

Environmental Impact Assessment of Constructed Wetland in the Jiaohe River Estuary of the Songhua Lake

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Abstract Wetland plays an extremely important role in economy and ecological environment, and the construction of constructed wetland also has a certain impact on the environment. Via the evaluation on environmental status of constructed wetland, the main environmental problems are found out, and the impact of construction of constructed wetland project on local water environment and ecological environment is analyzed, and evaluation conclusion is obtained.

Key words Constructed wetland; Environmental status; Environmental impact assessment

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Due to its important role in economy and ecological environment, wetland is called "kidney of the earth"^[1]. According to the *Convention on Wetlands of International Importance Especially as Waterfowl Habitat*, wetlands refer to natural or artificial, permanent or temporary swamps, wet plains, peatlands or water areas, with static or flowing, fresh, brackish or saline water bodies, including water areas with a water depth of no more than 6 m at low tide.

The implementation of constructed wetland in the Jiaohe River estuary of the Songhua Lake will purify the effluent from the sewage treatment plant at the lower reaches of the Jiaohe River estuary, which has an important role in preventing water pollution of the Jiaohe River main stream to the Songhua Lake and reducing regional pollution load into the lake.

1 General situation of the project

The constructed wetland project in the Jiaohe River estuary of the Songhua Lake is located on the left bank of the Jiaohe River. It starts from 1.6 km at upstream of river confluence of Xinnong Township and then goes down to river confluence of Xinnong Township. A constructed wetland is planned to be built at the entrance to the lake of the Jiaohe River, and construction content contains oxidation pond, surface flow constructed wetland and wetland supporting works, and its main task is to treat effluent from sewage treatment plant.

2 Environmental status and evaluation

2.1 Status quo and evaluation of surface water environment

Seen from water quality, water quality at 100 m from original rubber dam of the Jiaohe River and 100 m from the newly built dam

all does not exceed the standard, but TP at the Songhua Lake region of the Jiaohe River estuary exceeds the standard, which is caused by agricultural non-point source pollution on both sides of the river.

2.2 Status quo and evaluation of groundwater environment quality

The monitoring and analysis are conducted in Xiaojiaohe Village and Xixiaotun, and groundwater in the region overall could meet class III standard requirements of the *Groundwater Quality Standard* (GB/T 14848–2017).

2.3 General situation of the Songhua River Three Lakes Reserve

In October of 1982, the People's Government of Jilin Province approved the establishment of the Songhua Lake Nature Reserve, and the area was 354 098 hm². In 1990, the People's Government of Jilin Province approved the establishment of the Songhua River Three Lakes Provincial Nature Reserve, and the area was enlarged to 1 144 710 hm². In September of 2009, the State Council approved that 115 253.2 hm² of the original Three Lakes Provincial Reserve was promoted to a national nature reserve.

The Songhua River Three Lakes Provincial Reserve refers to the Songhua Lake, the Hongshi Lake and the Baishan Lake in the upper reaches of the Second Songhua River, the water area of the Songhua River section connecting the three lakes, and the land area delimited along the lake and the river. It is in southeast Jilin, and spans 33 townships and one street in Fengman District, Jiaohe City, Huadian City of Jilin City and Jingyu County and Fusong County of Baishan City in administrative region. It is 196 km long from south to north and 119 km wide from east to west. Total area of the region is 1 144 710 hm², and it is slightly rectangular. Provincial protected area is divided into lake area, near lake area and far lake area, and the evaluated constructed wetland is in far lake area.

The reserve is rich in plant species. At present, there are 1 489 species, 526 genera, 160 families and 63 orders of wild plants, 403 species, 93 families and 35 orders of vertebrates, and

896 species, 156 families and 16 orders of insects. In Fengman Reservoir, it is rich in fish, but the composition of fish fauna is simple, dominant by complex fish in river and plain, containing Cyprinidae, Cobitidae, Siluridae, Channidae, Bagridae, Serranidae, and Eleotridae^[2].

The land use types of the Songhua River Three Lakes Provincial Nature Reserve include 70.6% of woodland, 11.9% of agricultural land, 1.6% of sparse woodlot, 1.3% of shrub and shrub land, 2.3% of uncultivated forest land, 5.0% of waters, 6.0% of industrial and mining, construction, transportation, power transmission and other land, and others are cutting site, nursery land, barren mountain and wasteland, erosion ditch, bank erosion land and swamp.

2.4 Existing major environmental problems Industrial and domestic point source pollution: the sewage outlet into the river has a certain impact on the water quality of the Songhua Lake. Agricultural non-point source pollution: the main agricultural non-point source pollutants are ammonia nitrogen, TN and TP, and they are from cultivated land and domestic livestock and poultry breeding. Soil erosion: it mainly comes from damaged forest land, sloping farmland, flooded land, private farming and a small part of construction land.

3 Main environmental impact analysis

3.1 Environmental impact during construction period The construction wastewater of the project is reused after treatment. There is no construction camp in the project, and local houses are rented. Domestic sewage is collected by ecological toilet and transported out regularly, without being discharged. The construction period is selected in the dry season, which has little impact on the surface water environment.

During the construction period, the construction of dams, artificial islands and cofferdams may increase the suspended solids in the water body, making that the water turbidity is increased in the project area, but this impact will end with the finish of the construction period. Moreover, the project is only a small part of the Songhua Lake. After the operation of the project, the impact will disappear, and the habitat will be improved. Therefore, the impact on animals during the construction period is acceptable. In construction process of the project, soil in the range may be disturbed, causing soil erosion, and water and soil loss is formed in rainy season. The beaches in the project area are within the inundation red line of the Songhua Lake. In fact, it will be inundated by flood during flood period and become a part of the Songhua Lake. During the dry season, the surface is exposed to become a river beach, on which some wet meadows such as willow bushes and miscellaneous grasses are distributed. In wetland construction process, this part of vegetation will be cleared and replaced by artificially planted aquatic plants, such as *Phragmites australis*, *Typha orientalis*, and *Acorus calamus*. Although the original surface vegetation will be destroyed during construction, the surface vegetation will be restored during operation and can play an impor-

tant ecological function. If a variety of aquatic plants are planted in the wetland, the biodiversity of the wetland can also be greatly enriched.

3.2 Environmental impact during operation period

3.2.1 Environmental impact analysis of surface water. The large volume of water body in the project area has slow flow rate and long retention time, which is conducive to the settlement of suspended solids. It could reduce the turbidity and chromaticity of the water body. The flow velocity in the reservoir area is small, which reduces the exchange rate of water and gas interface and the migration and diffusion capacity of pollutants. Therefore, reoxygenation ability is weakened, making that the self purification capacity of water body after interception is weaker than that of the original river. The flow velocity in the project area is small, and the transparency is increased, which is favorable for algal photosynthesis. The water stored in front of the dam for several days is eutrophication due to the massive growth of algae. Submerged vegetation and rotten organic matter will consume a lot of oxygen in water and release biogas and a lot of carbon dioxide, which also leads to the greenhouse effect.

3.2.2 Environmental impact analysis of soil. The possible influence of constructed wetland on the soil in the project area is secondary salinization of soil. Soil secondary salinization means that before people reclaim and use (mainly irrigation), the soil is not affected by salinization, or is only slightly affected by salinization, but it becomes salinized soil after a certain period of irrigation. It is generally induced by human unreasonable irrigation (such as flood irrigation, poor drainage or poor irrigation water quality) and use, and is destruction of land resources by human activities^[3]. The most important preconditions for soil secondary salinization are the salt contents of soil and irrigation water. Neither of them is available in this area, and most of the soils in this area are brown soil, albic soil, meadow soil, alluvial soil and paddy soil. The contents of sulfate, chloride, carbonate and bicarbonate of sodium, potassium, calcium and magnesium in the soil are very low. The water source of the wetland is the Jiaohe River, and there are basically no salts formed by the above ions, and the pH value of the water quality is about 7. It can be seen that the proposed wetland will not lead to secondary salinization of soil.

3.2.3 Impact analysis of aquatic organisms. During the operation period, the water velocity decreases, which is conducive to the closure of nutrients. In the floristic structure, there will be more species, especially many species suitable for slow flow and still water life. Phytoplankton will be dominated by Chlorophyta and Cyanophyta suitable for still water, and the number of diatoms suitable for flowing water will be reduced. The zooplankton may be dominated by copepods and their nauplius larvae.

3.2.4 Impact analysis on regional ecological environment. After the completion of the project, a wetland will be formed all year round. After the constructed wetland is built and operated for several years, a large number of aquatic plants represented by *P. au-*

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3.3 Pollution investigation results The test results show that the site soil contains a high content of heavy metals such as copper, lead, and zinc. Among them, the distribution of pollution characteristics is analyzed. Benzene compounds and petroleum hydrocarbons are fully exposed to the surface soil in the middle of the site, which is closely related to the leakage of chemical production raw material intermediates

3.4 Health risk assessment Through the analysis of soil statistics, the pollution index of heavy metals and aromatic compounds is high, and they profoundly affect the residents around the industrial park. The intake of heavy metals is mainly from domestic water, and the intake of aromatic compounds is mainly from living water and respiratory tract.

4 Conclusion

In summary, in order to continuously improve the efficiency of site soil pollution treatment and achieve efficient use of sites, it is necessary to comprehensively investigate and analyze site contaminated soil, strengthen the integration of site pollution investigation results, accurately assess site pollution risks, and promote the normal progress of site governance to meet the needs of sustainable development of the ecological environment in essence.

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stralis will grow, and other aquatic organisms in the wetland will also multiply. This habitat may provide new foraging and resting space for birds, especially waterfowl, and will have a positive significance for enriching regional biodiversity. For example, after many years of operation, the West Dabao Constructed Wetland of Yingtai Oil Production Plant of Jilin Oilfield has attracted many waterfowls to inhabit and forage here due to the increase of wetland water surface. Wetland can regulate and store flood during flood period, slow down the time of flood peak entering the lake, and reduce flood control pressure. As the wetland has the function of detaining flood, it will also have a positive significance for the runoff supplement of regional groundwater.

4 Conclusions

The wetland control project belongs to that of eco-environment protection and pollution treatment, and but does not belong

to production construction project. Project construction could improve water quality of river, and the improvement of river water quality and river landscape will also improve the living environment of coastal residents. After the constructed wetland is completed, it will play the role of conserving and regulating water, and can also supplement groundwater resources. Overall, the project has good environmental, social and economic benefits.

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