

A Discussion on the Relationship Between Sustainable Utilization of Water Resource and Urban Ecosystem

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Abstract: Based on the principle of the urban ecology, the relationship between water resources and the urban ecosystem, and the restricting of water resource to the urban sustainable development are discussed. It is emphasized that water, as a kind of resources, is important for development of mankind and society, and converting wastewater and rainwater into new resources is valid for solving the shortage of water resources. Moreover it is analyzed and discussed the important significance of wastewater and rainwater reclamations for building a harmonious urban ecosystem and ensuring the sustainable development of the society and economy. Water resources reuse has great importance to the urban ecosystem and the sustainable development of urban economy.

Keywords: urban ecosystem, water resources, water pollution, and sustainable development

1. INTRODUCTION

Water resource is the prerequisite for humankind's sustainable development which affects the scale of the city, the development of industry and the living standard of the residents. Water is the most active one among all the factors which influence the environment. The relations among the urban population, economy, resources, and environment are discussed in this passage. The relations among the social economy action of the urban residents, the city environment and social conditions, the existing problems and countermeasures which go with before-mentioned situation are discussed in the passage as well. The water resource not only influences the ecosystem but also affect the economy development of the city^[1].

2. WATER RESOURCE AND ITS EXPLOITATION AND UTILIZATION

The total amount of water resource is abundant in our country which ranks sixth in all the countries of the world^[2], however, the usable water resource is only $1.1 \times 10^{12} \text{ m}^3$. Therefore, water resource is poor in our country according to the per capita amount of water resource. The water resource has been excessively explored and used by a roughly mode of "exploitation-utilization-sewage-drainage" in a long time, consequently the water resource was depleted and destroyed. The problem of lack of water has puzzled over half areas of our country.

The expansion of the city scale and a mass of living and production sewage which let off without meeting the drainage standard those deteriorate the deficient conditions of water resource^[3]. At present, the drainage amount of waste water is about $365 \times 10^9 \text{ m}^3$ in our country per year in which only 20% are

treated by the second class standard, and there are yet about $200 \times 10^9 \text{ m}^3$ are waste water that let off without treatment, which lead to the comedown of its original using function of the considerable water body.

3. THE INFLUENCE OF WATER ON THE URBAN ECOLOGY

One of the characteristics of city sustainable development is that there is high quality and abundant water resource in the city and around adjacent area^[4]. With the development of economy and the advance of citizen's standard of living, there is not only a great increasing requirement for the amount of water but also a great increasing requirement for the water quality. The basic function of water is drinking, washing, used in industry production, regulating the climate, aspersing the roads, irrigating grass and trees, creating ecological scenes etc. therefore, water is very important to the social economy and the sustainable development of environment of the whole urban area. Satisfying the requirements of living and production and at the same time maintaining a cleanly water environment those are important signals and essential measures to construct modern ecologic city.

3.1 The influence of water quantity on the urban ecology

In a city, the water resource quantity is the total amount of the surface water, ground water and precipitation which within the urban area. The amount of water supply is only one part of the water resource in the city. It is considered that the water resource is plentiful only when the amount of water supply meets the requirement in the city. If there is not enough water resource in a city, on the one hand, it would affect the scale of industry production, the

developments of social economy and the residents' standard of living; on the other hand, water resource especially the amount of surface water will directly affect the climate of a city. Therefore, the deficient water resource will not only bring on lower humidity which would easily make for forming dry island in the city but also influence the urban ecology scene and the ecology system around it, such as the insufflations of roads, irrigation of grass, garden, fountain and waterscape for entertainment.

The excessive exploitation of ground water results in the falling of groundwater level to a large degree, which leads to a descendent funnel area. In the area, the ground declines, bridges and houses go down, the sewage reflows, buildings and roads crack, the ground split and sink. All above phenomenons seriously affect the geographical environment of the city. Moreover, the service pipes, drainpipes, electric power and communication cables, gas pipes and thermal pipes those imbedded underground would be influenced and destroyed in various degrees which would cause great loss to a city. The excessive exploitation of groundwater causes the sharply drop of groundwater level, consequently, which bring about the disappearance of springs and many other natural sights. Finally, the resource is exhausted and the ecosystem is destroyed.

3.2 The influence of water quality on the urban ecology

The water quality means in more ways than one. On the one hand, it means that the water has to be treated to accord with the standard of supplying water quality. On the other hand, the waste water has to be treated for the sake of the sustainable development of human society^[5]. The urban supplying water should accord with the water standard for drinking, production, fire protection, irrigation, toilet washing and aspersion. The sewage should be discharged by the national sewage discharging standard. The water quality influences the urban ecology. At first, the water quality directly relate to the health of people, which had been recognized by our ancestors before 2000 years. It presented the relations between environment, water quality and people's health in a book. If the residents drink the water which falls short of the water standard, they may feel uncomfortable or be ill seriously. For example, it is easily suffer hypothyroid if iodine is lack in the water; and it is apt to suffer fluorine bone disease if there is excessive fluorine in the water. In the next place, the quality of water used for industry production directly affects the quality of products, the life of equipments and the development of economy. Finally, the water quality influences urban ecologic sights. The bad water quality would affect the sights for appreciation, such as fountains, plazas, parterres and moats, which would worsen the habitation where the urban residents live.

The pollution of surface water deteriorates the water quality. The contaminated water resource which contained excessive poisonous ions influences the residents' living and health, moreover, which may even lead to death. The investigation shows that the

residents who live along a polluted river in Huai River are harmed severely. Their death rate is 1.44 times higher than the people who live in contrasting area. Their malignancy mortality is 4.1 times higher than the contrasting area people. The crowds live along a certain polluted river whose incidence of cancer is 8-16 times higher than the national average level. The people who live nearby a river which contains high three types of nitrogen have an obvious higher malignancy mortality than the national average level in JinanXin town, Jiangsu province. The investigation about drinking water and state of water pollution in Shanghai, Suzhou and Changzhou shows that the organic substances in water lead to mutagenicity in the water resource. The residents live nearby the pollution area whose incidence of cancer is distinctly higher than other areas... It is obvious that the environment pollution has been one of the most important factors to residents' health.

The pollutions of surface water destroy the ecosystem as well, which turn an integrated, completed, multiple, multifunctional and stable environment system into a simplified food cycle, scarce genres, single structure and fragile one, therefore, the ecology is off balance. It is reported by "Chinese environment" that large scale infective disease occurred in most of the prawn breeding area one after another, which result in the reduction of 120,000 tons of prawns. Five kinds of fishes which go against the river have been extinct in nine branches such as Liao river which inflood into the Bohai Sea. In addition, the phenomenon of abundant nutrition aggravates in many large lake, the phenomenon is more distinct in the inner lake of the city. Therefore, the relation between biology community and environment has been damaged.

4. THE METHODS TO MAINTAIN THE URBAN ECOLOGY BALANCE AND TO SOLVE THE SHORTAGE OF WATER RESOURCE

The lack of water resource and the pollution of water have severely impeded the sustainable development of the city, which have been the main contradiction of water project in the city. In order to protect the urban ecology balance, it is necessary not only to make use of the exiting water resource in reason, but also to improve the utilization rate of the water, exploit and use the unconventionality water resource sufficiently, reuse the waste water and rain water effectively. All those are effective methods to solve the problem of the lack of water. Moreover, the reuse of waste water would reduce the sewage amount which discharge into water body, therefore, the pollution of the water resource is alleviated. It is a very important method to protect the water resource.

4.1 To convert waste water into new resources

With the acceleration of urbanization and industrialization, the water requirements of living and production increase sharply, therefore, the discharge amount of waste water increase accordingly. These sewage and waste water mostly discharge into the lakes or rivers without treatment, which would

severely pollute the water body and accelerate the shortage of water resources. The quality of sewage or waste water is improved through treatment and purifying, which can meet a certain water requirement with low water quality standard, therefore, the waste water or sewage is reused as a new resources. The above process is called "sewage recycle". Sewage recycle is an effective way to solve the shortage of water resource, especially, it is more important than exploiting new water resources for the cities which are lack of water. Moreover, the method of sewage recycle accord with the objective reality that water resource is inadequate in our country^[6]. A great deal of water is required in the industry departments, which accounts about half of the total water requirement in the city. If the water requirements in industry departments are classified to fresh water, reclamation water and recycle water, then the natural water could be saved largely. The recycle water is generated by the second class treatment water which is treated by further technical processes. The recycle water can meet a certain water requirement. It is mostly used in industry production processes, which save the water resources and product cost. Recycle water can also be used for urban irrigation, buildings and fire fighting. The utilization of recycle water will not only reduce the consumption of natural water, alleviate the burden of water supply factories, relieve the water utilization contradiction between supply and demand in city, but also reduce the sewage discharge amount, which will bring about considerable benefits of environment and economy in the city. Moreover, the cost of the water factory which generates recycle water by sewage is lower than the waterworks which generates tap water by natural water. therefore, the utilization of recycle will save the costs of water resource and construction and lower the consumption of resources, which is in favor of the sustainable development of the urban economy.

Converting sewage into new resources which will alleviate the shortage of water resource and lighten the environment pollution. Therefore, there is a great future of it. So it is necessary to take it as the basic strategy and countermeasure for water resource protection and to take it to the schedule of urban development and construction

4.2 To convert rainwater into new resources

Converting rainwater into new resources means a lot, such as storing for drink, storing for penetration, used as recycle water, used as irrigation water in the area where is lack of water. The rainwater directly infiltrate into ground in the natural ecosystem. In the urban drainage system, The rainwater is blocked by impermeable ground whereafter flow into drainage system, which result in the reduction of rainwater that infiltrate into ground, therefore, the treatment amount in the sewage treatment factories are increased. Managing to make the best of rainwater which is an important method to solve the shortage of water. The quality of rainwater is usually perfect. If the rainwater is collected before it touches to the ground or mixes with sewage, then it is clean because it only be contaminated when it pours through the air. It can be

used for many kinds of occasions through simply treatment, such as irrigating grass and trees, washing toilets, cleaning streets and supplying cooling water etc.. Rainwater is usually collected at the top of the buildings. It can be clarified by virtue of precipitation or filtration. Separating and discharging original rainwater, as a usual method to solve the problem of dirt and acid rain which is usually adopted, at the same time, refined filtration nettings are mounted to clean out the dirt and sands in water tank. The impermeable earth's surface accounts for a high proportion in urban area. So it is possible to collect rainwater by excavating ponds, canals or swamps in order to prevent the rainwater from discharging through drainage system quickly. To treat and purify the rainwater when the rainy season is over, finally, the purified rainwater is used for many kinds of occasions. The pollution load of rainwater is from washing air and the surface of streets. The pollution degree of rainwater relates to the urban population, industrialization conditions, and the degree of urbanization. According its different water quality, the collected rainwater could be used again after corresponding treatments. Generally speaking, rainwater recycle is more convenient, economical, and feasible than sewage recycle, which can achieve the goal of developing resources and reducing expenditures. The technology of rainwater reclamation is rapidly developed in Japan, Singapore and Kenya; those countries are good examples for us. At present, the focal point of rainwater reclamation is in the countryside in our country. Developing and boosting the process of rainwater reclamation in the city which plays an important role in constructing good urban ecosystem, protecting water environment, saving water resource, relieving the pressure of water supply, reducing rain flows in city, decreasing the investment of capital construction in the city.

4.3 The scale of the city should be equal to the water resources in the area

There should be abundant water resource in a sustainable development city; so such measures as water supply, water-conservation, recycle water etc. could totally meet water demand which containing industrial water requirement, domestic water, commercial water and other kinds of requirements in the city. On the contrary, the urban population and industry development should be in the limit of local natural resources. Water resource is usually the bottle-neck to the economic development in the western area where water resource is deficient. Therefore, the scale of urban area and the layout of industry development must correspondent to the quantity of local water resource. Moreover, development of the city should be harmonious with the around circumstances.

5. CONCLUSION

This passage discusses the relations between water resources and urban ecology and sequentially analyzes the restriction of urban development and urban ecology construction and balance which affected by the shortage of water resources. The

human being should tend towards urban ecology according to the ecological rules. It is necessary to think much of exploiting and utilizing the potential reproducible water resources, such as sewage and rainwater etc. converting sewage and rainwater into new resources that is an effective way to solve the shortage of water resources in the city. This method would play an important role in protecting water resource, constructing favorable urban environment and realizing the sustainable development of the city

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