Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 28 (2012) 709 – 714

Procedia Engineering

www.elsevier.com/locate/procedia

2012 International Conference on Modern Hydraulic Engineering

Research on Water Resource Exploitation and Utilization Potential of the Yellow River Basin

XU He[a], LIU Jiahong[a], QIN Dayong[a], a*

[a]*State Key Laboratory of Simulation and Regulation of Water Cycle in River Basin, China Institute of Water Resources and Hydropower Research, Beijing, 100038, China*

Abstract

Based on the meaning of water resource exploitation and utilization potential, the year of 2009 was chosen as current year, the exploitation potentials and the water-saving potentials of the Yellow River basin by the years of 2020 and 2030 were analyzed; the exploitation potentials were analyzed from surface water, groundwater and unconventional water resources; the water-saving potentials were analyzed from the water utilizations of agriculture, industry and city life (containing domestic, building industry and tertiary industry); besides doing better in water resources management, the Western Route Project is considered as the effective measure to release the imbalance between water supply and demand in the basin.

Keywords: the Yellow River basin, water resource exploitation and utilization potential, water-saving potential, the Western Route Project, water resources

1. Introduction

The Yellow River basin is known as energy basin for its hydropower resources in the upper reaches area, coal resources in the middle reaches area and oil and gas resources in the middle and lower reaches area. However, in the northwest there is too little water to match the abundant land and minerals. There have occurred years-lasted and provinces-extended droughts many times in the history. As the exploitation of economy and the immoderate human activities, the contradiction between water demand

* Xu He. Tel.: +86-15910510485
E-mail address: crane_xu@126.com.

doi:10.1016/j.proeng.2012.01.795

and supply is becoming serious, and the environment is getting worse concurrently. To solve the problem of water resources shortage is necessary and urgent.

2. Basic theory and methods

There are broad sense and narrow sense of water resources exploitation and utilization potential. The front is defined as the difference amount between available quantity of the national economy and present water supply amount which can be used and controlled through engineering, and the water resources can be saved in present water usage by engineering and non-engineering measures [1]. And the latter doesn't contain the amount from water-saving, which analyzed the further increased water resources amount only from open resources [2]. However, according to the appeal of setting up a water-saving society, the broad sense one is more practical.

2.1. Water resources exploitation potential

Water resources exploitation potential is analyzed in three aspects which are surface water, groundwater and unconventional water resources.

Surface water resources exploitation potential is defined as the limit threshold value of water resources developing quantity, the available quantity of surface water resources deducting the water consumption (see Eq.1 and Eq.2). The available quantity often gained by surface water resources amount deducting the amount that cannot be used and unable to be used [2].

$$W_{sp}=W_{sa}-W_p \quad (1)$$

$$W_{sa}=W_s-W_n-W_u \quad (2)$$

Where W_{sp} is the surface water resources exploitation potential; W_{sa} is the available quantity; W_p is the water consumption; W_s is the amount of surface water caused by local precipitation; W_n is the amount cannot be used, containing the releasing capacity left to be developed by downstream, the necessary amount to maintain the watercourse's basic functions and ecosystem's health; W_u is the amount unable to be used under various constraints, mainly the storm floods. All the units of the parameters are m^3.

Groundwater resources exploitation potential is defined as the difference between the available amount of groundwater and the consumption (barring return flow) [3]. The available amount of groundwater often indicates the groundwater can be constantly renewed and compensated during being developed, generally doesn't contain the deep phreatic water during calculating.

Unconventional water resources contain reclaimed water, rainwater and brackish water. Wastewater can be treated to reclaimed water with various quality levels for agriculture, industry, city life and groundwater recharge [4]. Rainwater can be collected by shed, forest road surface and small collections, and solve the problem of water shortage to some extent in the local. The brackish water is mainly used to irrigate, supply to city life, industry and environment after desalted and depurated. But it is still in the exploring stage and hasn't been widely used. The exploitation of unconventional water resources are driven by economic benefit, pressure of water resources quality and environment, and so on.

2.2. Water-saving potential

Water-saving potential has two meanings that are supplied water-saving potential and consumptive water-saving potential. According to *the national integrated water resources planning technique rules*, the supplied water-saving potential is defined as the maximum possibility of water resources saved from the present physical quantity. And the potential is calculated by the difference between status level and