Spatial Distribution Characteristics and Influencing Factors of Weishan Lake

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Abstract. Weishan Lake is one of the four lakes in the Nansi Lake and an important water transport hub for the east route of the South-to-North Water Transfer Project. The water quality study of Weishan Lake is conducive to a comprehensive understanding of the water quality and ensure the smooth progress of the South-to-North Water Transfer Project. This paper uses the water quality comprehensive pollution index evaluation method to analyse the water quality of Weishan Lake, and uses ArcGIS drawing software to spatially distribute the concentration of CODMn, NH3-N, TP, TN and SS in Weishan Lake water quality monitoring. Visualize to analyse the maximum impact factor for each space. At the same time, this paper combines the water quality evaluation results of Weishan Lake and the cause of water pollution, and puts forward the control countermeasures suitable for the pollution control of the basin, which provides a basis for the Weishan Lake watershed management and the realization of the water quality target of the South-to-North Water Diversion Project.

1. Introduction

Weishan Lake is an important storage lake for the main line of the South-to-North Water Diversion Project. At the same time, it is also a lake in the surrounding water system, and its water quality faces various risks. In 2012, the State Council promulgated and implemented the "Implementation Opinions on Pollution Control Plan for the East Route of the South-to-North Water Diversion Project", which stipulates that the water quality of Weishan Lake meets the three criteria in the "Environmental Quality Standard for Surface Water". Because Weishan Lake is the only external drainage body for industrial and agricultural production and domestic wastewater around the surrounding water system and river basin, although the water pollution control and interception and diversion project construction in recent years, the water environment quality of the river basin has been significantly improved, but still Faced with certain water quality risks. The main possible sources of pollution include urban industrial wastewater along the project, domestic sewage and various non-point source pollution in the surrounding countryside, organic pollutants in the surface soil environment of the basin, and pollution in the lake. At present, Weishan Lake is a type of eutrophic lake. The analysis and assessment of the

water quality of Weishan Lake will help to fully understand the water quality of the Weishan Lake Basin and ensure the smooth progress of the South-to-North Water Transfer Project.

2. Weishan Lake Overview and Point Layout

Weishan Lake is located in the south of Weishan County, Shandong Province. The lake covers an area of 660 square kilometers and has an average water depth of 1.5 meters. It is the largest freshwater lake in northern China and belongs to the lower lake basin of the Nansi Lake.

In order to fully understand the water quality of Weishan Lake, a total of 8 sampling points in different spaces were selected, which were located in the channel area, the water grass area and the coast. The latitude and longitude of 8 points are extracted by GPS, and the position layout is as shown in Figure 2-1. Water quality monitoring indicators have depth, transparency, temperature, pH, water turbidity, DO, total suspended solids, CODMn, TN, TP, NH3-N; among them, depth, temperature, water turbidity, DO, PH value on-site measurement, other The indicators are taken back to the laboratory after collecting the surface water samples of the vertical lines in each sample. The sample collection and preservation follow the current national or industry standards (specifications), mainly based on the "Technical Specifications for Surface Water and Wastewater Monitoring" (HJ/ T 91-2002), "Technical Regulations for Design of Water Quality Sampling Plan"-(HJ495-2009), Technical Regulations for Preservation and Management of Water Quality Samples (HJ495-2009), etc.

Figure 1. Weishan Lake sampling point

3. Water quality assessment method

The water quality comprehensive pollution index evaluation method is one of the important methods to evaluate the quality of water environment. The comprehensive water quality pollution index is calculated based on the evaluation of individual pollution index. Calculation method for single pollution index:

$$Pi = \frac{Ci}{Si}$$

Among them, Ci--contaminant measured concentration
Si - the standard value of the corresponding category.

Calculation method of comprehensive pollution index $P = \frac{1}{n}\sum_{i=1}^{n} Pi$

According to the size of the comprehensive pollution index, the water body can be divided into 1 standard: P≤0.8, the water body has no obvious constraints, and its function can be fully utilized. The individual water quality indicators can basically reach the requirements of the water environment functional area;

2 Basic compliance: 0.8<P≤1.0, the water body is restricted by certain water quality indicators to a certain extent, but the water environment function damage is small, and some individual pollution indexes exceed the standard; 3 pollution: 1.0<P≤2.0: the water body is obviously Restricted, the water quality is polluted, and many water quality indicators can not meet the requirements of the water environment functional area; 4 heavy pollution: P>2.0: the water body is seriously polluted, and the water body function can not meet the requirements, and the individual water quality indicators can not meet the water environment as a whole. Functional area requirements, some water quality indicators exceeded the standard.

Table 1. Evaluation results of Weishan Lake water quality comprehensive pollution index method

fid	Single pollution index				Comprehensive pollution index	Evaluation results
	NH3-N	TN	TP	COD(Mn)		
1	0.03	34.75	0.2	0.84	7.436	heavy pollution
2	0.03	33.15	0.2	0.795	7.209	heavy pollution
3	0.16	33.02	0.2	0.91	7.176	heavy pollution
4	0.03	33.94	0.2	0.795	7.253	heavy pollution
5	0.03	32.51	0.2	0.872	7.11	heavy pollution
6	0.08	32.02	0.2	0.802	6.978	heavy pollution
7	0.12	31.95	0.2	0.937	6.957	heavy pollution
8	0.23	32.64	0.2	0.968	7.212	heavy pollution

According to the monitoring results of 8 data points of Weishan Lake, the spatial distribution contour maps of CODMn, NH3-N, TP, TN and other indicators were drawn by using gis drawing software.

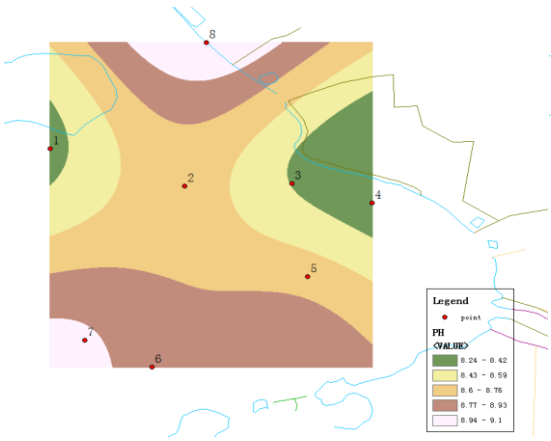

Figure 2. PH contour map of the sampling point

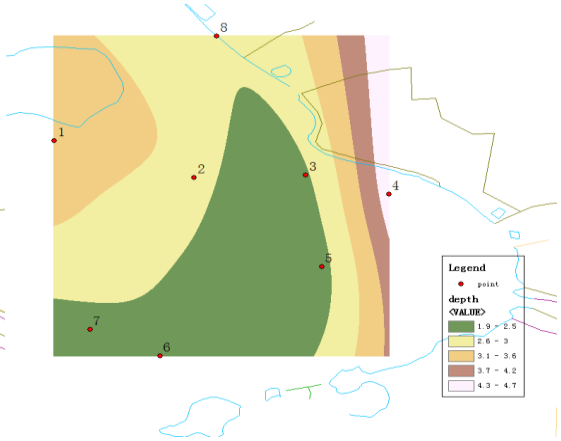

Figure 3. Depth contour map of the sample point

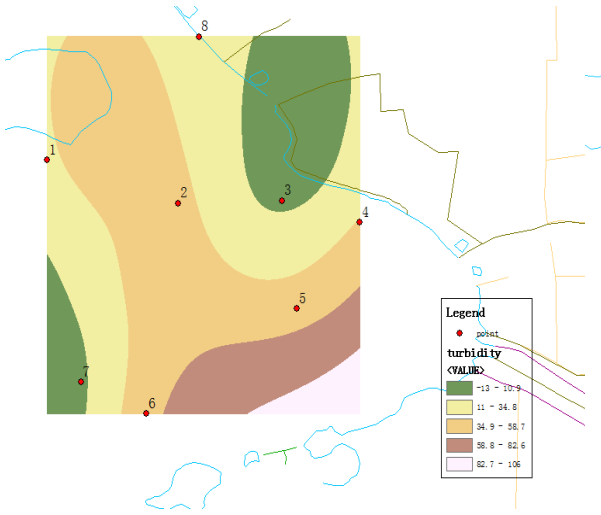

Figure 4. Turbidity contour map of the sample point

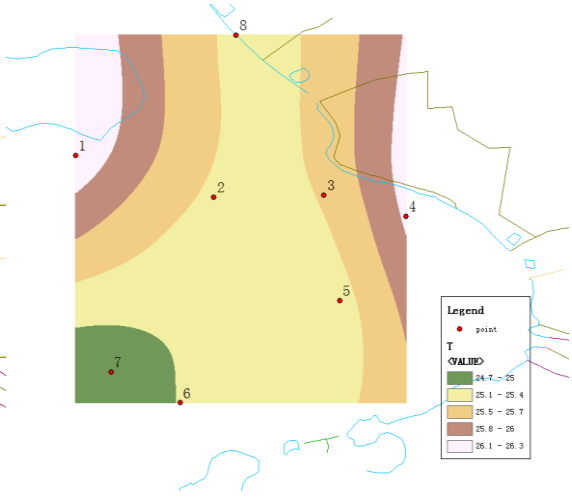

Figure 5. Tcontour map of the sample point

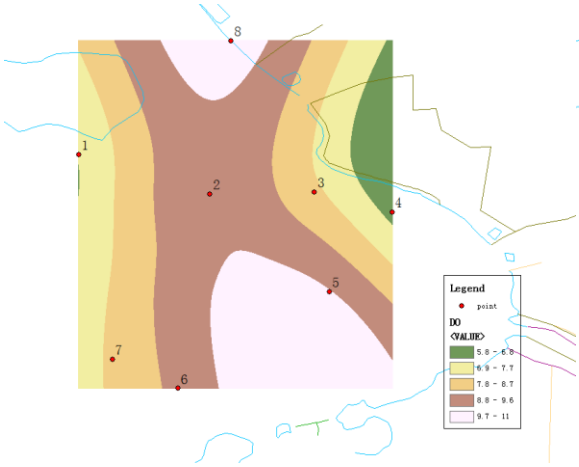

Figure 6. DO contour map of the sample point

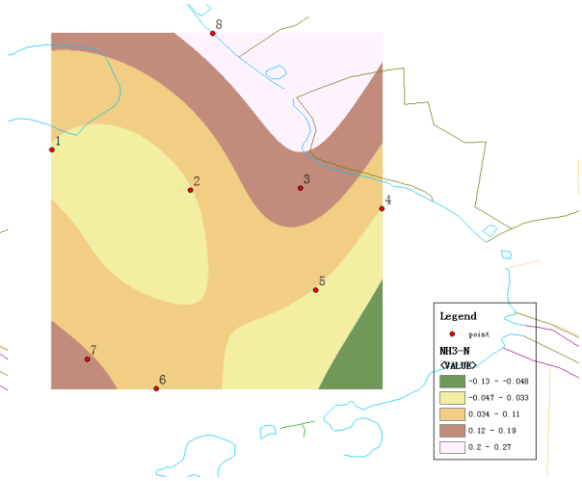

Figure 7. NH3-N contour map of the sample point

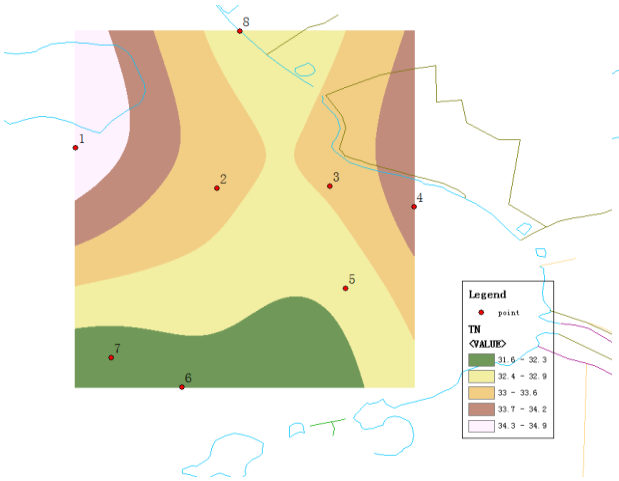

Figure 8.TN contour map of the sample point

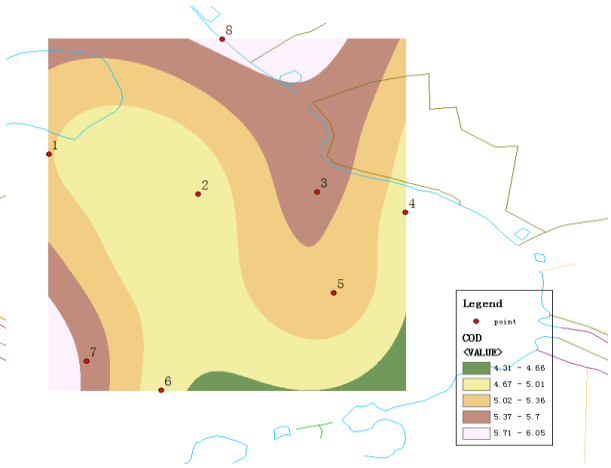

Figure 9. COD contour map of the sample point

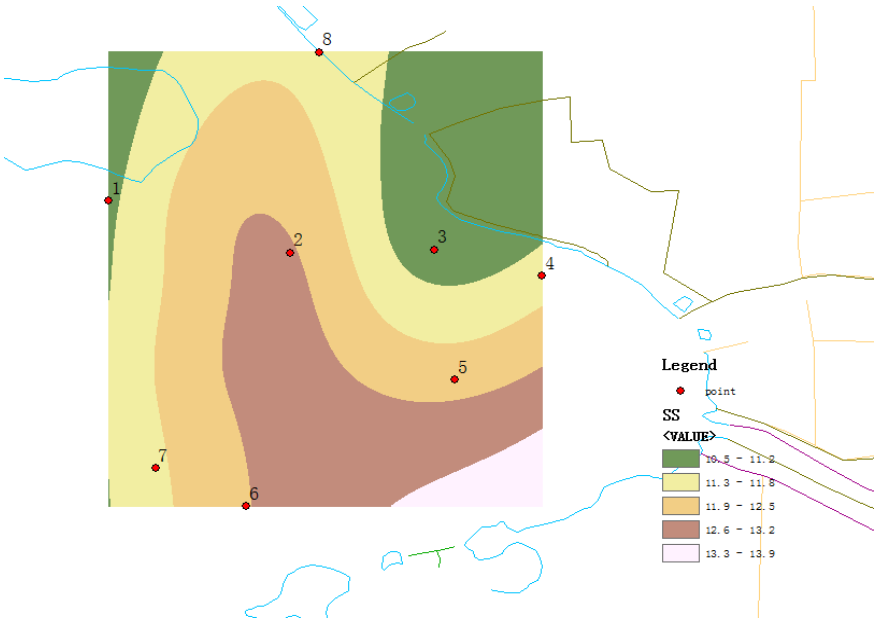

Figure 10. SS contour map of the sample point

It can be seen from Table 1 that the comprehensive pollution index of the eight sampling points of Weishan Lake has reached the level of serious pollution. The most influential factor affecting this index is the total nitrogen content. The average concentration of total nitrogen is 32.99 mg/L. The concentration exceeds the Class III standard, in which the ammonia nitrogen and total phosphorus meet the requirements of the Class II water body standard, and the CODMn also meets the Class III water body standard requirements. The contour map shows that the total nitrogen content of No. 1 and No. 4 on the coast is high. Combined with the contour map, the total nitrogen content may exceed the standard. The reason may be excessive use of chemical fertilizer, causing agricultural non-point source pollution, poultry farming wastewater entering the lake or Excessive discharge of domestic sewage and industrial wastewater discharged by surrounding enterprises are not up to standard.

4. Conclusion

Excessive total nitrogen content is one of the key factors affecting the water quality of Weishan Lake. To solve this problem, it is necessary to further analyze the source of nitrogen in Weishan Lake water body, and at the same time, the sewage discharge of households and enterprises around Weishan Lake, farmland The non-point source pollution situation was investigated to find the root cause of the total nitrogen exceeding the standard, and the water quality problem of Weishan Lake was solved according to local conditions.

Acknowledgments

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