Tarim River valleys, a new mode of management combining catchmental and regional jurisdictions has been introduced. In 1999, the State Council authorized the Yellow River Water Conservation Committee to exercise exclusive managerial and dispatch powers over the allocation of water resource of the Yellow River. Subsequently, a special dispatch procedure was established for the Yellow River. Under that procedure, the central government has the power to allocate water quotas, while the amount of water flow is controlled by sections. Provincial governments are responsible for distributing water, and the power to allocate water is centralized for major water-drawing points and key reservoirs. Administrative bodies were set up for Heihe and Tarim rivers to regulate the allocation and distribution of water in those areas and coordinate water use for residential, industrial and ecological purposes in an integrated fashion.

(e) Beginning in 2002, the Chinese government undertook a massive water-resource mapping and planning endeavor on national, catchment and regional levels. The planning encompasses the following components: water-resource survey and assessment; survey and assessment of water-resource development and utilization; forecast of water demand and supply; strategies and action plans for water conservation, water-resource protection and allocation; and assessment of the effectiveness of planning. Compared with previous plans of a similar nature, the new plans are much more comprehensive, in-depth and extensive and are expected to complete by 2005. So far, assessment of water resources has been wrapped up, resulting in a preliminary report. A number of other plans – such as the National Anti-Flood Plan, National Plan for Reservoir Construction and the 10th Five-Year Plan for Water Conservation – have been completed, greatly boosting the government's regulatory capacity and the nation's water sustainability.

(f) New progress was achieved in integrated management of the urban water sector. By 2003, 1,206 administrative entities – over half of all the administrative entities above the county level – had set up water administrations or introduced integrated water management. In Shanghai and Hainan, for example, the newly formed Water Administration exercised exclusive powers in flood control, water supply, water use, water conservation, water discharge, sewage disposal and recycling.

(g) New ground was broken in pioneering water rights and water marketing. We have developed allocation plans for each catchment, introducing an aggregate-control rule and clarifying the ownership right, use right, operational right and transfer right for each jurisdictdion. In Dongyang, Yiwu, Yuyao and Cixi, Zhejiang province, water right trading was introduced. Dongyang is relatively rich in water resource while Yiwu is short in water supply. The two cities, through consultations, signed an agreement on transferring the water use right of Hengjin Reservoir of Dongyang to Yiwu at an agreed-upon price. In addition, three provinces in the upper reach of Zhanghe River – Shanxi, Henan and Hebei – have settled their dispute over water allocation through an agreement. Changzhi City in Shanxi province agreed to supply water from its five reservoirs to Hebei and Henan at a mutually acceptable price.

(h) Reform of the construction and operation of water-conservation projects has stepped up. The State Council released a document called Opinions on Introducing Reforms into the Management System for Water-Conservation Projects. In 2003,10 provinces (autonomous regions, municipalities) unveiled plans for revamping project management procedures. Nationwide, a campaign was launched to straighten up water-conservation project management: dividing up responsibilities between different levels, determining the nature of the water-management entity, standardizing financial disbursements, separating management from maintenance, and overhauling the pricing and fee-collection procedures. In addition, another guiding document called Opinions on Introducing Reforms into the Management System for Small Water-Conservation Projects in Rural Areas was issued. At present, more than 6 million of the 12 million small-size projects in rural China have switched to the new managerial system.

(i) Published a water-resource newsletter and bulletin and make them available to the public. Beginning in 1998, we published a National Bulletin of Water Resource (1997-2002) and, beginning in 2001, we have also edited and published a newsletter on China's water resource and its utilization.

(j) Quotas for water use and strengthened management of water consumption and demand have been set up. In 1999, the Ministry of Water Conservation, the State Development Planning Commission and the State Economic and Trade Commission jointly issued a Notice on Implementing the National Standard of General Rules for Technical Examination and Management for Water-Drawing Licensing, requiring water administrative authorities to work with relevant industries to set quotas for enterprises. In September 1999, the Ministry of Water Resources circulated a Notice on Strengthening Water Quota Setting and Management, requiring quota setting to be launched nationwide. At present, 14 provinces (municipalities) have set quotas, reinforcing water use and demand management.

(k) Setting of standards for water resource management and speeded up information systems buildup. A number of applications systems – including the National Command System for Flood and Drought Control and a water conservation portal website – are being built. Model Yellow River and Digital River, two other important information systems, are also under way. Technical standards have also been made to aid water management.

1.3 Means of Implementation

(a) Built and improved a comprehensive regulatory framework for water management. The Chinese government has revised and promulgated the Water Law and other relevant administrative regulations, technical policies and standards. It has also put in place institutions such as water-drawing licensing, water-quality standards, water discharge licensing, total discharge control, and feasibility study for water resource needs for construction projects. These provide the legal framework for water resource management in China.

(b) Promoting comprehensive management of catchment-wide water resource through implementation of plans. Since 1998, the Chinese government has formulated China's Agenda 21 for Water Conservation, Plan for Medium- to Long-term Water Supply, the 10th Five-Year Plan and Program through 2010 for Water Conservation, Plan for Sustainable Utilization of Water Resource in the Capital City in the Early 21st Century, Plan for Harnessing Heihe River, and Plan for Harnessing the Tarim River. Currently, the country is drafting a National Program for Water Resource and implementing the three plans for Beijing, Heihe River and the Tarim River.

(c) Improving the technical level of water management through advanced science and technology. This includes enhanced resource monitoring, technology upgrading, high-technology application, and information systems building.

(d) Enhanced international cooperation. Currently, China has joined more than 40 inter-governmental and international non-governmental organizations and forged cooperative ties with more than 60 countries and regions in the field of water conservation. This has resulted in increased international exchanges and training and the introduction of advanced foreign technology and practices to China.

1.4 Major Groups Involvement

(a) Localities have held various forms of technical training and workshops on a variety of subjects, such as water-resource plan drafting, quota setting, feasibility studies for construction projects, water balance testing, and water-resource preservation and management.

(b) A consultative system has been put in place. Public opinions are sought on major public issues concerning water use in a particular locality or region. All forms of consultations are held so that the decision-making process is open, fair and impartial.

(c) Stakeholders from all parties and across industries and regions have been mobilized and encouraged to participate in water management.

(d) The general public – particularly research institutes and researchers – has been mobilized to participate in water-resource management research. This has taken forms such as joint research and open bidding for major research projects involving the drafting of laws and regulations, managerial restructuring and technical innovation.

(e) Water users, as well, have been encouraged to participate in overhauling the existing irrigation practice. Nationwide, more than 3,000 water users associations have been formed in irrigation-accessible areas. For rural drinking-water projects, farmers who will benefit from such projects form cooperative organizations after democratic consultations to manage the projects autonomously. In addition, hearings are held for water pricing so that the stakeholders' interests are addressed.

(f) Localities have strengthened the promotion of water-control based on law, and raised the

water law consciousness of the public.

1.5 Challenges and Obstacles to Implementation

(a) Water is a fundamental natural resource and an economic resource of strategic importance. Currently, water resource development and utilization in China is out of sync with the needs of socioeconomic development and, indeed, the water-resource issue has become a major hurdle impeding China's socioeconomic development. Enhanced water management and water economization and conservation remain a daunting task.

(b) The existing management system remains to be further improved. The integrated management model by catchment and region is not completed, producing a direct negative impact on the sustainable use of water resource. For years China's water-resource regulatory powers haves been fragmented between different departments and localities. The responsibilities for flood control, water supply, water use, water discharge and sewage disposal, for example, are divided up between different departments, some overlapping with each other. This makes it difficult for inter-departmental coordination. Centralized and unified regulation of water resources in China remains a daunting challenge.

(c) During the planned-economy era, China overemphasized the building of water-conservation facilities but paid inadequate attention to supporting facilities and management. As a result, many water-conservation facilities that have been completed are not well-equipped with supporting facilities; many facilities are dilapidated and worn out; management devices and technologies are outdated. All this has seriously hampered the sustainable use of water.

(d) Under-pricing of water is incompatible with market economics. Currently, water is under-priced in most parts of China and ownership rights are not clearly defined. A water market has not yet taken form. The Rules for Regulating Water Prices for Water-Conservation Projects, promulgated in 2003, went into force on January 1, 2004, but water-price reform and the creation of a water market remain an arduous task.

(e) Information monitoring is seriously inadequate regarding the dynamic developments of water resource, water use and sewage discharge. This is evident in the following areas: the scope of monitoring is not extensive and frequency insufficient; monitoring devices and facilities are outdated and the level of automation low; and information transmission and processing capacities are underdeveloped.

1.6 Recommendations

(a) Continuing with the mapping of water resources across the country; accelerate the pace of implementation of water-management projects in Beijing, Heihe and Tarim rivers; ensure water dispatch in the Yellow River and other northern provinces with water shortages.

(b) Accelerating legislation on water resource management; strive to have the Rules for Implementation of the Water-Drawing Licensing System and other regulations released in 2004.

(c) Improving the means for water-resource management. Further improve and tighten the licensing system for water-drawing and strengthen feasibility study work for construction projects; improve the supervision and regulation of licensing and feasibility study work; set rates as soon as possible for water-resource fee collection; pilot water rights and water market studies; create a standardized management system for water resource; push the method of deciding the water demand according to the supply, so as to raise the efficiency and benefit of water use.

(d) Deepening the structural reform for water management. Strengthen unified management of water resources in a particular catchment area and establish an authoritative, efficient and well-coordinated administrative system for major catchment areas; create an administrative and coordinating mechanism combining management by catchment with management by region; aggressively push the restructuring of water management by centralizing regulatory powers for urban flood control, deflooding, water conservation, water supply, water use, water economization, water discharge, water-resource preservation, sewage disposal and recycling, and groundwater reuse.

(e) Stepping up reform at water project management entities by determining the nature of these entities – whether they are a for-profit or not-for-profit organization – clarifying their responsibilities and powers, and improving their level and efficiency of management.

(f) Strengthening water, water resource and water-quality monitoring by building information networks for water supply, water use and water discharge, as well as network systems for water monitoring and allocation for major drainage areas and administrative regions.

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2 Reasonable Allocation of Water Resource

2.1 Time-bound Targets and Commitments:

In the early 21st century, China has entered a new phase of development known as "building an all-out well-off society" – common prosperity for all. The overall objective for the allocation of water resource at present and in the near future is to support sustainable socioeconomic development with the sustainable use of water resource. Specifically, we aim at the following goals:

- Ensure the reasonable allocation of water resource, the safety of water-supply networks and the efficiency of safeguard systems through reasonable development, efficient use, effective protection, optimal distribution, and a sound industrial and economic structure.
- Coordinate water consumption for residential, industrial and ecological purposes, coordinate water consumption for catchments and regions, and coordinate water consumption for agricultural, industrial and urban sectors.
- Give priority to residential consumption of water for both urban and rural residents, ensure socioeconomic demand for water, including the demand for water resource due to food safety concerns, and improve water supply for ecological improvements while safeguarding subsistence and development.

2.2 Latest Progress

(a) While maintaining rapid economic growth, comprehensive social progress and steady improvement of people's livelihood and improving the ecological environment, China has kept water consumption at a low level. Between 1980-2001, the country's GDP grew 6.8-fold, or 9.6% annually, but its water supply and consumption rose only at around 1.09% annually. Facing the pressure of steady population growth, rising living standards and accelerated urbanization and industrialization, China has largely met needs for water consumption for residential, grain production, and economic purposes. Per capita water consumption remained almost the same during the years. With only 6% of the world's renewable water resource and 10% of the world's arable land, China raises 22% of the world's population.

(b) Remarkable progress has been made in infrastructure buildup. In some parts of the country, a sound situation of water allocation has taken form. By the end of 2002, the total capacity of China's reservoirs reached 559.4 billion cubic meters, accounting for 18% of the total of the country's surface water resource. Annual freshwater supply stood at 550 billion cubic meters, of which 440 billion cubic meters was surface water, 110 billion cubic meters groundwater, 2 billion cubic meters recycled water and rainwater, and 21.6 billion cubic meters seawater.

(c) In 2003, a number of projects, including the South-North Water Diversion Project – a mammoth project designed to uniformly allocate the water resources of the Yangtze, the Yellow, the Huaihe and Haihe rivers – broke ground. Southern China is rich in water resource whereas northern China suffers from acute water shortage. The diversion project is a strategic step to rationalize the allocation of water resource in China and ease water shortages and ecological degradation in northern China. According to the blueprint, water will be drawn from the lower, middle and upper reaches of the Yangtze River and three diversion routes will be built in the eastern, central and western parts of China, connecting with the four rivers of Yangtze, Yellow, Huaihe and Haihe. In addition, other small water-diversion projects at Nierji, Lengjiang River, Shapotou, Ningxia, Gansu, and Zipingpu, Sichuan are also progressing smoothly. The Three Gorges Dam project has already reached three goals: initial storage of water in the reservoir; test dual-route navigation through Class-5 floodgates; and power generation of six units at the power plant on the left bank of the river.

(d) We have won a victory in combating drought. During 1999-2003, China was hit with the worst serial drought since 1949. That drought hit more than 20 provinces (autonomous regions, municipalities), affecting 127 million hectares of crops. Eighty million hectares of crops were seriously affected and 20 million hectares were devastated. Some large and medium-sized cities in northern China suffered from serious water shortages as a result. In 2000, 2002 and 2003, faced with a serious water shortage, Tianjin, a port city east of Beijing, implemented an emergency plan to divert water from the Yellow River into the city. In 2003, Beijing, the capital city, drew 78.08 million cubic meters of water from upper-reach reservoirs to the city's Miyun Reservoir and 33.24 million cubic meters of water from Cetian Reservoir in Shanxi province via Hebei province into the city's Guanting Reservoir. From November 2002 to June 2003, improvement was made to the distribution of water resource of the Yellow River to ensure the continuous flow of the Yellow River while easing water shortages along the river. From 2000 to 2003, more than 300 deep wells and more than 4700 shallow wells of exploring and using combined demonstration were completed in the heavy droughty regions in 12 western provinces (regions and cities), solving the drinking water problem for more than 1.3 million people.

(e) Significant improvements were made to water supply for ecological purposes in some drainage areas and regions. The Chinese government pays great attention to ecological water consumption. Through reasonable distribution of water throughout the entire catchment and centralized allocation of water resource, the government coordinates water consumption for ecological, residentialand industrial purposes and reclaims the ecological environment in some water-short regions. The Yellow River area, despite a serious drought in 1999, managed to maintain the flow of water in the lower reach for four years running, improving the ecological environment. Xinjiang, a far-flung province in northwest China, diverted water from Bositeng Lake to the lower reach of the Tarim River for four years in a row, bringing water back to a section of the river 200 km down the Daxihaizi Reservoir after having dried up for 20 years. Thanks to the move, the Taitema Lake at the end of the river was restored to a size of more than 200 square km, revitalizing large tracts of shrubs and poplars in the lower reach of the Tarim River. In northwest China, a project to divide water of the Heihe River at the junction of Gansu province and Inner Mongolia was successfully implemented for four years, ensuring water supply for oases in the lower reach of the river and rejuvenating the West Juyanhai Lake which was left dry for 42 years. The East Juyanhai Lake resumes a water space of 27 square km, becoming once again a habitat for water birds. As a result, the trend of ecological degradation was reversed. Between 2001-2003, water was drawn from Nenjiang River in Heilongjiang province into the Zhalong Wetland Nature Reserve in the province for three years in a row, restoring the swamps from 130 square km back to 770 square km. At the end of 2002, water was drawn from the Yangtze River into the Nansi Lake which was drying up. In 2003, nearly 1.2 billion cubic meters of water was drawn from the Yangtze River into the Taihu Lake, easing a drought and improving the water quality in the surrounding areas. In 2004, another ecological project to divert water from Yuecheng Reservoir into the Baiyangdian lake in Hebei province also broke ground and went into operation. In areas where groundwater was excessively drawn, quotas were imposed and refills were made, achieving remarkable results.

2.3 Means of Implementation

(a) Revised vision and policies. The Chinese government in recent years, while developing water resource, has paid great attention to applying new ideas in the development, utilization and distribution of water resource. This is most evident in the new concept of development centering around human development and full, coordinated and sustainable socioeconomic development. A new philosophy for water management in the new era has been put forward to coordinate the development and preservation of water resource, in particular the coordination and reasonable allocation of water resource for residential, industrial and ecological purposes. The idea of

supporting sustainable socioeconomic development with water sustainability has been established and incorporated into water management activities. A series of effective policies have been made to improve the government's regulation of public resources and give play to the role of market forces in the distribution of resources. New ground was broken in some catchments and regions with a view to reasonably distributing water for different purposes, achieving sound economic, social and ecological results.

(b) Made plans for sustainable utilization of water resource. The idea was to complete mapping and planning of water resources within three years beginning in 2002 on a national, catchmental and regional level. Guided by the new philosophy for water management in the new era, a number of water-resource plans for the south-north water diversion project, the Yellow River, the Tarim River, the Heihe River, and Beijing. These plans laid a solid foundation for the reasonable development, optimal distribution, effective protection and scientific management of water resource, thereby boosting water management on both a catchmental and regional level and building up capacities for water sustainability.

(c) Restructured industries and productive forces to harmonize socioeconomic development with water resource sustainability. While growing the economy, the Chinese government has actively promoted industrial restructuring and upgrading of the mode of growth. It pays attention to both the role of water resource in supporting and safeguarding socioeconomic development and the interactions between coordinated economic growth and water resource. In drought-hit areas, in particular, the industrial layout and the economic structure must be compatible with local natural conditions and the water-resource environment, so that human beings can live harmoniously with nature, and water resources can be utilized in a sustainable and efficient manner.

(d) Accelerated legislation to regulate water resource optimization. With the implementation of the new Water Law, the water-drawing licensing system, the water quota system and the compensation system for water use, we have endeavored to regulate water resource development and utilization with a combination of laws, administrative regulations, administrative measures, technical regulations, and incentives. Four provinces – including the economically developed Guangdong province – have enacted administrative regulations, and 28 provinces, including Hunan and Jilin, have mapped out rules for water-resource fee collection. Other provinces, including Jiangsu in east China, have enacted rules on groundwater management. All these provide a legal framework for regulating the optimal distribution of water resource.

(e) Increased spending in water conservation, particularly the distribution of water. The government has adopted an expansionist fiscal policy to increase spending in backbone water source and resource distribution facilities. Between 1998-2002, the central government spend more than 178 billion yuan, equal to 70% of the total amount of spending by the central government in water conservation since 1949. That amount was also 2.36 times the amount spent in the 48 years from 1949-1997. Local governments have also increased spending in water conservation, particularly in water diversion and distribution works. As a result, water supply has been diversified.

(f) Stepped up research and development to support optimization of water distribution. The central and local governments have, through various government-funded research programs, mobilized all walks of life to participate in the R&D of key technologies, key projects, planning for catchments and regions, studies on interactions between water resource and socioeconomic development, and research on water consumption for ecological improvements. A number of major findings have been achieved, providing scientific proofs for government decision-making.

In recent years, China has conducted two massive experiments to divert water and silt from the Yellow River. In 2003, for example, 120 million tons of silt from the Yellow River was diverted into the sea.

(g) Strengthened water-resource management and distribution. Thanks to centralized management and coordinated allocation of water for residential, industrial and ecological purposes, we have improved the ecological environment of certain parts of the country that were seriously hit by droughts and promoted local socioeconomic development in a sustainable fashion.

(h) Strengthened groundwater monitoring and estimation. The monitoring network of groundwater resource, divided by drainage areas, was already established, and has been gradually improved. From 2000 to 2003, the new round of nationwide groundwater estimation and strategy study was completed.

2.4 Major Groups Involvement

(a) Local water-conservation authorities, working with educational authorities, hold summer camps each year during summer breaks to promote water awareness among youths. Youth organizations all over the place have also organized various activities raising awareness of the preservation of the Yangtze and Yellow Rivers.

(b) Mass media – TV, radio and newspapers – at central and local levels have launched education campaigns on sustainable utilization of water resource.

(c) The Chinese Academy of Sciences, Chinese Academy of Engineering and other social organizations have participated in strategic studies and technological innovation initiatives to tackle key technical problems for the optimal allocation of water resource.

(d) Relevant government departments, social organizations, local governments and experts have been consulted on the layout, planning and construction of major construction works and on the drafting of guidelines and policies for water-resource allocation.

2.5 Challenges and Obstacles to Implementation

(a) China's water resource is not distributed evenly spatially or temporally, with floods and droughts ravaging the country repeatedly. The south is water-rich while the north is short on water, a situation not compatible with the distribution of population, arable land and productive forces. Water systems north of the Yangtze River account for 64% of the nation's total acreage of drainage systems, but their combined water reserve is only 19% of the total. Northern China, therefore, is prone to droughts; even the rain-rich southern China also suffers from seasonal droughts due to unevenly distributed rainfall. Two thirds of the water resource of China is floodwater over the course of four months in a year, and the country is often hit with several years of excessive rainfall or little rainfall in a row.

(b) Severe water shortages. For years China's average water resource aggregate totaled 2.81 trillion cubic meters, but on a per capita basis, it came down to 2,200 cubic meters, or one quarter of the world's average. Northern China is internationally recognized as a region seriously short on water. For many years the country's ground fresh water stood at 773.7 billion cubic meters, with 352.7 billion cubic meters exploitable. Assuming water demand remains at normal levels and no over-exploitation takes place, China is 30-40 billion cubic meters of water short a year. Each year, 7-20 million hectares of farmland is hit with droughts, and more than 20 million rural residents have difficulty getting drinking water. Of the 660 cities in the country, more than 400 are short of

water and 110 seriously short of water. A total of 160 urban residents are affected. Large cities such as Beijing and Tianjin face a serious water shortage crisis if they run into several years of low water levels in a row. Because of excessive exploitation of groundwater, more than 100 groundwater depressions have been formed, covering 150,000 square km. In certain parts of the country, the situation has deteriorated so much that some geological disasters such as surface subsidence and seawater invasion.

(c) The continuous population growth, rapid economic development and accelerated urbanization pose great challenges to water supply and food safety. The Chinese population is expected to peak around 2030 at 1.6 billion, an increase of 360-460 million from now. Per capita water resource ownership will reach 1,750 cubic meters by then. With the rapid growth of the national economy, the living standards of both urban and rural residents will rise considerably, leading to a drastic increase in residential water consumption. Assuming that China reaches its goal of becoming a moderately developed nation by the middle of the 21st century, it will need 750-800 billion cubic meters of water by some rough estimate. That means it needs to add a capacity of 150-220 billion cubic meters on top of existing capacities. Given that exploitable water sources are subject to various limitations and mounting technical difficulties, China will find it more difficult in the future to develop its water resource, and water shortage – particularly in northern China – will become more acute.

(d) Developments in the water-resource situation in the future will likely further aggravate the water-resource crisis. With increased human activities, water and soil resources are increasingly exploited. The actual consumption of water in certain parts of the country – particularly in northern provinces – either naturally or artificially is greater now than under the natural state of the past. This has resulted in a drastic reduction of exploitable water resource. By some rough estimate, the average annual water resource aggregate of the Haihe River over the last 20 years has declined by 11% from the past, and the natural water inflow of the Yellow River west of Huayuankou has decreased by about 7%. In addition, given the low rate of wastewater treatment and recycling and the exponential growth of water consumption for industrial and urban residential purposes predicted for the future, the discharge of wastewater will increase proportionately. A deterioration of the water environment is almost certainly inevitable if the discharge of wastewater remains unchecked, thereby exacerbating water shortages. Therefore, China will face three challenges simultaneously: water shortages, wastewater treatment, and wastewater cleanup.

(e) A growing China, however, will need more water resource as its economy expands. At the same time, demand for water will also rise for ecological purposes (such as protecting and reclaim the natural vegetation and ecological environment in the lower reaches of inland rivers, maintaining the basic water levels for river waterways and refilling over-exploited areas) and for environmental purposes (such as vegetation planting and landscaping for residential compounds). This will pose grave challenges to water supply. Initial estimates have it that north China alone will need 77-90 billion cubic meters of water for ecological improvements.

(f) The regulatory system remains inadequate, and a unified water management regime for an entire catchment is not yet in place. This will negatively affect the reasonable allocation of water resource. The operational system is also incompatible with the need for water sustainability and market economics. In particular, the prices of water, electricity and water conservation have long been lower than their market value, making it difficult to ensure the orderly proceeding of the building and management of water-resource facilities or to allocate, utilize and protect water resource. Furthermore, the quality of managerial staff and the means of management are far from meeting the requirements of maintaining water sustainability in the new era.

2.6 Recommendations

(a) Harmonize the relations between man and nature, between socioeconomic development and water resource, paying special attention to the efficient use, reasonable allocation, full conservation, effective protection and unified management of water resource. Adjust water supply and demand and revamp industrial and economic structures in light of the sustainability of water resource of a particular catchment and the requirements of socioeconomic development and ecological preservation. Optimize the allocation of water resource, coordinate water uses for catchmental and regional purposes, for residential, industrial and ecological purposes through increased supply, curbed demand and effective protection of water resource.

(b) Plan water resource well to ensure the healthy and orderly development of water resource. Accelerate the drafting of the national master plan and specific allocation plans for rivers in light of the overall national socioeconomic plan. Identify the objectives, goals, priorities, size, steps, policies and measures for water resource development in compliance with natural and economic laws and taking into consideration the country's comprehensive national power.

(c) Accelerate the construction of water-resource works and open up new water sources to form a web of water systems to secure water supply for a particular drainage area or region. Take measures to conserve water and clean up wastewater to raise the efficiency of water use and achieve water sustainability. Step up the construction of the South-North Water Diversion Project, which has already been approved by the state, and other water-allocation projects to ease shortages in northern China and ensure water supply.

(d) Increase spending and create a stable financing mechanism. Increase government spending in water resource development and utilization, particularly in the construction of strategic water-resource allocation works on a national, catchmental and regional level; give play to the role of market forces in fund-raising to finance water-resource facilities, and mobilize the public to participate in the construction of public works.

(e) Deepen reform and improve the water-resource investment and regulatory mechanism. Establish a reasonable water pricing mechanism and compensation system for water consumption; standardize and regulate the water sector through improved regulatory procedures and economic incentives.

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3 Urban and Rural Water Supply

3.1 Time-bound Targets and Commitments

The JPOI reaffirmed the Millennium Development Goals , i.e. reducing by half the world population that has no access to safe drinking water by 2015.

The Chinese government has set the following goal for ensuring water supply for rural and urban residents: newly adding an additional 16 billion cubic meters of capacity for cities and 12 billion cubic meters of capacity for towns during 2001-2005; securing water supply for residential and industrial purposes for key water-short cities; raising water access rate to 98.5% in cities; providing drinking water to the remaining 24 million rural residents that were left out in the National Poverty Alleviation Program; providing drinking water to another 26 million rural residents with drinking-water problems due to population increase or changes in water-resource conditions between 2004-2005; improving the quality of water in rural areas where drinking water is available, so that 90% of the water sources are protected and the quality of water meets standards set forth in the Guidelines for Implementing Sanitary Standards for Residential Drinking Water in Rural Areas.

3.2 Latest Progress

(a) China has made initial progress in providing rural residents with drinking water. By the end of 2002, China had managed to provide drinking water to 260 million rural residents. Between 2000-2003, the State Development Planning Commission and the Ministry of Water Resources had, using 5.7 billion yuan of treasury bonds and matching funds from local governments and farmers, built 580,000 drinking water facilities in rural areas for 34.09 million people. Of that amount, 4.1 billion yuan was used to provide drinking water to the 24 million rural residents that were left out in the National Poverty Alleviation Program, 850 million yuan to convert drinking water for 3.72 million people living in fluorin and arsenic-infected areas, 600 million yuan to provide drinking water to 4.32 million people who had new drinking-water problems in recent years due to population growth and changes in water-source conditions, 150 million yuan to provide temporary drinking water to 1.82 million people who had drinking-water problems due to droughts.

(b) Fresh progress has been made in technological development for improving the quality of water in rural areas. In some parts of the country, the quality of natural water does not conform with drinking-water requirements, and seriously affect people's health. In recent years, brackish water has been purified successfully through a variety of techniques, such as altering the water source, improving water quality. These techniques have been applied in many parts of the country, significantly improving the quality of drinking water in those places and enhancing the quality of life for local residents.

(c) A remarkable increase has been recorded in the country's water-supply capacity for cities. Between 1998-2002, China added 8.2 billion cubic meters of capacity for urban areas, with annual water supply reaching 146.3 billion cubic meters and per capita fresh-water consumption reaching 291 tons. During 2001-2002, newly increased capacities for cities reached 17.04 million cubic meters per day. By the end of 2002, water access rate reached 78%, covering 274.2 million people. Water-supply services are branching out to small towns. In Jiangsu and Zhejiang, suburban areas the adjoining hub cities also benefit from the hub cities' water supply facilities. To ease water shortages in Beijing and Tianjin, a cross-regional water-diversion project was undertaken. In 2003, Beijing drew 78.08 million cubic meters of water from upper-reach reservoirs to the city's Miyun Reservoir and 33.24 million cubic meters of water from Cetian Reservoir in Shanxi province via Hebei province into the city's Guanting Reservoir. In addition, to fulfill the demand of emergency water supply, based on the careful exploration, the

groundwater resource has been developed and utilized reasonably.

(d) Water supplies to towns and townships have also developed rapidly. By the end of 2002, nearly 30,000 water supply facilities had been built at towns of various sizes, with a daily capacity reaching more than 60 million ton (not including capacities supplied by self-built facilities). Altogether, nearly 200 million people have benefited from the project, and local socioeconomic development has also received a boost .

3.3 Means of Implementation

(a) The Chinese government takes seriously the provision of drinking water to rural residents. Providing drinking water and ensuring drinking water safety for rural residents is a top priority for governments at all levels. Chief executives at provincial, prefectural and county levels are personally held responsible for implementing the project from beginning to end: planning, fund-raising, supervision of engineering quality, and maintenance.

(b) A sustainable strategy for water use in urban areas has been established. This strategy, known as "giving priority to water saving, treating wastewater as an overriding task, opening up new sources, and putting water to comprehensive uses", serves as the guideline for policy-making, planning and programming. Water saving is given top priority because of China's basic national conditions of water scarcity; wastewater treatment is an essential element of a water resources strategy because it serves multiple purposes: protecting water resources, improving the water environment, and increasing water supply; opening up new sources is necessary for ensuring the full utilization of water resources, establishing a multi-source mechanism and safeguarding water supply. While enhancing water saving and wastewater treatment, the optimal allocation of water sources should not be neglected. Finally, comprehensive utilization of water is needed to raise water efficiency in cities. In addition to reasonably exploit surface water and ground water resources, the exploitation of recycled water, rainwater, seawater, mildly salty water and other new, non-conventional water sources must be promoted.

(c) Reform of water pricing mechanisms has accelerated. The Chinese government has promulgated the Rules for Regulating Urban Water Supply Prices to promote reform in this respect. Urban water supply is now basically market-driven as opposed to state-subsidized. A progressive pricing mechanism has been introduced to residential water consumption and another price-hike rule introduced for non-residential, extra-plan water consumption. In most cities the price of water has reached the break-even level, allowing market and technical forces to regulate water resources in cities. Price auditing has also been undertaken to prepare for water price regulation in the future. These measures have raised the cost awareness of companies and created conditions for the establishment of a reasonable cost accounting system.

(d) Planning of water supply has also been enhanced to aid city and town authorities in the building and management of water-supply facilities. Since 2000, three plans have been drafted: Outline of Program for Poverty Alleviation in the Water Resource Area, the 10th Five-Year Plan for Solving Drinking-Water Problems in Rural Areas Across the Country, and the 10th Five-Year Plan and Long-term Program Through the Year 2010 for Water Supply to Small Towns.

(e) A diversified financing mechanism has been put in place to raise funds from multiple sources to fund public water-supply works. These sources include fiscal subsidies provided by central and local governments, contributions from local residents that will benefit from the works, donations by organizations and individuals, and investments by other parties. Market-oriented reforms have been introduced into the water-supply business to encourage private capital and foreign investment to participate, giving a boost to the water supply sector in urban areas. At

present, some companies whose core business is water supply have been publicly traded, and private investment is beginning to flow into this sector.

(f) Attention has been paid to the preliminary stage of projects and project management enhanced to ensure the quality of public works and their sound operation. One of the most important measures taken was the implementation of the "project corporate responsibility" system, the tendering system and supervision system in project construction, with a view to strengthening supervision and monitoring of project progress, quality and fund management. Rules for Managing the Building of Drinking-Water Facilities for Human Beings and Animals in Rural Areas and other related rules have been formulated to enforce post-completion management, define administrative bodies and staff, specify management rules, and set water prices.

(g) Government departments concerned work closely with each other in stepping up water-supply infrastructure building. This inter-agency effort involves water resource, construction, planning, finance, banking and health departments at various levels.

3.4 Major Groups Involvement

(a) Funding for building drinking-water facilities in rural areas has been raised through a variety of channels: contributions from locals who will benefit, government subsidizes, and donations from organizations and individuals. Local governments at all levels, social organizations, farmers and women participated extensively in the endeavor.

(b) The All-China Federation of Women and the China Foundation for Women's Development set up a special fund – Earth's Love Foundation – with 116 million yuan of donations raised from all walks of life to help build reservoirs in northwest China. By the end of 2003, the project had progressed to Stage Four, involving an investment of 110 million yuan. Nearly 90,000 reservoirs and 1,070 smaller facilities had been built.

(c) Township-based water-supply facilities provide services to local residents and enterprises, therefore they received generous support and sponsorships from them.

(d) Hearings are held on water pricing reforms in cities, and representatives from all walks of life, including water users, are invited to attend those hearings.

3.5 Challenges and Obstacles to Implementation

(a) A thorough resolution of the drinking-water problem in China remains an arduous task, given China's territorial size, complex natural conditions, universal scarcity of water in areas with limited access to drinking water, frequent changes to water sources, and engineering complexities. The situation is further compounded by a continuously growing rural population, repeated droughts in different parts of the country, the over exploitation, pollution and poor management of water sources, and outdated facilities – all of these factors result in new populations with no access to drinking water or people thrown back to poverty and having difficulty obtaining drinking water.

(b) Cities in northern China face the most severe water shortages, polluted water sources and insufficient water-supply facilities; cities in southern China, on the other hand, also face a water shortage qualitatively due to water pollution. Statistics show that of the 660 cities that have been granted a "city" status by the central government, more than 400 suffer from water shortage to varying degrees, and 110 are plagued with serious water shortage. Of the 32 very large cities with more than a million population, 30 have long been struggling with water shortages. Insufficient

water supplies are costing China's cities over 200 billion yuan of losses annually, affecting nearly 40 million people.

(c) Some water-supply facilities – particularly pipelines – are outdated, affecting water efficiency. This is due in part to the historically low price of water and the lack of maintenance of pipelines. In addition, leakages are commonplace as pipelines made of different kinds of steel are interconnected. Facility maintenance has been seriously under-funded for many years. Incomplete statistics based on a survey of 92 cities indicate that 2,369 km of pipelines of the existing facilities have been in service for 50 years.

(d) Development of water-supply facilities for small towns and rural areas has also been slow due to insufficient spending. This is inconsistent with the requirements of socioeconomic development. It is also uneven: in the more developed areas, it is more advanced; in the less developed areas, however, water supply is scare. More than one third of townships in the country have no standard central water-supply facility or inadequate capacities. In the vast rural areas, water is collected on an individual basis. This constitutes a serious constraint for local socioeconomic development and the improvement of people's livelihood. Currently, water supply facilities for small towns and rural areas are financed primarily through self-raised funds, with state subsidies playing a complementary role. However, since most such facilities cost a lot, and most areas with drinking-water difficulties tend to be economically underdeveloped, local governments and residents are not in a financial position to fund those facilities. This lack of funding directly limits the development of water supply in small towns and rural areas.

(e) The efficiency of water-supply facilities has not been maximized due to poor management, small size of facilities, inadequate procedures, unreasonable prices, and low skill levels on the part of staff.

3.6 Recommendations

(a) Strengthen leadership and clarify responsibilities. Governments at all levels and relevant departments should give priority to the project of easing drinking-water difficulties for rural residents. Leading officials in charge of water resource should take a personal interest in the matter and the chief executive assume overall responsibility. Regulatory powers should be well-defined, and resources from various departments should be coordinated to ensure the success of the endeavor.

(b) Increase funding through various means. Local governments and residents that will benefit from public works will continue to be the main source of funding while seeking guidance and support from the central government. A multi-source and multi-tier financing mechanism should be created to open up new sources of funding to finance water facilities.

(c) Implement developmental plans and improve the drafting of urban water-supply plans in accordance with the principle of coordinated planning and development of rural and urban areas. Villages or households should help a certain number of people secure drinking water; for urban areas, water-supply plans should take into account the building of water-supply, wastewater treatment and wastewater recycling facilities simultaneously, and a procedure be established to assess the enforcement of those plans periodically. Other steps include strengthened project management in line with capital construction requirements; tailoring the specifications of facilities to local conditions; increasing technological input; and reinforcing supervision and inspection.

(d) Strengthen post-construction management and maintenance. Improve the maintenance

and service codes for urban water-supply facilities, build an urban water-supply safety net and an emergency response system; and increase training of water-supply professionals.

(e) Step up reform of pricing mechanism for water supply. Using economic leverages to regulate water consumption to ease water shortages and promote water-saving. Adjust water prices in line with water cost and changes in demand and supply, introducing, for example, seasonal prices or seasonally-adjusted prices.

(f) Step up construction of water-source facilities. Coordinate development of water sources in both rural and urban areas in line with water-resource plans made for a catchment and region and overall urban planning. In particular, there is a need to build stable, reliable and safe water sources in cities that lack water. At the same time, water sources must be presered and contingency plans prepared in case of severe droughts.

(g) Continue to increase funding for the building and renovation of water-supply facilities, particularly pipelines, and, wherever possible, introduce integrated water supply for both urban and rural residents. Further liberalize the building and operating market for water supply by introducing competition and encouraging domestic and foreign investment into the sector. Step up restructuring of water-supply enterprises through the establishment of a modern enterprise system. Further improve the water-supply franchising system and build a sound regulatory regime to oversee the market.

(h) Accelerate progress in water-supply science and technology; draft the Program for Scientific and Technological Advancement in Urban Water Supply Through the Year 2010; make full use of advanced technology to increase the security of water supply, raise the quality of water and improve management.

(i) Reinforce policy-making and law-making: revising or enacting regulations in a planned and phased manner; raise public awareness of a looming water crisis and the need for water-saving.

(j) Utilize multiple water sources. Encourage the reuse of recycled wastewater, the storage and use of rainwater and floodwater, the use of seawater and brackish water, exchange of water between urban and rural areas, and development and use of new water sources.

(k) Boost the building of water-quality monitoring devices. Bolster protection of water sources, inspection and monitoring of water plants and pipelines; and build an information system monitoring water quality in both urban and rural areas.

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4 Water-Saving

4.1 Time-bound Targets and Commitments

The Outline of the National Program for Water-Saving (2001-2010) sets the following goal for water demand: by 2005, total water consumption should be controlled within 620 billion cubic meters and by 2010, 670 billion cubic meters.

The National 10th Five-Year Plan for Water-Saving Irrigation and Program for Development Through 2010 sets the following goal for agricultural water-saving: expanding the acreage of farmland benefiting from water-saving irrigation from 16.39 million hectares in 2000 to 25.3 million hectares in 2005; adding 28 billion cubic meters of water-saving capacity; by 2010, further expanding the acreage to 32 million hectares and the capacity to 50 billion cubic meters.

The Program of Development for Water-Efficient Dry Farming (2004-2010) propose the following goals: By 2005, build 200 pilot counties for water-efficient dry farming in regions with serious water shortages: northwest, north and northeast China. These pilot counties, together covering 6.7 million hectares, will in turn spur another 15 demonstration areas. Between 2006-2010, building on the above-mentioned project, expand the experiment to southwest China by building another 400 pilot counties in that region, bringing the total number of pilot counties to 600. The acreage of dry farming under the pilot program will increase by another 13.3 million hectares, totaling 20 million hectares. The new initiative should spur the development of 18 demonstration areas.

The National 10th Five-Year Plan for Industrial Water-Saving sets the following goals for industrial water-saving: keeping the growth rate of water consumption for industrial production at 1.2% while growing the industrial value added at 10% annually between 2000-2005; reduce water consumption for every 10,000 yuan of industrial value added from 340 cubic meters in 1999 to 170 cubic meters in 2005.

The Program for Technological Advancement in Urban Water Saving Through 2010 sets the following goals for urban water-saving: 100% application rate of water-saving devices in newly built residential buildings and existing buildings in urban areas by 2005; 100% application rate of water-saving devices in public facilities in urban areas; 96% recycling rate of cooling water from air conditioners.

4.2 Latest Progress

(a) The momentum of growing water consumption along with economic growth has been brought under control. Between 1997-2002, total water consumption across the country hovered around 550 cubic meters; the efficiency of water use has risen considerably, with water consumption for every 10,000 yuan of GDP dropping from 9,820 cubic meters in 1980 to 683 cubic meters in 1998 and further to 537 cubic meters in 2002.

(b) Water consumption for irrigated farmland has remained at the same level for many years despite the increasing acreage of irrigated farmland. Water efficiency has risen steadily. By the end of 2002, total acreage of farmland having access to water-saving irrigation facilities reached 21 million hectares. In addition, 16.7 million hectares of farmland benefited from non-facility-based water-saving technical measures. Water consumption for farmland irrigation dropped from 350 billion cubic meters in the late 1990s to 340 billion cubic meters in 2003, saving 10 billion cubic meters of water. Water consumption for irrigation per hectare also declined from 6,500

cubic meters in the late 1990s to 6,000 cubic meters in 2003, saving 500 cubic meters per hectare. The acreage of farmland with effective irrigation rose to 55.86 million hectares. Water consumption per hectare of farmland fell from 8,745 cubic meters in 1980 to 6,540 cubic meters in 1998 and further down to 6,038 cubic meters in 2002.

(c) Dry-farming has been incorporated into a larger effort to build water-efficient agriculture. China is a major agricultural country with both irrigated and non-irrigated farming coexisting – only 41% of its farmland is irrigated, and the rest (totaling 77.13 million hectares) has no access to irrigation at all. In recent years, China has paid great attention to developing dry-farming. Up to date, more than 200 pilot counties in dry-farming have been built. Measures taken to improve farming conditions include process improvement, application of machinery and biotechnology, and engineering works. As a result, rainwater use in dry-farming areas has increased from 6.75 kg (grain) to 9 kg (grain) per hectare per millimeter rainfall.

(d) Dry-farming water-efficient techniques have been applied. Nationwide, 22. 7 million hectares of farmland have benefited from the application of such techniques as "shallow-and-wet drying", "walking irrigation", applying water-preserving agents, mulch film and biological covering. In addition, another 667,000 hectares of farmland have benefited from other techniques such as tent-storage of rainwater, spray-irrigation and seep-irrigation. At the same time, drought-resistant and water-saving varieties of crops have been cultivated and water-efficient irrigation technologies developed.

(e) Significant results have also been achieved in industrial water-saving. At the end of 2002, the reuse rate of industrial water reached 81%, and industrial water intake slowed down from an average 4.2% per year during 1993-1999. Water intake for every 10,000 yuan of industrial value added fell from 337 cubic meters in 1998 to 241 cubic meters in 2002, a drop of 9% per year.

(f) Renovation of urban pipelines has sped up and application of water-saving devices has been promoted. Annually, 3.8 billion cubic meters of water is saved in Chinese cities.

(g) Remarkable progress has been made in water-saving technology. Over the last two decades, great strides have been made in water-saving technology for industrial, agricultural and urban applications. In the 1970s, canal leak prevention and improving canal water efficiency was the main manner to agricultural water-saving technology; by the mid-1990s, however, new techniques were developed that combined facility- and non-facility-based water-saving measures, and water-saving measures with high-yielding measures. The concept and the ensuing technical system of technological integration for developing highly efficient and water-saving agriculture have been advanced, so that agricultural production today is highly efficient and low in water consumption. In industry, it used to be that water-saving meant increasing the reuse rate of industrial water; today, it means renovating equipment and technology, upgrading and optimizing the industrial structure. In light of local water-resource conditions and socioeconomic development, we have overhauled local industrial structures and geographical distribution and optimized the allocation of water resources, and the results have been very encouraging.

4.3 Means of Implementation

(a) Established administrative bodies and made policies and regulations to promote water-saving. Governments at all levels have established administrative bodies based on water-resource regulatory departments. A series of regulations on water-saving was enacted.

(b) Set goals for cities to save water. In 2000, the central government made it clear that cities should set water-saving as a key policy goal. Specifically, when building a project, the main body

of the structure should proceed simultaneously with water-saving devices from the design stage onto the engineering stage and operation stage. In addition, the water-intaking company must put in place its water-use plan, water-saving goals and water-management rules. Cities short of water are required to close, suspend or merge before a deadline industrial enterprises with high water consumption and strictly limit water use for high-consumption industrial and agricultural projects. Cities with an industrial water reuse rate lower than 40% are not permitted to newly increase its industrial water quota and new water-supply projects will be restricted. In 2001, a set of measurements were established to determine whether a city is "water-saving" or not. By 2003, 10 cities – including Beijing and Shanghai – had been certified as "water-saving" cities.

(c) Made water-saving plans for industry, agriculture and cities. These include the Outline of National Program for Water-Saving (2001-2010), Key Points for the South-North Water Diversion Program about Water-Saving, and other related programs. Some provinces (municipalities, autonomous regions) also enacted and have been carrying out their local water-saving programs.

(d) Established standards for water-saving. Progress was made in quota-setting at provincial level. The first national technical standard for water-efficient products, Technical Specifications and General Administrative Rules for Water-Efficient Products, has been promulgated, along with other national standards such as Quotas for Water Intake for Industrial, Business and Public Entities and Quotas for Urban Residential Water Consumption. Some localities have published quotas of an advisory nature. These quota regimes provide an institutional guarantee for water conservation.

(e) Used demonstration projects to create water-efficient agriculture, industry, cities and communities. Since 1996, more than 200 model counties have been certified as growing water-efficient and drought-resistant crops, eight national experimental zones established for application of water-saving technologies in farming, and 10 other experimental zones set up for water-efficient irrigation. Between 2001-2005, a total of 16 million hectares of farmland in northern China will be covered under a major pilot program; in 2003, work continued at 266 large irrigation works to renovate dilapidated water-supply facilities, and 200 pilot projects in water-efficient irrigation continued to make headway. Furthermore, a host of other pilot projects were undertaken in high water-consuming industries such as thermal power generation.

(f) Built water-saving communities. In December 2002, the central government issued the Guidelines for Piloting the Building of Water-Saving Communities and launched the first group of pilot cities – Zhangye, Gansu; Mianyang, Sichuan and Dalian, Liaoning. Zhangye, in particular, made initial progress in improving water efficiency. That in turn ensured the smooth implementation of a plan to clean up and reclaim the lower reach of Heihe River, thereby promoting local socioeconomic development. This provides a good example for other cities in their effort to build water-efficient communities.

(g) Advanced science and technology in water conservation. The state has incorporated key water-saving technologies into a list of "key technologies to be developed" and another list of "high-tech" to be applied. Remarkable progress has been made in the development of waterless and water-efficient processes such as dry cement production, air cooling technology, dry discharge technology and dry coke-extinguishing technology. A number of water-efficient equipment and devices have also been applied and promoted. A policy statement, China's Water-Saving Technology Policy, is being drafted.

4.4 Major Groups Involvement

(a) Mass media: Media campaigns have been launched to publicize water-saving policies, regulations and knowledge and promote public awareness of water conservation. The media have also been instrumental in monitoring and supervising water efficiency.

(b) Publicity campaigns: Each year, particularly on occasions such as World Water Day, China Water Week and City Water Conservation Week, various forms of publicity campaigns are conducted across the country to mobilize public participation in water conservation. In addition, information dissemination campaigns have also been held to promote water-saving.

(c) Government departments and social organizations: They organize various forms of workshops and training programs on water use and conservation. They also publish booklets on water-saving tips and hold quizzes on water conservation.

(d) Exhibitions on water-efficient products and technologies.

(e) Summer camps: In 1999, the Office for Water Conservation held summer camps themed water saving in Beijing, Shanghai, Xi'an, Dalian and Qingdao. Students participating in the activity learned about water-saving in China, their awareness of water conservation much enhanced as a result. In 2001, the All-China Women's Federation also held activities themed "women's participation in water conservation".

(f) The Office for Water Conservation solicited submissions from the public of water-saving marks and published them on March 22, 2001, the World Water Day.

(g) Farmers and water-users in many areas formed associations to participate in water management. Water efficiency has increased dramatically in those areas as a result.

(h) The public has also been encouraged to monitor and supervise water efficiency through local water-saving offices – their telephone numbers are published.

4.5 Challenges and Obstacles to Implementation

(a) China is a developing country with a serious shortage of water. Its water-resource supply is unlikely to increase substantially along with socioeconomic development. Therefore, it must seek to improve water efficiency and production efficiency through water-saving. This poses a grave challenge to traditional, outdated modes and technology of water consumption.

(b) Public awareness of water shortages and water efficiency, however, has been low for a long time; water-wasting is commonplace in everyday life and industrial and agricultural activities, a far cry from the requirements for high efficiency.

(c) The situation is further compounded by outdated facilities and poor management. For a long time, there has been over-emphasis on facility building with inadequate attention paid to management. Likewise, there has been over-emphasis on the main body of the facility but less attention to supporting facilities. Much remains to be done in those respects. A survey of 402 large irrigation networks covering more than 20,000 hectares of farmland indicates that over 60% of those facilities fail to reach the designed capacity. In total, all the existing facilities amount to 82% of the designed capacity. Of the 373 facilities built at the head of canals, 70% of seriously worn out or damaged, 16% out of service, 10% should be demolished, and only 4% are in good shape. Of all the structures built on the canals surveyed, 21% are seriously worn out or damaged, 9% out of service, and 10% should be demolished. Of the 188,000 km of canals surveyed, 54,000

km (29% of total) is in a shaky state. There is no metering device in most of the areas surveyed. Management devices and tools are outdated, and much needs to be done to improve and renovate existing facilities. All this requires funding.

(d) In cities, pipelines are dilapidated and leakages are serious, causing huge waste. Non-conventional water is seldom used. Despite the great amount of funding needed to fix the piping system, available funding is limited. Although a number of facilities have been put into service to use seawater, recycled wastewater and rainwater, they are under-utilized, and much of the demand for freshwater remains unmet.

(e) The application of water-efficient technologies in cities is not extensive enough and water-efficient devices and equipment is not promoted enough. This is due in large measure to the large amount of investment needed to purchase, install and operate those facilities. China's home-made devices are technologically backward and inferior in quality, unable to meet needs for high water efficiency.

(f) Under-pricing of water and undefined water ownership are incompatible with market economics. In the planned economy era, water supply was seen as public welfare and water prices have long been lower than market values. Water saved in agriculture can be diverted to cities for residential and industrial purposes. By the same token, water saved in the upper reaches of a river can be used to increase water supply in the lower reaches. Currently, such diversions are done mainly through administrative decrees at no cost. Beneficiaries are not motivated to save water.

(g) Due to historical reasons, China still has some industrial enterprises with high water consumption. In those factories, processes and equipment are outdated, and technical renovation and industrial restructuring are difficult.

4.6 Recommendations

(a) Build water-efficient communities on all fronts. This effort should be guided by water right and market economics theories and aim at improving the efficiency of water resource. It should center around the establishment of a unified regulatory regime and the creation of an incentive and operational mechanism to encourage water-saving. Legal, administrative, economic and technical tools should be employed to promote water-saving. National socioeconomic plans should incorporate projects designed to raise water efficiency and improve productivity.

(b) Governments at all levels should increase funding for water-saving. Efforts should first focus on 402 large irrigation facilities and more than 5,000 medium-sized ones to speed up facility overhaul and technical renovation. This includes the installation of metering devices and management tools, promotion of water-efficient technologies in light of local conditions, and the renovation or urban water-supply pipelines to reduce leakages. We should also promote the application of water-efficient devices for daily household use and increase industrial water efficiency through the installation of water-efficient equipment and industrial restructuring and upgrading and in conjunction with the Western Development and Revitalization of Northeast China initiatives.

(c) Improve the regulatory framework and strengthen rule of law. This entails modifying local regulations, quotas and standards on water conservation in line with the Water Law, Urban Water-Supply Regulations and the Rules for Urban Water Conservation. Where water is in short supply, water-saving measures should be compulsory.

(d) Create a compensation and incentive mechanism to encourage water-saving; continue to

deepen water-price reform toward a reasonable pricing system and restructure of water-supply enterprises, so that pricing will play its due role in regulating demand, encouraging water-saving and promoting use of recycled water. A compensation system should be established for water use and a water market should gradually take shape.

(e) While promoting water-saving and improving water efficiency, we should also optimize the allocation and rationalize the development of water resources in line with plans mapped out for catchments and regions and urban plans. Integrated measures should be taken to ease water shortages and raise water efficiency in key regions and wherever possible, take measures to increase the use of rainwater, recycled water, treated wastewater and seawater.

(f) Develop new water-efficient technologies and measures through advances in science and technology. Pool resources of research institutes, colleges, manufacturers and water users to develop and integrate new water-efficient technologies, new materials and devices. Build an information network on water consumption and water-efficiency management, improve the service system for promotion of technology and bolster technical advising.

(g) Continue awareness and education campaigns through mass media; set up and improve pilot programs for water-saving; boost information sharing and knowledge impartation.

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5 Use of Non-Conventional Water Resources

5.1 Time-bound Targets and Commitments

Rainwater storage: The 10th Five-Year Plan and Program of Development Through 2010 for Storage and Utilization of Rainwater proposes the following goals: Between 2001-2005, 1.3 billion square meters of rainwater-collecting pools will be newly built, 12 million facilities (cellars, pools and containers) will also be added, so that the total capacity of rainwater storage will reach 1.16 billion cubic meters; 880,000 hectares of drought-resistant and water-preserving farmland and 220,000 hectares of water-efficient farmland will be developed, providing drinking water for 7.7 million people and 7.75 million heads of livestock.

Seawater use: The Program of Development for Technological Advancement in Urban Water Saving Through 2010 proposes that by 2010, seawater use amount to 13% of total water demand for Chinese coastal cities.

Wastewater reuse: The above-mentioned document also proposes that by 2010, 30% of treated wastewater – in the amount of 7.8 billion cubic meters – will be reused.

5.2 Latest Progress

(a) Small rainwater-storage facilities have been built to provide drinking water for human beings and animals while irrigating crops. These facilities can be in the form of cellars, pools, containers, reservoirs or ponds. A survey done in early 2000 showed that nationwide, 5.6 million such facilities had been built with a combined capacity of 1.8 billion cubic meters, which was used to irrigate 1.22 million hectares of farmland and provide drinking water for 15.32 million people and 9.66 heads of livestock.

(b) Use of non-conventional water sources has been incorporated into a larger plan for integrated urban water-resource utilization. In recent years, China has adopted a new strategy for urban water supply. That strategy, as discussed earlier, is known as “giving priority to water saving, treating wastewater as an overriding task, opening up new sources, and putting water to comprehensive uses”. By the end of 2002, 537 plants had been built to treat municipal wastewater, with a daily capacity of 38.13 million cubic meters. Forty percent of municipal wastewater is now treated and 2 billion cubic meters of treated wastewater is reused.

(c) Progress has also been made in seawater use. In 1995, China used 5 billion cubic meters of seawater. In 2002, that figure soared to 21.6 billion cubic meters. Breakthrough progress was made in the research and development of seawater desalination technology and equipment. In some coastal enterprises, seawater desalination plants with a daily capacity of 5,000 tons have been built. Coastal cities made much headway in seawater use. Qingdao, a coastal city on the Bohai Rim, Shandong province, for example, used more than 2.3 million cubic meters of seawater per day in 2002, amounting to 880 million cubic meters for the year.

(d) Progress has also been made in certain parts of the country in the purification of brackish water through desalination and filtering. In some places, salty water is mixed with freshwater for irrigation, a technique that uses brackish water while reducing consumption of freshwater.

5.3 Means of Implementation

(a) Active guidance and support for using non-conventional water sources. To ease water shortages, the central and local governments have set aside special subsidies to encourage the use of non-conventional water sources. For example, fiscal subsidies are available for the building of rainwater collecting and storage facilities; the municipal water-supply management and

operational regimes are being overhauled; the prices of freshwater are being lifted; and preferential policies are available for wastewater reuse and seawater use. These measures have fully mobilized interest in investing in non-conventional water use.

(b) Demonstration and piloting through advanced science and technology. The state listed wastewater treatment, seawater use, rainwater-irrigated agriculture and rainwater collection and storage in a plan for key technological breakthroughs. Great attention has also been paid to the R&D of technologies and to industrial policy-making to promote use of non-conventional water sources.

(c) Standard-setting. China has promulgated and implemented standards and norms for wastewater recycling and reuse and seawater use, as well as the Norms for Designing Rainwater Collecting and Storage Works.

(d) Management overhaul. A policy of "whoever built and owned a facility will manage and benefit from the facility" was made regarding individual rainwater storage facilities located in disparate places. Inheritance and transfers are permitted under that policy; some even are issued a Property Ownership certificate to encourage farmers to build cellars around their house and on their plot of land.

5.4 Major Groups Involvement

(a) Local governments, social organizations and farmers have taken an active part in the endeavor. The public, while participating extensively in the utilization of non-conventional water sources, also monitors and supervises the construction and management of those facilities.

(b) The All-China Federation of Women has played an active role by setting up a special Earth's Love foundation to help mothers in water-short western China build rainwater-collecting and storage cellars. Since its launching in 2000, the program has solved drinking-water problems for 400,000 people in that region, greatly improving the living conditions for women and children.

5.5 Challenges and Obstacles to Implementation

(a) Despite the progress made so far, utilization of non-conventional water sources remains inadequate. For a long time, non-conventional water use has not received adequate attention because of difficulty in rainwater collection, high cost or worries about the quality of reused wastewater. Little consideration was given, for example, to the recycling and reuse of wastewater, the substitution and desalination of seawater and the collection and storage of rainwater in the government's water-resource development plans.

(b) Funding has been seriously inadequate. Because little consideration is given in urban construction to reuse of recycled water, seawater use and use of rainwater and flood water, urban infrastructures for non-conventional water source utilization are falling apart, and fund-raising is difficult for building new facilities for non-conventional water use.

(c) In impoverished rural areas, rainwater-collecting and storage facilities are funded mainly with self-raised money from farmers. Because of economic underdevelopment, progress has been slow.

5.6 Recommendations

(a) Incorporate the development and utilization of non-conventional water sources into the master plans for catchments, regions and cities as a component part of water-resource

development. Draft a Special Plan for Seawater Use and a Special Plan for Wastewater Treatment and Reuse, and revise the Special Plan for Rainwater Collection, Storage and Use. Customize the plans to local conditions and implement them.

(b) Develop polic ies and incentive schemes to encourage, support and guide the use of non-conventional water sources. Policies on funding, marketing, industrial development and taxation need to be overhauled.

(c) Improve the regulatory framework for non-conventional water use, including the technical regulations and standards for water-quality management, water-use management, and quota setting.

(d) Continue with publicity and education campaigns to promote awareness of non-conventional water use, particularly among water users. Set up and improve pilot programs for water-saving; boost information sharing and knowledge impartation.

(e) Reasonably use non-conventional water sources through advances in science and technology. List key research projects in this area in central and local governments' programs for science and technology. Promote non-conventional water use through demonstration projects. Reduce the cost of desalination of seawater using advanced science and technology and raise the level of engineering science and technology.

(f) Improve management. Local governments should, in light of local conditions, map out and plan the use of non-conventional water sources and ensure that all statistics are accurate. Quotas and water-quality standards should be set, and management systems and rules reviewed and improved.

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6 Flood Control and Disaster Mitigation

6.1 Time-bound Targets and Commitments

China's goals for flood control and disaster mitigation are: by 2010, build a flood-control system for major rivers to fortify their flood-control capacity; build a modern flood control management system and monitoring system to effectively regulate and adjust water activities. Major rivers should reach designed capacities and standards in their flood-control safety zones, i.e. capable of fighting major floods seen once every 50 years. Key sections of the rivers should meet even higher standards, i.e. able to withhold floods seen once every 100 years. Sections of normal importance should be able to resist floods seen once every 20 years. Very large cities should be able to fight floods seen once every 100 years, large cities 50-100 years, and medium-sized cities 20-50 years. Key sections of medium- and small rivers should be able to resist floods seen once every 10-20 years; and key coastal dykes should be capable of withholding high tides seen once every 50 years plus strong winds measuring 8-12 degrees.

6.2 Latest Progress

(a) A flood-control system consisting of dams, hub facilities and flood-storage zones has been built for large rivers. Over the last five decades, China has invested heavily in flood-control facilities. Up to 2002, 274,000 km of dykes have been built, protecting 510 million people and 42.86 million hectares of farmland. Nationally, 82,000 km of dams comply with national standard; 85,000 reservoirs of various sizes have been built with a combined capacity of 559.4 billion cubic meters; 98 flood-storage zones have been opened covering 35,000 square km, with a total capacity of 98 billion cubic meters.

(b) Recent years have witnessed increased investment in flood-control facilities for large rivers. Since the big flood of 1998 at the Yangtze and Songhua rivers, China has increased funding for building dykes for the Yangtze River, the Yellow River and Songhua River. The Three Gorges Dam reservoir on the Yangtze River has begun storing water. By the end of 2002, the main dyke of the middle and lower reaches of the Yangtze River – totaling 3,500 km – and the main dyke of the Yellow River – totaling 2,900 km – had reached the designed standard; 2.42 million people had relocated in a sweeping move to return farmland to lakes and rivers; 2,900 square km of water space had been reclaimed; and 13 billion cubic meters of flood-storing capacity had been added. The Xiaolangdi Reservoir had gone into service, and flood-control facilities at the lower reach of the Yellow River had been fortified. The first and second phase of the backbone improvement work had wrapped up for the Taihu Lake. Finally, remarkable progress had also been made in dyke-building for Songhua, Liaohe, Haihe, Huaihe and Pearl rivers.

(c) The flood-control standards in place now for large rivers are much higher than in the early 1950s. Currently, those standards range from 20-50 years for dykes of normal importance to 100 years for key sections. For medium- and small rivers, the standard is 10-20 years. This is also true of cities – 207 of the 639 cities with flood-control responsibilities have reached statutory standards.

(d) A regulatory framework has been established for flood control. This consists of the Flood-Control Law of the People's Republic of China, Anti-Flood Regulations, Regulations for River Management, Provisional Rules for Compensation for Flood-Storing Areas, and other relevant laws and regulations. Flood-control command centers and administrative bodies have also been bolstered. At the same time, a floodwater and meteorological forecast system and an information system have been established on a preliminary basis, and a national command system for flood control is underway.

(e) We have withstood many great floods, safeguarding the stable development of the Chinese economy and society. In 2003, for example, we achieved a great victory in the fight against a catchment-wide flood in Huaihe River. In that fight, we focused on human needs and took good care of dislocated people. We used various forecast technologies and tools to divert flood water, using flood-relieving and flood-storing functions alternately to control water levels. Although the flood in 2003 was bigger than the 1991 floor in severity, the actual losses were smaller, and fiscal spending was also smaller than in 1991.

(f) While improving flood-control infrastructures and management, we have taken an integrated approach combining flood control with water supply and ecological preservation for catchments and regions. Therefore, the flood-control facilities and management measures have, in addition to controlling floods and mitigating disasters, played an important role in water conservation and ecological preservation.

6.3 Means of Implementation

(a) Local governments and various departments regard flood control as a first priority and have taken effective measures to ensure that the stated goals are met. Since 1987, the Chinese government has step by step implemented a chief executive responsibility system under which the chief executive of a jurisdiction assumes overall responsibility for flood-control work in that jurisdiction, while individual government departments fulfill their own duties in accordance with their responsibilities.

(b) We have also introduced the notion of harmony between man and nature, initiating a transition from flood control to flood management. The Chinese government, in the wake of the big flood of 1998 along the Yangtze River, made major adjustments to its flood-control tactics: highlighting the harmonious coexistence between man and nature while fortifying flood-control facilities; conducting socioeconomic activities in light of the characteristics of floods; emphasizing the need for deploying flood-control facilities in the context of catchment-wide ecological reclamation; and applying systems theory and risk management methods in transitioning from flood control to flood management.

(c) We have raised the level of decision-making regarding flood water diversion through application of science and technology. This includes the modification and improvement of flood-water diversion plans for rivers and major facilities, properly handling the conflict of interests between the upper and lower reaches of rivers, between trunks and tributaries, between left and right banks, between urban and rural areas, and between different regions. This involves the coordination of interests for flood control vs. water conservancy, flood control vs. drainage, parochial vs. overall well-being, near-term vs. long-term goals, and normal vs. priority importance. Effort is also needed to fortify three links in flood control: flood forecast, flood water diversion and disaster alleviation, in order to minimize losses.

(d) Flood-control management and legislation have been strengthened. A series of laws and regulations have been enacted to regulate water-related activities, in particular capacity-building and procedures for flood-control, as well as management of rivers, flood-storing zones and flood-control facilities.

(e) A series of policies aimed at flood control and disaster mitigation and regulating the interrelationship between man and nature have been made. In 2000, China issued the Provisional Rules for Use of Compensation in Flood-Storing Zones, and pilot programs were conducted to pioneer disaster insurance for flooded areas. Some provinces levied a flood-control tax to bolster

building and management of flood-control facilities.

6.4 Major Groups Involvement

(a) Various government departments and organizations, under the centralized command and direction of flood-control authorities, have duly performed their duties in fighting floods and rescuing flood victims. Members of the public, People's Liberation Army, Armed Police, police and militia forces took an active part in fighting against floods.

(b) Training on flood control and disaster mitigation of administrative officials, regulatory authorities, managerial staff and residents living in flood-control areas has been boosted; publicity campaigns have been launched to promote public awareness of modern flood-control techniques.

(c) The All-China Federation of Women, in conjunction with Peking University, Wuhan University, and Regina University of Canada, held a high-level workshop on "flood control, ecological preservation and sustainable development". The program was sponsored by the International Development Agency of Canada.

6.5 Challenges and Obstacles to Implementation

(a) China is one of the countries worst-hit by floods. Floods impact a vast stretch of land frequently, causing untold damages. About two thirds of the country's landmass succumb to flooding of differing degrees and types; 65% of its GDP is generated in flood-control areas in the middle and lower reaches of large rivers, and 42% of the population, 30% of farmland, hundreds of cities and large numbers of key infrastructures and enterprises are located in those areas. In the 1990s, floods wreak havoc on main river systems six out of 10 years. In some drainage areas, severe floods visited almost every year. Hilly mountainous and plateau areas, which together constitute 70% of the country's landmass, are often ravaged by flooding and mudslides. Coastal provinces and cities are hit by typhoon-induced floods seven times a year on average. The Yellow River and Songhua River sometimes see flooding caused by icing. In northwestern Xinjiang and Qinghai, flooding caused by melted snow is a common disaster.

(b) Due to institutional problems, China's flood-control capacity is unable to meet requirements of its socioeconomic development. At present, reservoirs already in service control only 19% of the country's annual flow of rainwater; backbone flood-control facilities have been planned but not yet built for main rivers, resulting in a low capacity to control floods. In addition, most of the existing reservoirs were built in the 1950s and 1960s. For historical reasons, their design standards were too low, engineering quality poor, and matching facilities lacking. Most of them are outdated and in poor conditions, with many potential hazards unattended. This poses a great threat to the security of those facilities.

(c) Flood-relieving facilities in cities are underdeveloped, causing serious in-city flooding. On the one hand, accelerated urbanization means an increase in non-permeable floor space, which leads to an increase in rainwater collection. The refilling of creeks, lakes and ponds in cities reduced their water-storing capacity and led to an increase in surface runoff and flood peaking; on the other hand, a concentration of urban populations and wealth means losses could be huge if floods hit. Flood control will be an even more arduous task as the urbanization process accelerates while flood water-discharging facilities are not keeping pace.

(d) Geological disasters' position is very critical. In the hilly areas along upper reaches of Chinese rivers, geological disasters such as collapses, landslides and mudslides occur frequently during the flood season, threatening local people's life and property.

(e) Flood-control management has its weakness. Regulations and procedures that were promulgated to implement the Flood-Control Law are inadequate and the sound management tools are still lacking; a risk-management mechanism has not been put in place yet, and the flood-management technology is underdeveloped.

(f) Socioeconomic development, however, is requiring higher demand for flood control and disaster relief. Areas threatened by flooding tend to be more economically developed than elsewhere with a large concentration of population. The threat of flooding will be present for a long period of time, and potential losses and risks from flooding will increase with progress in local economic development and urbanization.

6.6 Recommendations

(a) Transition from flood control to flood management. Enhance flood management through improved legal system and the establishment of a system that functions efficiently and meets local conditions. Ultimately, man and floods should coexist harmoniously along major rivers. Land-use policies favorable to aversion of flood risks should also be made in line with flood-control plans; flood insurance should be introduced and a social safety net be created to share flood risks and bolster flood-fighting capacities.

(b) In the lower reaches of large rivers and in plains, we should, building on existing facilities, continue to focus on "prevention first" while combining prevention (storing floodwater) with remedy (releasing floodwater). Maintain and expand flood-releasing capacities of large rivers through dredging of waterways and dyke enforcement. Restore and maintain the floodwater-adjusting capacity of lakes through reasonably constructing and using flood-storing zones.

(c) Build needed trunk and tributary control works to enhance flood-control capacities while satisfying needs for water-resource use and ecological preservation.

(d) Complete, as soon as possible, risk-removing and dam-reinforcing for large- and medium-sized reservoirs located in cities, densely populated areas, and industrial and transport facilities of strategic importance, in line with the principle of "responsibility-by-level" – leading officials at a certain level are responsible for reservoirs located within their jurisdiction.

(e) Improve management of flooded areas and flood-storage areas by flattening dykes to relieve flood water and returning fields to lakes; prevent occupation of flood-running shoals or narrowing flood-running channels; relocate in an organized way residents living in flood-running areas to keep up their flood-storing capacity.

(f) Curb soil erosion at the middle and upper reaches of large rivers through afforestation, reclamation of forests, planting of trees and grass, banning farming on steep slopes, and building small reservoirs or dykes wherever possible.

(g) Improve dredging and management of river mouths and, if necessary, construct new flood-relieving channels in some sections of rivers.

(h) Set reasonable draining standards in key waterlogged areas in accordance with the principle of dealing with both flooding and water-logging at the same time. For coastal areas seriously threatened by storm surges, build high-standard dykes around cities to withstand large storm surges.

(i) Improve monitoring, forecast and control of geological disasters such as collapses, landslides, mountain floods and mudslides. Avoid geological disaster-ridden areas for city-building.

(j) Modernize flood control through innovations in science and technology. Draw up flood-risk charts for rivers; create a national flood-control information system based on an information-gathering system, supported by a computer network and a communication system and centering around a decision-making support system. Increase international exchanges and cooperation in flood control and disaster relief.

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7 Preservation of Soil and Water in River Basins

7.1 Time-bound Targets and Commitments

Soil and water preservation in river basins should observe natural laws. Such efforts should encompass the preservation of water, land, grassland, forests and wetland resources, as well as control and treatment of water pollution. The objective is to maintain the virtual circle of ecosystems, reverse the trend of biological degradation, and reclaim the ecosystems.

The National Program of Ecological Buildup, drafted in 1998, stated that by 2050, China should curb soil erosion in places where conditions permit, plant trees and grass in places suitable for greening, reclaim desertified and degenerated grassland, build an environmental monitoring system and environmental protection system. Substantial improvements should be made to the ecological environment in most parts of the country. Subsequently, China made some plans, including the 10th Five-Year Plan and Program Through 2010 for Soil Preservation and a number of forestry projects such as the of Action for Preservation of Natural Forests in the Upper Reach of the Yangtze River and the Upper and Middle Reaches of the Yellow River, as well as the National Program for Ecological Preservation of Grassland. These plans set the following goals to be met by 2010:

- Curb soil erosion by another 550,000 square km, so that 35% of land with soil erosion will be recovered; silt will be reduced by 10% for large rivers in the south and by 20% in the north; build a preventive and monitoring system in all areas with soil erosion.
- Forest coverage to reach over 19%; build an ecological shelter belt consisting of trees and shrubs and a logging industry, easing soil erosion at major river basins and desertification in desertified areas and reversing the trend of overall ecological degradation. Bring the number of wetland reserves to 450 and internationally important wetland reserves to50; build 53 national-level pilot zones for wetland preservation and development.
- Preserve 70 million hectares of grassland, amounting to 19.4% of degenerated grassland; increase the percentage of artificial grassland and improved grassland to the total acreage of grassland from 3% at present to over 13.3%; bring rat and pest damage under control at key grasslands; new build 50 million hectares of artificial grassland and improved grassland; reclaim 33 million hectares of desertified and degenerated grassland; slow down the increase rate of desertified and degenerated grassland and farmland by 60% from the 2000 level.

The National Program for Ecological Preservation proposes that by 2010, China build 55 ecological preserves, of which 15 are national-level ones.

The 10th Five-Year Plan for Environmental Protection proposes that by 2005, the discharge of major pollutants such as chemical consumption of oxygen and ammonia nitrogen decrease by 10% from 2000 and the trend of environmental deterioration be reversed; the quality of environment be improved for large- and medium-sized cities and key regions; over 60% of cities above the prefecture level reach national standards for surface water quality; 45% of wastewater generated in cities get treated; central drinking-water sources in rural areas reach national standards; 60% of poultry farms reach national standard for discharge of sewage, 70% of them reach national standard for recycling of poultry droppings; ease agricultural pollution by building a number of pilot counties for ecological preservation; build a cluster of beautiful small towns. Irrigation water to reach national standard, and the quality and safety of farm produce to increase fully.

Water-pollution control and treatment plans drafted by relevant central government departments

propose the following goals for key watersheds such as the Three Rivers and Three Lakes (Huaihe River, the Haihe River, the Liaohe River, the Taihu Lake, the Dianchi Lake and the Chaohu Lake): by 2005, the chemical consumption of oxygen in those areas drop by 1.45 million tons from 5 million tons in 2000, the discharge of ammonia nitrogen decline from 820,000 tons in 2000 to 200,000 tons. Another Program for Water-Pollution Control and Treatment in the Three Gorges Reservoir and the Upper Reach of the Yangtze River proposes that the Three Gorges Reservoir area reach national standard III for surface water quality by 2005 and national standard II by 2010.

7.2 Latest Progress

(a) Progress has been made in water pollution control and water-resource protection. China has put in effect water-quality standards, wastewater discharge licensing and aggregate control systems across the country, with a view to tackling the urban wastewater problem through mandating factories producing industrial wastewater in order to comply with statutory standards within a deadline. Between 1998-2002, the compliance rate for industrial wastewater discharge rose from 67% to 88%, the discharge of COD in industrial and municipal wastewater dropped 2.7% annually. Between 2000-2003, 472 pollution-generating sites had been cleaned up in the Three Rivers and Three Lakes areas; the discharge of pollutants fell by 20-25% (in the Three Rivers area) and 40-50% (in the Three Lakes area), resulting in improvement of water quality to varying degrees.

(b) Major progress has also been made in ecological reclamation projects. Thanks to the implementation of an emergency water-recharging project in the Zhalong Nature Reserve in Heilongjiang province, the acreage of wetland there has increased from 130 square km to 700 square km, providing a habitat for rare birds such as crane. Water has also been diverted from the Yangtze River to fill up Nansi Lake, expanding the water surface of the lake from 147 square km to 370 square km. This improved the ecosystem for species dwelling in the lake, averting a biological wipeout. Another project taking water from the Yangtze River into the Taihu Lake effectively improved the environment for the lake and surrounding areas, enhancing the self-purifying capacity of the lake and improving the quality of water supplied to neighboring areas.

(c) Soil preservation has also made much headway. Between 1998-2002, a total of 270,000 square km of land with soil erosion had been reclaimed, with 800,000 hectares of farmland opened on steep slopes restored as forest or grassland. Nature was allowed to take its own self-healing course, speeding up the process of soil preservation. Pilot programs were undertaken in 128 counties across the country, and preventive works built in the headstreams of large rivers. A moratorium on felling and grazing was imposed on 520,000 square km of mountains in 894 counties.

(d) In forest and wetland protection, China launched six key projects for forestry protection, including one protecting natural forest resources. Afforestation efforts picked up. In 2002, 7.77 million hectares of forestland was planted, up 57% over 2001; forested acreage topped 100 million mu for the first time. Of that, 6.78 million hectares (87% of total) were forests planted in the six key projects. By 2002, 535 wetland preserves had been set aside in Songhua, Liaohe, Haihe, Huaihe, Yellow and Yangtze rivers.

(e) The ecosystem in grassland has been restored. Between 2000-2003, the central government launched a number of projects in that respect, including one seeking to restore the natural vegetation in grassland, another one aimed at creating enclosures in grassland, and still another one targeting the establishment of bases for grass seeding. By 2000, 693,000 hectares of artificial grassland had been built, 800,000 hectares of enclosures established, and 450,000

hectares of seeding bases completed, restoring the ecosystem in grasslands.

(f) We have reinforced protective measures, effectively maintaining and restoring fishing resources and the ecosystem. Since 1995, China began to impose a moratorium on fishing during hot maritime seasons. Since 1997, a dual-control scheme has been put in place for marine fishing boats and rated power of fishing boats. Since 1999, we have proposed and implemented "zero growth" and "negative growth" plans for marine harvesting. Since 2002, we have also introduced a moratorium on fishing in the middle and lower reaches of the Yangtze River. With the approval of the State Council, that moratorium was applied to the entire Yangtze River in 2003. Fishing administrative authorities have taken other measures to lessen fishing activities in China's near seas and protect its fishing resources, such as reinforcing the fishing licensing system, disbarring unlicensed fishing boats, cracking down on fish-electrifying and poisoning, introducing quotas for fishing, phasing out worn-out fishing boats, reducing the size of fishing fleets, and transferring fishing boats to other uses.

7.3 Means of Implementation

(a) Reinforced legislation and management. The Chinese government revised the Water Law, took more effective measures to protect water resources, and promulgated a series of laws, regulations, and technical standards, including the Soil Preservation Law, the Forestry Law, the Water Pollution Prevention and Treatment Law, the Anti-Desertification Law, and the Law on Wild Animal Protection. Central to those laws and regulations is the reasonable exploitation and protection of water and land resources, forestry, grassland and wild animals. We have consistently applied the principle of holding leading officials responsible for ecological preservation. Governments at one level sign a contract with a higher-level government to ensure all the goals are met.

(b) Important progress has been made in plan-drafting. The Chinese government pays high attention to planning the reasonable exploitation and effective protection of water and land resources. In recent years, it has completed the drafting of the National Program for Ecological Preservation, the National Program for Soil Preservation and Ecological Buildup, the National Program for Grassland Protection and Buildup, the National Program for Wetland Protection, water-pollution control and treatment plans for the Three Rivers, Three Lakes, the Bohai Sea, and the Three Gorges Reservoir, and a number of forestry projects such as the Program of Action for Protection of Natural Forest Resources in the Upper Reach of the Yangtze River and the Upper and Middle Reaches of the Yellow River. Funding for implementing those plans has been secured. To restore the ecosystems for major watersheds, we have made plans for the sustainable use of water resources at Heihe and Tarim rivers and are making the Program for the Recovery of the Water Ecosystem at Haihe River and the Program for Water Resource and Wetland Preservation at Zhalong Nature Reserve.

(c) Created an operational mechanism combining macro-regulatory tools with market forces. The Chinese government permits market forces to play a fundamental role in the allocation of resources. We try to regulate water use, wastewater discharge and resource development through reasonable pricing, levying of waste-discharge fees and imposing fines for exceeding waste-discharge quotas. Attempts have also been made to commercialize the building and operation of municipal waste disposal facilities. The Chinese government has, through contracting out soil preservation to households, auctioning off the use rights of barren hills, ditches, mountains and shoals, and equity cooperation, diversified investment in resource development and pollution control.

(d) Improved the level and efficiency of ecological reclamation and preservation through

science and technology and public opinion. We have paid great attention to promoting and applying practical technologies in ecological preservation for river basins. Demonstration and training are but two common ways to impart knowledge to farmers to build up their capacity for ecological protection.

(e) Introduced quotas for fishing; implemented moratoriums and off-limit fishing zones; improved planning and management of fishing waters; stepped up value-added release of fishing resource to boost eco-fishing.

(f) Strengthened cooperation and exchanges with foreign governments, scientific communities and international organizations. Introduced foreign capital, advanced technology, concepts, management models and expertise.

7.4 Major Groups Involvement

(a) Resource and environmental protection has been incorporated into the curriculum of nine-year compulsory education, 140 institutions of higher learning, hundreds of secondary schools and vocational schools, Party schools and high-level-official training schools. Green School contests have been conducted among colleges, middle schools and elementary schools.

(b) Public participation has been active. China set March 12 as Tree-Planting Day to encourage citizens to plant trees.

(c) We changed the way soil preservation facilities, anti-desertification facilities and grassland reclamation facilities are built and operated in a bid to encourage the public to take an active part in that process. In particular, we published information regarding goals to be reached for a particular project, specific tasks, and job offers for locals. Public opinions were solicited. Villagers' committees made commitments on the job offers, then scheduled investments and engineering work. Special attention was paid to transparency of information regarding contractors, supervisors, project progress and use of funding.

(d) A number of non-governmental environmental groups have emerged in some large- and medium-sized cities, which do a lot of publicity and education work. As a result, Green Communities, Green School and other environmental notions have been widely accepted and public awareness enhanced.

(e) Ecological and environmental data have been made publicly available. An information mechanism has been established to keep the public informed of ecological, environmental and water resource conditions through the publication of briefing materials such as Inter-Provincial Geological Bulletin, Soil Preservation Bulletin, Water Resource and Environmental Quality Bulletin, and Forest and Grassland Bulletin.

(f) Non-governmental organizations: National Grass Variety Review Committee reviews and registers grass varieties as part of an effort to improve grass variety management, promote superior varieties and localize good varieties. China Forestry Society and China Grass Society organize academic exchanges at home and abroad; China Water Partnership Committee has held seminars on water sustainability.

7.5 Challenges and Obstacles to Implementation

(a) Water pollution control and treatment remains an arduous task. With the economy and urbanization increasing rapidly, the reduced portion of wastewater discharge has been offset by newly increased pollution. The integrated water pollution is rather serious. In 2002, of the

123,000 km of rivers assessed, 35.3% was rated V or worse than IV. Pollution is especially serious in sections cutting through cities. All the large freshwater lakes and urban lakes are polluted to varying degrees. Of the 24 lakes assessed, six were rated as "compliant with or better than III", another six polluted, and 12 others seriously polluted.

(b) The trend of land degeneration and ecological deterioration continues unabated. Total acreage of land with soil erosion amounts to 3.56 million square km, or 37% of the country's total landmass. Recent years have witnessed worsening soil erosion in many parts of the country. Nationally, about 10,000 square km of land newly succumbs to soil erosion a year. Desertification continues to expand, as evidenced by the growing acreage of degenerated grassland, deserfitied land and salinized land. Together, 135 million hectares of grassland – one third of the total – is degenerated, desertified or salinized, and that number is still growing at 2 million hectares a year. Some localities, out of short-term interests, open up grassland excessively, aggravating the desertification of land.

(c) The environmental quality continues to deteriorate in rural areas. Already 10 million hectares of farmland have been polluted to varying degrees. The quality and safety of farm produce are at stake as waste disposal is non-existent, agricultural chemicals are overused, and garbage pollution is unattended. Small township enterprises are almost universally pollution-ridden, and in small towns environmental infrastructures are lacking. In addition, drinking water in rural areas is polluted to varying degrees.

(d) China's huge population and economic underdevelopment pose huge pressure on the nation's ecosystems. Rapid economic growth and rising demands for improved living standards has led to increased use and consumption of water, land, forestry and grass resources, damaging the environment. At present, the trend of ecological degeneration is continuing unabated, and environmental degradation is expanding in scope, depth and severity. In the head streams of large rivers such as the Yangtze and Yellow rivers, the situation is deteriorating. Major lakes and wetlands are shrinking, and rivers and lakes in northern China are drying up and groundwater levels are dropping dramatically. This has aggravated flooding and desertification. Over-grazing in grasslands has damaged forestland and grassland, aggravating soil erosion. The acreage of habitats for wild animals and plant species is shrinking and ecosystem worsening.

(e) The awareness of ecological preservation remains low in many parts of the country, particularly with regard to the importance of water-pollution control and treatment. This has resulted in phenomena such as pursuing near-term and local economic growth at the expense of the environment; over-emphasis on development but inadequate attention to environmental preservation; and excessive development of resources.

(f) Funding for environmental protection and infrastructures has long been inadequate. Most areas with ecological degradation are located in poverty-stricken mountainous areas with austere natural conditions. Lack of funding has contributed to the deterioration of environment in those areas.

(g) Regulatory capacities and tools have also been lacking, particularly in the area of environmental monitoring. An unsound regulatory regime, lax enforcement and weak regulation have limited the role and authority of environmental authorities.

7.6 Recommendations

(a) Strengthen leadership and continue to implement plans. Governments at all levels should regard ecological conservation as a top priority on their agenda and take effective measures to

ensure the smooth implementation of the plans. Local governments should, in line with the national master plan for ecological preservation, make their own plans in light of local conditions and incorporate the plans into their socioeconomic development plans. Ecological construction is a cross-regional, cross-departmental and cross-century systems project. The National Development and Reform Commission should, in collaboration with other relevant departments, create an interagency mechanism to strengthen leadership and coordinate actions. Local governments and central government departments should each fulfill their due responsibility and implement their plans in accordance with the national master plan.

(b) Step up legislation for ecological preservation. Publicize relevant laws and regulations extensively and intensively to promote public awareness of those laws and regulations. Establish and improve upon a regulatory system based on pertinent laws and supplemented by administrative regulations. Strictly enforce laws and tighten up legal supervision by cracking down on illegal and criminal activities.

(c) Promote advanced and applicable science and technology in vegetation, soil preservation, anti-desertification, grassland building, water-efficient agriculture, dry-farming and eco-agriculture. Pay attention to the training of talent. Pool resources to tackle key technologies in ecological preservation in search of breakthroughs. Encourage research and development institutions to engage in ecological projects, and protect their intellectual property rights. Existing research organizations should, in line with regional plans, improve their environmental monitoring, technological promotion, information services and technical exchange networks, helping localities with planning and design. Implement the experimental zone program in earnest in line with the principle of experimentation-demonstration-promotion. Local governments and central government departments should sum up their experiences in earnest and promote standard technical procedures. We should also cultivate and apply quality varieties and advanced applicable technology for different regions.

(d) Further improve soil preservation. While accelerating efforts to curb soil erosion, we should further promote soil preservation and reclamation. Step up mud dyke-building on the Loess Plateau and accelerate property right reform for dyke-owners; create a sound building and operating mechanism to ensure the quality and efficiency of the works. Build ecological construction pilot zones and create a national survey network and an information system for soil preservation. Continue to bolster preventive measures to curb man-made soil erosion.

(e) Build and improve upon a stable funding system. Increase funding for ecological construction and preservation in line with the principle of “government regulation, market facilitation and public participation”. Combine funding from government with that from collectives and individuals to raise funds from multiple channels and on multiple levels. Incorporate key ecological projects into the national master plan for capital construction, with local governments providing matching funds. Local governments should be responsible for funding local projects. Governments at all levels and relevant central government departments should divide their duties and financial resources and make long-term arrangements for ecological construction. The central and local governments should build into their budgets funding for ecological construction.

Improve the management of the forestry fund and grassland fund that have already been established to ensure that they are indeed used in soil preservation, vegetation and other environmental purposes. Open up new channels of fund-raising. Build a benefit-compensation system in accordance with the principle of “whoever benefits compensates; whoever damages (the environment) recovers”. Encourage all kinds of investors to invest in ecological facilities in

accordance with the principle of "whoever invests operates and benefits". The state should recognize and reward those that have made outstanding contribution to China's environmental cause. Members of the public are the main force for ecological preservation. We should mobilize people to participate actively in tree-planting and grass-growing activities. Continue to improve the labor system to motivate surplus rural laborers to participate in eco-building projects in slack seasons, in accordance with the principle of "whoever builds (a facility) owns it".

Increase fiscal spending in environmental protection with the implementation of the new wastewater-discharge fee regulations. Develop and improve upon economic policies favorable to environmental spending to promote diversification of funding sources. Encourage and support businesses, in particular private and foreign ones, to commercialize the building, operation and management of environmental facilities through mergers and acquisitions, project financing, BOT and other forms. Further forge and improve upon the pricing mechanism for environmental resource utilization by introducing a system of paid distribution of waste discharge and a licensing system and exploring – and improving – a trading system for waste discharge rights. Fully implement or improve the fee-collection system for wastewater discharge; adjust the rates in accordance with the principle of "break even or settle for small margin; introduce market-based pricing in a gradual manner", in order to ensure the smooth building and operation of urban environmental infrastructures.

(f) Coordinate water use for different regions with watershed as the basic unit. Reasonably allocate water for residential, industrial and ecological purposes. Ensure the minimum demand for water for rivers and lakes to maintain the virtuous circle of the water ecosystem and gradually reclaim the degenerated ecosystem through the allocation of original water rights and the unified distribution of water resource.

(g) Build and enforce a water-intake licensing and waste-discharge licensing system and put in place a water-quality monitoring system. Strictly enforce the review and supervision system for waste-discharge outlets into rivers to control waste discharge. Strengthen management of water source preserves and areas with excessive groundwater exploitation and clean up urban rivers and lakes.

(h) Establish an interagency pollution control mechanism to push forward the prevention and control of water pollution. Implement the pollutant-aggregate control system fully after determining the pollutant-dissolving capacity of a certain water system and divide up the quotas for discharge of water pollutants among pollution-generating organizations. When determining the quotas for discharge of pollutants for a pollution-discharging entity, focus on the implementation of issuing licenses to those that discharge pollutants within their set quotas in the key drainage areas, regions, and maritime zones, and all over the country. Introduce, on a trial basis, a water pollutant discharge trading system in connection with the discharge licensing system, on condition that the water quality within a catchment area does not deteriorate. Strengthen supervision of urban wastewater treatment plants to ensure that the environmental infrastructures already established are functioning.

(i) Provide greater protection for natural forests, wild animals and plants, wetlands and ancient trees, while afforesting major rivers, desert edges and coastal areas. Bring about ecological improvements on a large scale through measures such as putting a moratorium on tree-felling and relying on nature's self-healing power. Vigorously adjust the mode of agricultural production and animal husbandry to curb the excessive exploitation and damage of nature by human activities. Put a moratorium on tree-felling and grazing and increase vegetation in areas with a fragile ecosystem to mitigate soil erosion.

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8 Drinking-Water Safety in Rural China

8.1 Time-bound Targets and Commitment

The Plan of Implementation of World Summit on Sustainable Development reaffirmed the target from the United Nations Millennium Declaration that is to halve, by the year 2015, the proportion of people without access to safe drinking water.

According to the Five-year Plan of national economic and social development, by 2005, the proportion of people from rural China with access to water supply accounts for 60%, by 2010 accounts for 70%. The 2003 working conference on rural drinking water proposed the following goals: by the end of 2010, reduce the number of rural residents without access to safe drinking water – currently standing at 300 million – by one third; by the end of 2020, solve the drinking-water safety problem for all.

8.2 Latest Progress

(a) Great progress towards the rural water supply target is due to the effective organization and mobilization of the Chinese government and with active public participation. By the end of 2002, the proportion of rural residents who benefit from water supply program was almost 92%, among which, 260 million people gained access to drink water by the water supply project.

(b) From 1981 to the end of 2002, the investment of rural water supply accumulated more than 70 billion yuan. Between 2000-2002, the central government invested a total of 5.7 billion yuan special treasury bond funds in water supply project in rural China, with the concentration on helping western provinces solve the problem of lacking water. And 3.409 million people benefited from this project, which was the greatest project undertaken since 1949 benefiting the largest number of people.

(c) We improved drinking-water conditions for rural residents, thereby raising their quality of life significantly. Typical surveys of target groups (including women and children) in five provinces (Hebei, Hubei, Inner Mongolia, Jiangxi and Yunnan) showed that water consumption in those areas had risen from 20 liters/person/day to 41 liters/person/day.

8.3 Means of Implementation

(a) Drafted plans for water supply for small towns and rural households. In light of changing circumstances and based on experience, we have put forward a new concept of development focusing on harmony between man and nature and centering on human needs. Satisfaction of people's need for safe drinking water has been made an important item on the government's agenda. We drafted plans for water-supply development and safe drinking water for small towns and rural households during 2001-2005. In response to the rapid expansion of small towns, we invested heavily in central water-supply for villages and small towns, improving drinking-water conditions for local residents.

(b) Bolstered policy studies and policy-making and stepped up the building of a monitoring system. We developed a series of national technical regulations, standards, manuals, charts and applications software for rural water supply and put in place a drinking-water quality monitoring system for rural areas.

(c) Developed and implemented guidelines for safe water supply for rural areas in light of local conditions. The government advocates the use of safe drinking water, with various government departments working together to make it happen. Public endorsement and individual participation are indispensable to the success of the project, while private funding is solicited. Builders of facilities are responsible for managing and maintaining them. Strict quality standards

are imposed, and metering devices are installed for fee-collecting purposes.

(d) Increased funding and improved capital management. The Chinese government drastically increased funding in improving drinking-water conditions for rural households. Between 2001-2002, 5.1 billion yuan of treasury bonds were invested in the endeavor. At the same time, we encouraged local residents who will benefit from the facilities to raise money among themselves, solicited contributions from the public, and encouraged private and foreign investment in this sector. In capital management, we open all expenses and revenues to public scrutiny to ensure transparency and efficiency of fund use.

(e) Strengthened international cooperation. The Chinese government actively supports and has participated in international programs and initiatives related to rural water supply. Goals have been set for different stages of development in light of the nation's conditions. The Chinese government has for years conducted extensive cooperation with international organizations or foreign governments in the area of rural water supply and safe drinking water. The World Bank, for example, has provided a loan of US$338 million in four installments to be implemented in 39,000 villages in 167 counties in 18 provinces. Altogether, 22.67 million rural residents will benefit from the project with sufficient safe drinking water, hygienic toilets and health education. These international aid projects have served as a good example to other regions, spurring them to develop their own water-supply facilities, supporting them to train managerial and technical personnel, and promoting the development of management procedures, technical regulations and standards. China's practices in return have won recognition and praise from the international community.

(f) Took full use of all available means to publicize safe drinking water and promote awareness of safe drinking water and sanitation among target groups in order to help them shed unhygienic customs and habits. Ultimately, the goal is to make farmers realize that water conversion is to their own benefit, thereby motivating them to participate in the effort voluntarily.

(g) Installed metering devices and collected fees to sustain water supply facilities. Water prices are cost-based with an appropriate margin to ensure the normal operation of the facilities.

(h) Trained professionals at various levels in designing, building, operating, monitoring and managing facilities.

8.4 Major Groups Involvement

(a) Representatives from townships and villages that will benefit from water-supply facilities funded primarily with government and collective investment are participating in administrative committees for those facilities to exercise their rights and fulfill their responsibilities as contributors. Representatives of villagers participate in water users association for facilities funded primarily with collective and private investments and government subsidies. They exercise their rights in overseeing matters such as water pricing, water-quality monitoring, services of the operator, and the revenues and expenses.

(b) The All-China Federation of Women organized its branch outlets in various places to raise 116 million yuan from the public to support women in western China build rainwater-storing cisterns. The Central Committee of the Communist Youth League also raised 250 million yuan from home and abroad to help protect the Yangtze and Yellow rivers.

(c) Members of the public and organizations donated money toward the drinking-water project. Local People's Congresses and People's Political Consultative Conferences (assemblies

of people's representatives) have also taken an active part in project supervision, raising many suggestions for improvement. The media have reported on the various projects. Women's and youth organizations at all levels have played an instrumental role in mobilizing public participation, publicizing knowledge, demonstrating the benefits of water conversion and assisting farmers do away with unhygienic habits.

(d) The vast number of beneficiaries participate in the building and management of water works. Farmers, including those living in ethnic-inhabited areas, are encouraged to take part in water conversion projects. They formed Farmers Association for Water Plant Management and the Association for Rural Water Supply and Sanitation to oversee facility operation and management, personnel training, information disclosure, technical advising, international exchanges and market study.

8.5 Challenges and Obstacles to Implementation

(a) China falls much behind other moderately developed countries in prevalence of safe drinking water, particularly in rural areas in the central and western parts of the country with severe natural conditions and economic underdevelopment. In those areas, water sources are poor and infrastructures lacking, with huge disparities existing between different areas. In short, it remains a daunting task to realize the goal of providing safe drinking water to farmers by 2020.

(b) While the country's water shortage and water pollution are deteriorating, there is also a growing number of people without access to safe drinking water or who used to have it but later lost it due to population growth, socioeconomic development or changes in water sources. Aggravating poor water sources and water shortages, some springs and rivers have dried up and groundwater levels have dropped in certain places due to changes in water sources. This has brought drinking-water difficulties to people who didn't have to worry about drinking water before. In addition, technical standards for drinking-water works in rural areas are too low and water-treatment facilities are non-existent, making it impossible to guarantee the amount and safety of drinking water. Most drinking-water works built before were wells, cisterns or pools which will dry up if hit with drought for a few years in a row. Many villagers draw water directly from wells, rivers, lakes, reservoirs or ponds. Although water supply for those sources can be guaranteed in normal years, the water quality is often substandard. In many parts of north China, shallow groundwater contains excessive mineral or fluorine contents. People in those areas drink brackish water or high-fluorine water. Deep-aquifer groundwater is very limited and costly to tap. On the other hand, many drinking-water sources – particularly surface water and shallow-seam groundwater – are seriously polluted due to substandard discharge of industrial or residential wastewater and increased use of pesticides and chemical fertilizers. These polluted water sources in turn cause diseases. In short, the number of people without safe drinking water is growing and the difficulty of resolving drinking-water problems is increasing.

(c) Current management and operational regimes are incompatible with needs for comprehensive, rapid and healthy development of rural water supply. Rural water facilities are numerous and widely distributed. Many are directly managed by users themselves who are not professionally trained. Typically, not attention is paid to management and maintenance of those facilities.

(d) The task of reducing diseases transmitted by unsafe drinking water in rural areas has posed a grave challenge to the rural drinking-water project. More than 50 diseases in China are transmitted through unsafe drinking water; 150 million rural residents drink water with excessive micro-organic contents – microorganisms are very prone to triggering an epidemic outbreak. In addition, more than 65 million rural residents drink water with excessive fluoro-arsenic contents

and over 37 million people drink brackish water. In the past, substandard drinking water was assessed mainly by visual and germ standards; now, however, they are increasingly assessed by chemical or toxicological indicators. The most effective way to reduce diseases and improve public health is providing safe drinking water for all.

8.6 Recommendations

(a) Promote institution-building to provide a legal guarantee for urban water supply and environmental hygiene. First, create a management model integrating rural water supply with sanitation and health education and enact relevant laws, regulations, rules and technical standards; second, strengthen monitoring and assessment of law enforcement so as to identify and resolve problems in a timely fashion to ensure that the laws and regulations achieved the desired results.

(b) Coordinate planning, pay equal attention to both the quantity and quality of water supply, integrate pollution control with pollution treatment and combine engineering measures with non-engineering ones. First, strengthen protection of drinking-water sources. We need to designate and delineate water source preserves and make rules strictly controlling the installation of waste-discharging outlets around those preserves in order to prevent pollution of water sources. Second, boost the building of safe drinking-water works. We need to determine the scale and standards of these facilities in line with the needs for building an "all-out well-off society" and the affordability of farmers, making sure that funding is adequate, all the auxiliary facilities are in place, and quality complies with statutory standards. Promote tap-water works in places where conditions are ripe for central water supply but existing facilities are substandard; refresh water sources in places where pollution of existing facilities is serious and recovery of water sources is difficult; install new water-treatment facilities for existing facilities not equipped with water-treatment devices. Build individual facilities in hilly places where people are dispersed in light of local conditions; build rainwater-collecting and storing facilities in places where freshwater is limited; build individual wells where groundwater supply is abundant; build interim facilities for villages that are listed in emigration or relocation plans.

(c) Reinforce government functions and improve interagency coordination. Delineate the responsibilities between various central government departments and local governments at various levels; give play to the strengths of individual departments and improve interagency collaboration and cooperation and avoid duplicate responsibilities and resource wastage. Allow government to take advantage of its power and capacity to mobilize public participation and pool resources to promote safe drinking water in rural areas.

(d) Continue to combine self-raised funding with government support. In poverty-stricken areas, the government should provide the bulk of funding while encouraging farmers to contribute money or labor. In recent years, to implement the Millennium Development Goals set by the United Nations, some international organizations are raising money to help developing countries build drinking-water facilities. We should take advantage of this opportunity and use as much foreign aid as possible in our endeavor.

(e) Build a project management and operating mechanism compatible with market economics. Step up the research and formulation of laws, regulations, policies and plans and establish a management system with clear-cut property rights and well-delineated rights and responsibilities and a dynamic operating system; grow the rural water-supply market. In project management, pay great attention to participatory management, in particular giving full play to the role of trade associations to protect the interest of users. Implement an accreditation system for water suppliers through trade associations; introduce competition and incentives in operations by breaking down barriers across government departments, administrative regions and forms of

ownership.

(f) Promote the research and application of appropriate technologies in light of changing circumstances in rural China. Improve the drinking-water quality and sanitation monitoring network and intensify research in those areas; increase information sharing and the promotion of appropriate technologies.

(g) Distribute water sources rationally, taking into consideration both near-term and long-term interests, both quantitative and qualitative concerns. Wherever possible, build high-standard works to ensure water supply even in years of severe drought. Where exploitation of groundwater is absolutely needed, a balance between exploitation and refill must be achieved to ensure water sustainability.

(h) Build up capacity for rural water-supplying organizations; train professionals and managerial staff on planning and designing, operations management, benefit assessment, and progress monitoring. Establish a network of managerial and technical personnel and service providers at national, provincial, municipal and county levels.

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