



HBUT School of Science & HBUT-China

# Wuhan Lake Protection and Management Research Report

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Research area	<hr/> Wuhan <hr/>
Research team	<hr/> HBUT Dandelion Volunteer Service & 2018 iGEM HBUT-China <hr/>
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# Contents

Abstract.....	5
Problem Statement.....	6
1.1 The background of investigation.....	6
Investigation Method Design.....	7
2.1 Research framework.....	7
2.2 Research goal.....	8
2.3 Research subjects and scope.....	8
2.4 Investigation method.....	8
Investigation Implementation Process.....	10
3.1 Questionnaire design.....	10
3.2 Survey work time allocation.....	11
The research work time is from June 5, 2018 to July 21, 2018. The time allocation is shown in Figure 3.2-1.....	11
3.3 Distribute questionnaire .....	11
In the questionnaire issuance stage, we determine the number of questionnaires based on the calculated sample size and print some questionnaires. In order to ensure that the collected questionnaires are true and effective, we distributed a total of 300 questionnaires and collected 250 valid questionnaires with a recovery rate of 83.16%. During the issuance process of the questionnaire, our team members went to the lake parks around the four lakes in East Lake, Yuehu, Nanhu and Shahu, and distributed around the lakes, in an effort to provide the authenticity of the survey objects. reliability.....	11
3.4 Street interviews.....	11
There are 166 lakes in Wuhan, and the large and small lakes are scattered in all corners of Wuhan. It is Wuhan's unique water resources, which has created Wuhan's urban culture. After the regional distribution survey, the Dandelion Volunteer Service Team selected four lakes, namely Donghu, Yuehu, Nanhu and Shahu. Since the residents around the lake and the citizens exercising in the lake park have more opportunities to contact the lake, they are more concerned about the lake environment. The lake issue is more concerned, so residents around the constituency and citizens who exercise in the lake park conduct street interviews.....	11
3.5 Institutional interviews.....	11
Before interviewing the Wuhan Lake Administration, the Aihu Baihu Volunteers Association, and the Research Institute of Lakes and Lakes, the volunteer team members made preliminary preparations, and outlined the interviews of various agencies. During the interview, interviews with agency staff were conducted around these outlines.....	11
4.1 Problem analysis.....	12
4.2 Problem analysis process.....	25
Research Conclusions and Recommendations .....	27
5.1 Research conclusions.....	27
Appendix 2: sas program: .....	32

## List of charts

Abstract.....	5
Problem Statement.....	6
1.1 The background of investigation.....	6
Investigation Method Design.....	7
2.1 Research framework.....	7
Figure 2.1- 1 Technical roadmap.....	7
2.2 Research goal.....	8
2.3 Research subjects and scope.....	8
2.4 Investigation method.....	8
Investigation Implementation Process.....	10
Figure 3.1-2 Survey flow chart.....	10
3.1 Questionnaire design.....	10
Table 3.1- 1 Questionnaire description.....	10
3.2 Survey work time allocation.....	11
The research work time is from June 5, 2018 to July 21, 2018. The time allocation is shown in Figure 3.2-1.....	11
Figure 3.2- 1 Time allocation map.....	11
3.3 Distribute questionnaire .....	11
In the questionnaire issuance stage, we determine the number of questionnaires based on the calculated sample size and print some questionnaires. In order to ensure that the collected questionnaires are true and effective, we distributed a total of 300 questionnaires and collected 250 valid questionnaires with a recovery rate of 83.16%. During the issuance process of the questionnaire, our team members went to the lake parks around the four lakes in East Lake, Yuehu, Nanhu and Shahu, and distributed around the lakes, in an effort to provide the authenticity of the survey objects. reliability.....	11
3.4 Street interviews.....	11
There are 166 lakes in Wuhan, and the large and small lakes are scattered in all corners of Wuhan. It is Wuhan's unique water resources, which has created Wuhan's urban culture. After the regional distribution survey, the Dandelion Volunteer Service Team selected four lakes, namely Donghu, Yuehu, Nanhu and Shahu. Since the residents around the lake and the citizens exercising in the lake park have more opportunities to contact the lake, they are more concerned about the lake environment. The lake issue is more concerned, so residents around the constituency and citizens who exercise in the lake park conduct street interviews.....	11
3.5 Institutional interviews.....	11
Before interviewing the Wuhan Lake Administration, the Aihu Baihu Volunteers Association, and the Research Institute of Lakes and Lakes, the volunteer team members made preliminary preparations, and outlined the interviews of various agencies. During the interview, interviews with agency staff were conducted around these outlines.....	11
4.1 Problem analysis.....	12
Figure 4.1- 1 Resident population ratio.....	12
Figure 4.1- 2 Career distribution.....	12
Figure 4.1- 3 Wuhan Lake overall impression distribution.....	13
Figure 4.1- 4 Citizen lake environment satisfaction distribution.....	13
Figure 4.1- 5 Proportion of uncivilized behavior around lakes in the eyes of the public	14
Figure 4.1- 6 Lake problem map.....	15
Figure 4.1- 7 Proportion of the largest factor in lake environmental damage.....	15
Figure 4.1- 8 Proportion map for the purpose of protecting lakes.....	16
Figure 4.1- 9 Environmental protection knowledge survey scale chart.....	16
Figure 4.1- 10 Economic development and environmental protection survey scale.....	17
Figure 4.1- 11 Citizen participation volunteer service survey scale.....	17
Figure 4.1- 12 Citizen participation service survey map.....	18
Figure 4.1- 13 Citizens not participating in service reasons survey scale.....	19
Figure 4.1- 14 Citizen reporting channel survey scale chart.....	19
Figure 4.1- 15 Environmental protection system satisfaction ratio map.....	20

Figure 4.1- 16 Environmental protection system satisfaction ratio map.....	20
Figure 4.1- 17 Protection measures citizen satisfaction survey scale.....	21
Figure 4.1- 18 Citizens going to the lake park frequency map.....	21
Figure 4.1- 19 Lake park entertainment mode survey map.....	22
Figure 4.1- 20 Lake infrastructure satisfaction survey.....	22
Figure 4.1- 21 Lake park development satisfaction survey scale.....	23
Figure 4.1- 1 Citizenship recommendation summary.....	25
4.2 Problem analysis process.....	25
contingency table analysis .....	25
In order to explore the respondents of different occupations and whether they will respond to the Wuhan Lake Protection Policy and protect their ecological environment by rivers and lakes, we used SAS software to analyze the contingency table. ....	25
Analysis of the contingency table on occupations and response policies:.....	25
Figure 4.2-1 Frequency distribution table for different occupations and whether or not to respond to policies.....	25
Research Conclusions and Recommendations .....	27
5.1 Research conclusions.....	27
Appendix 2: sas program: .....	33

## Abstract

With the accelerated modernization of Wuhan, and the resultant large scale construction of various infrastructure and industry, commercial land and lake waters have been brought into conflict, with many water bodies and green shorelines being encroached upon, or even destroyed, the ecological environment of the city is under assault. The situation is getting more serious every day, and protection efforts are urgently needed. Informed by this situation, we designed and launched a survey.

In this survey, we first analyzed the satisfaction of the citizens of Wuhan City regarding the status quo of the lake environment by descriptive statistical analysis of the questionnaire results. Then, through the contingency table, we analyzed whether people respond to the government's policy of protecting lakes. The logistic model is used to study the factors that affect people's access to the lake park. By studying these factors, suggestions for making the lake park better can be proposed.

Finally, based on empirical analysis and theoretical support, we concluded that:

1. The public's satisfaction with the Wuhan lake environment still needs to be improved
2. Most citizens are environmentally conscious, but they have great resistance to action.
3. The effect of policy work is large, and policy implementation has effect
4. The living standards of the citizens are improved, and the requirements for the lake environment are higher.

In this regard, we make the following recommendations:

1. The government plays a leading role. After this investigation, we found that the initiation and implementation of a lake protection work is led by the government and drives lower-level units and civil organizations to carry out related activities. Therefore, though it is only the government which sets guidance and direction, we of the public must vigorously support the lower-level departments in implementing the policies and achieving good results.
2. The communication channel between the government and the public should increase. Although the Wuhan Aihu Lake Volunteers Association was established under the joint promotion of the Wuhan Water Affairs Bureau and the Changjiang Daily Newspaper, it has developed into a huge influence in Wuhan and leveraged many message board functions of the Internet. The communication channel is there, but we need to improve on means for the public to put forth their own opinions. And we need to get the government departments to more vigorously publicize these matters, to eliminate the practical and legal blind spots of the citizens.
3. There is still a need to increase environmental awareness through promotional activities. It is necessary not only for government departments to place public service advertisements on TV channels and other publicity activities of government departments, but also to involve various social forces. For example, the Aihu Lake team have carried out environmental protection public welfare projects; one person drives the family, the family drives the society and causes environmental protection effects in the society to drive more people to participate in the practice of ecological responsibility.

# Problem Statement

## 1.1 The background of the investigation

( 1 ) **The importance of ecological civilization construction.** President Xi made a report to the General Assembly on "Decisive victory in building a well-off society in an all-round way and winning the great victory of socialism with Chinese characteristics in the new era." Among them, the first part is "Work and historical changes in the past five years", the third part is "New Socialism Thoughts and Basic Strategies with Chinese Characteristics" and the ninth part is "Accelerating the Reform of Ecological Civilization System and Building Beautiful China" In particular, it discusses the staged achievements, guiding ideology and strategic deployment of ecological civilization construction. In the context of the new era, "the idea of establishing and practicing green water and green hills is the concept of Jinshan Yinshan" was first written into the report of the party congress of the world's largest political party. The report points out in the third part, "The New Era Thoughts and Basic Strategies of Socialism with Chinese Characteristics" (9): It is necessary to establish and practice the concept of *Lucid waters and lush mountains are invaluable assets*, and adhere to the basic national policy of saving resources and protecting the environment. Treat the ecological environment like life. All of this reflects the importance of ecological civilization construction under the new era and the healthy development of the motherland.

( 2 ) **The need for lake protection.** Our lakes are important resources. They are an important part of the river system. They have many functions such as regulating river runoff, developing irrigation, providing industrial and drinking water sources, proliferating aquatic organisms, facilitating shipping, improving regional ecological environment and developing minerals. At the same time, the development of the national economy plays an important role, yet the lakes and their basins are important places for human survival. The lakes themselves are sensitive to global changes. In the complex system of man and nature, lakes are the surface system of the earth. The connection point of the circle interaction is an important part of the land hydrosphere. For a long time, some businesses and industries have encircled lakes, invaded waters, exceeded the standard sewage, illegally cultured, illegally performed sand mining; all causing shrinkage of lake area, reduction of water space, deterioration of water quality, and biology. Problems such as habitat destruction are prominent, and lake functions are seriously degraded.

( 3 ) **Overview of the current situation of lakes in Wuhan.** Wuhan City is a city with unique water resources. It is surrounded by rivers and lakes. The water resources are quite abundant. The water area accounts for 1/4 of the urban area, and the number of lakes in the city, suburbs, and surrounding rural area is more than 200. According to statistics from 2015, there are 166 lakes in the city and suburbs of Wuhan, with a water surface area of about 867 square kilometers, accounting for 41% of the city's water area and 10.2% of the city's land area. Hundreds of lake stars are densely populated, so they are called "Jiangcheng" and "the city of Baihu", which is the pride of this city. If Wuhan is regarded as a living being, then 166 lakes are the blood of Wuhan. However, in recent years, with the acceleration of the modernization of Wuhan, and the resultant construction of various industries infrastructure, commercial land and lake waters are thrust into conflict, many water bodies and green shorelines are encroached upon or destroyed, and the ecological environment of the city is being assaulted. Despite the seriousness of these problems, there are still many bad practices affecting the lakes of Wuhan, such as water pollution, unreasonable development

and utilization, gradual disappearance of biodiversity, and increasing landscape fragmentation.

## Investigation Method Design

### 2.1 Research framework

Through the establishment of a reasonable survey framework, we will combine questionnaires, lakeside surveys, street interviews, plus information and assistance from government departments, Aihu Lake Volunteers Association, Lake Park Management Office and expert research activities to comprehensively understand lake protection and management in Wuhan. The status quo, qualitative analysis of Wuhan lake protection and management. Through the qualitative analysis of the questionnaire survey, the residents' satisfaction with the current lake protection and management in Wuhan was obtained. Combined with the lake problems discovered by the above analysis and practice team in practice, suggestions for the protection of lakes in Wuhan are proposed.

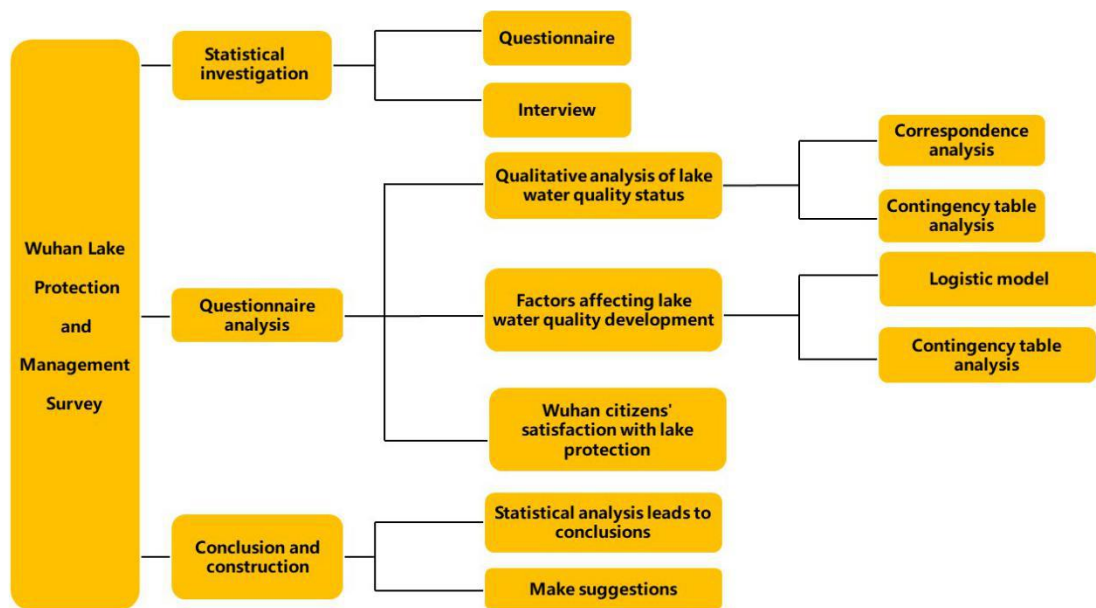


Figure 2.1- 1 Technical roadmap

## 2.2 Research goal

Wuhan has a large number of lakes and a large water area. Nowadays, the modernization speed of Wuhan cities is accelerating. The pollution problems of lakes and the contradiction between lake waters and urban commercial land are becoming more and more serious. The protection of lakes is imminent, and the call for protecting lakes is growing. The Wuhan government department is also aware of this problem, so many measures have been taken, and many policies and plans have been formulated to vigorously protect the work. The purpose of the practice team research is to investigate the current status of lake protection and management in Wuhan by investigating the interviews with ordinary citizens, government departments, and visiting private lake protection organizations.

The purpose of our research is as follows:

1. Understand the policy plan formulated by Wuhan.
2. Investigate the implementation of Wuhan policy.
3. Investigate the understanding of Wuhan citizens on policies.
4. To investigate the satisfaction of Wuhan residents on the management of lakes in Wuhan.
5. To investigate the satisfaction of Wuhan residents in the construction of lake park facilities.
6. Investigate the environmental awareness of Wuhan citizens and participate in volunteer service awareness.
7. Understand the role of civil society organizations in the protection of lakes in Wuhan.

## 2.3 Research subjects and scope

Survey object: Wuhan citizens overall.

Investigator: Wuhan Lake Administration, every citizen of Wuhan, and the Lovers of Baihu Volunteers Association.

Survey scope: Jiangnan District, Hanyang District, Wuchang District, Hongshan District

## 2.4 Investigation method

(1) Copywriting investigation method.

In the early stage of the large-scale questionnaire survey, we mainly used the copywriting investigation method to check the literature and news reports of Wuhan Lake Protection through manual search and computer search, and obtained second-hand information that has certain guiding significance for our research, and our understanding of the current status of lake protection and management in Wuhan, and the policy plan formulated by Wuhan.

(2) Questionnaire method

We mainly adopted the questionnaire survey method. The questionnaire survey method can save manpower and time and enable the respondents to express their opinions truthfully. We were able to conduct large-scale surveys, acquire ample sample data, and the results were easy to quantify. It was therefore conducive to data processing and statistical analysis. At the same time, the design of the questionnaire is as a dialogue between the investigator and the respondent. Through the design of hierarchical problems, this method can help the

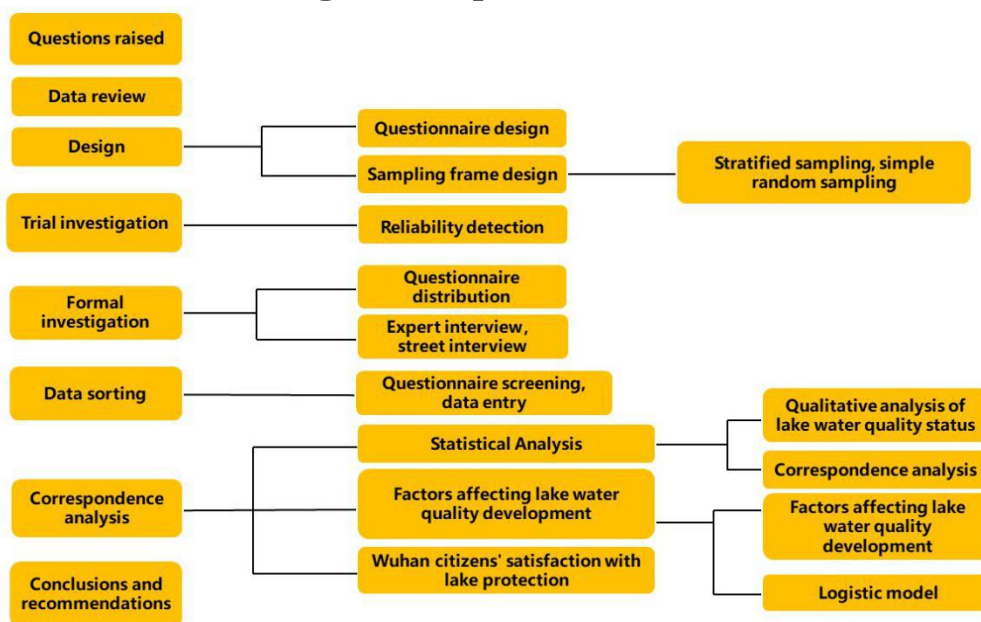


investigator to obtain the required data better. Therefore, we distributed a questionnaire entitled “Wuhan Lake Management and Protection Status Questionnaire” in social surveys. (See Appendix 1)

### (3) Interview method

During the investigation, the practice team went to the Wuhan Lake Management Bureau, the Aihu Baihu Volunteers Association, and the Research Lake Park Management Office for interviews. Via these interviews, we learned about the current status of lake protection and management in Wuhan: Wuhan Lake Administration is the lead unit carrying out policy research and implementation; Lake Park Management Office conducts daily maintenance of the lake as a policy implementation office; “Loves my Hundred Lakes Volunteers Association” as the core, local people complement the official lake protection agencies, and jointly safeguard the environment of the lake in Wuhan. The association serves as a bridge between the government and the people. Through interviews with these government agencies and civil organizations, we collected opinions and suggestions on the “most official” and “most civilized” protection of Wuhan lakes, which helped our team to understand the status quo of Wuhan lake protection and management.

## Investigation Implementation Process



**Figure 3.1- 2 Survey flow chart**

### 3.1 Questionnaire design

According to the research theme and the information collected by the practice team through the copywriting method in the early stage, the practice team prepared a questionnaire entitled “Wuhan Lake Management and Protection Status Questionnaire”. According to the needs of data analysis professional, we divided the research question into four parts, as shown in the following figure. These include:

**Table 3.1- 1 Questionnaire description**

	Questionnaire section	Description and connotation
Part I	Basic situation investigation	Investigator's basic information
Part II	Lake survey	Impression of the lake,
Part III	Protecting lake awareness	Problems with lakes
Part IV	Lake Park Situation Survey	How to protect the lake,

### 3.2 Survey work time allocation

The research work time is from June 5, 2018 to July 21, 2018. The time allocation is shown in Figure 3.2-1.



Figure 3.2- 1 Time allocation map

### 3.3 Distribute questionnaire

In the questionnaire issuance stage, we determined the number of questionnaires based on the calculated sample size and printed some questionnaires. In order to ensure that the collected questionnaires were true and effective, we distributed a total of 300 questionnaires and collected 250 valid questionnaires with a recovery rate of 83.16%. During the issuance process of the questionnaire, our team members went to the lake parks around the four lakes; East Lake, Yuehu, Nanhu and Shahu, and distributed around these areas in an effort to achieve authenticity of the survey objects.

### 3.4 Street interviews

There are 166 lakes in Wuhan, and the large and small lakes are scattered in all corners of Wuhan. It is Wuhan's unique water resources which has created Wuhan's urban culture. After the regional distribution survey, the Dandelion Volunteer Service Team selected four lakes, namely Donghu, Yuehu, Nanhu and Shahu. Since the residents around these lakes and the citizens exercising in the lake park have more opportunities to interact with the lake, they are more concerned about the lake environment. There it was important to target residents around the constituency and citizens who exercise in the lake park conduct street interviews.

### 3.5 Institutional interviews


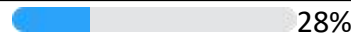
Before interviewing the Wuhan Lake Administration, the Aihu Baihu Volunteers Association, and the Research Institute of Lakes and Lakes, the volunteer team members made preliminary preparations, and outlined the interviews of various agencies. During the interview, interviews with agency staff were conducted around these outlines.

## Statistical Analysis of Survey Data

In order to ensure the efficient and orderly analysis process, we conducted a preliminary screening of the questionnaire to ensure that the questionnaires entered were true and effective, and there were no logical errors and missing and incorrect filling. Then we sorted the questionnaires, entered the data with the spss software, and finally confirmed that the entered data was accurate, and also organized the interview content, thus starting the questionnaire analysis process.

### 4.1 Problem analysis

#### Question 1


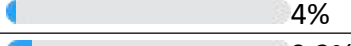


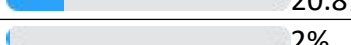
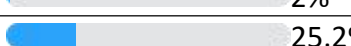

Have you lived in Wuhan for a long time?	
Yes	 72%
No (temporary residence)	 28%

**Figure 4.1- 1 Resident population ratio**

Chart analysis: 72% of the survey respondents were permanent residents of Wuhan, and 28% were temporary residents of Wuhan.

Conclusion of the problem: During the investigation, more than 70% of the residents lived in Wuhan, which is consistent with the majority of Wuhan residents during the practice preparation process, which proves the scientific nature of the survey.

#### Question 2

Your occupation?	
Student	 33.2
Official cadre	 4%
Worker	 9.2%
Teacher	 5.6%
Staff	 20.8%
IT personnel	 2%
Other	 25.2%

**Figure 4.1- 2 Career distribution**

Analysis of results: The occupational distribution of 499 people who filled out the questionnaire. Among them, the number of students accounted for 33.2%, the number of employees of a company accounted for 20.8%, the number of unskilled workers accounted for 9.20%, the number of teachers accounted for 5.6%, the number of government cadres accounted for 4%, the number of scientific and technical personnel accounted for 2%, and the other occupational people accounted for 25.20%.

Conclusion: From this result, we can see that as people's living standards improve, the entertainment activities of people's lives become more and more diverse, and the careers of people who walk in the park are more and more diversified. Due to the increasing demand for people's good material life and the diversity of occupations, it is more and more common to come to the lake to play in the pursuit of a better life. Therefore, it is necessary to strengthen the construction of Wuhan Lake Park. The large number of students indicates that the quality is improving, and they will choose to walk and exercise, as well as to watch the natural scenery.

### Question 3

What is your overall impression of the Wuhan Lake?	
Nice environment	32.4%
Serious damage	10%
So so	50%
The scenery is no longer the same	7.6%

**Figure 4.1- 3 Wuhan Lake overall impression distribution**

Analysis of the results: 32.4% of the people think that the “Wuhan Lake environment is beautiful”, 10% think it is “seriously damaged”, 50% think “neither good nor bad”, and 7.6% think “the scenery is no longer the same”.

Conclusion: It is believed that the number of people around the beautiful lakes of Wuhan is only 30%, indicating that the protection and restoration of lakes in Wuhan needs to be strengthened. At the 19th National Congress of the Communist Party of China, General Secretary Xi clearly proposed the two mountains theory as the guiding ideology of ecological civilization construction, and also emphasized the importance of ecological civilization construction. Wuhan is a city famous for its lakes, so with the accelerated development of Wuhan's modernization, it's more important than ever to strengthen our lake protections.

### Question 4

Do you think the lake environment has changed in recent years?	
Changed, got better and better	59.2%
Changed, got worse and worse	12.4%
No change	9.2%
No attention	19.2%

**Figure 4.1- 4 Citizen lake environment satisfaction distribution**

Analysis of the results: 59.2% of the people think that “the lake environment is getting better and better in recent years”; 19.2% of the people who are not paying attention; 12.40% of the people who think that “it has become worse”; The number of people who think “it has not changed” accounted for 9.20%.

Conclusion: This data illustrates two issues. On the one hand, with the strong support of the

state and the Wuhan government, effective management and protection measures have been formulated. The environment around the lake is getting better and better, and people are more and more fond of the environment around the lake. On the other hand, some people have insufficient awareness of lake protection, indicating that the promotion of lake protection is not enough, so further knowledge of this knowledge is needed.

### Question 5

What uncivilized behaviors have you seen around the lake? (multiple choice)	
Dumping construction waste, engineering waste or other waste	50%
Climbing, nailing trees, damaging green areas, lawns, or picking flowers, fruits, bamboo shoots	48.8%
Unauthorized fishing of aquatic plants and animals	29.6%
Fishing and swimming outside the designated area, time of day	44.4%
Paint smears on the scenery and facilities, or hang the items that affect the landscape without permission	24%
Burning items, open-air barbecue, or using open flames in the mountain forests	16.4%
other	5.6%

**Figure 4.1- 5 Proportion of uncivilized behavior around lakes in the eyes of the public**

Analysis of the results: It can be seen from the table that dumping various garbage around the lake, climbing trees and flowers and fishing outside the designated area accounted for 50%, 48.8%, and 44.4%, respectively.

Conclusion: The data shows that these uncivilized behaviors occur very frequently. If you want to curb these uncivilized behaviors as much as possible, you should formulate some park management systems to restrain these behaviors according to local conditions, and strengthen the law enforcement patrols of the lakes. Do some publicity about lake protection, let more people realize the importance of the lake and consciously protect the lake, put an end to uncivilized behavior, and make some contributions to the protection of the lake.

### Question 6

What do you think is the biggest problem with lakes at this stage?	
Reduced number of lakes	18%
Lake area shrinks	22.8%
serious pollution	24.4%
Deterioration of water quality and eutrophication	30%
other	4.8%

**Figure 4.1- 6 Lake problem map**

Analysis of the results: In the survey, the respondents believed that the biggest problem in the lake was the deterioration of water quality and eutrophication, accounting for 30% of the total number of people surveyed. The number of people with shrinking area and serious pollution was second, 22.8% and 24.4% respectively.

Conclusion: These options, and the number of people selected, indicate that there are still many problems in the lake at this stage, especially the deterioration of water quality and eutrophication. According to the analysis, these are the problems that the respondents can directly feel, and the consequences of the problems have led to serious declines in people's living environment, and leisure places, reducing the frequency of people's activities in the lake park, and leaving visitors with a poor impression. Therefore, in response to the call of the 19th National Congress, the Wuhan government should take some substantive measures to strictly obstruct the phenomenon of smuggling and draining, concentrate on rectifying the black and odorous water in Wuhan, and comprehensively enhance the overall impression of the lakes and rivers in Wuhan. On the one hand, the government must vigorously promote the “clear water into the lake” and water restoration projects. On the other hand, people need to understand the importance of protecting the environment from the impact of environmental issues.

**Question 7**





What do you think is the biggest factor in the damage of the lake environment?	
Natural factors such as climate change	10%
Filling the lake and making fish in the lake	22.8%
Municipal construction, tourism and real estate development boom	31.2%
The lake is heavily polluted and then landfilled	24.4%
Other	11.6%

**Figure 4.1- 7 Proportion of the largest factor in lake environmental damage**

Analysis of the results: Nearly one-third of the people believe that the boom in municipal construction, tourism and real estate development has destroyed the lake environment, followed by land reclamation and fish farming around the lake. The lake is heavily polluted and landfilled, accounting for 22.8% respectively. , 24.4%.

Conclusion: From the perspective of the choice of the interviewed population, everyone concentrates on the human factors and seriously affects the ecological environment of the lake. Therefore, the city should pay attention to the rationality of developing lakes during construction, avoiding the abuse of lakes and causing serious lakes. Reduced and severely polluted. At the same time, some policies and rewards and punishments should be formulated to constrain the development of lakes, and to raise awareness of the importance of the lake, so that people realize that to protect the lake, people's lives will be better.

### Question 8




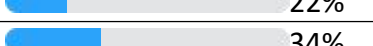
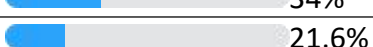

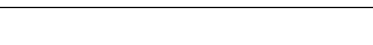
What do you think is the protection of the lake?	
In order to make the living environment more beautiful	 38%
Nothing, no need	 5.6%
In order to live in harmony with nature, for the sake of our children and grandchildren	 56%
other reasons	 0.4%

**Figure 4.1- 8 Proportion map for the purpose of protecting lakes**

Analysis of the results: The proportion of the sample selected to "come in harmony with nature for the sake of our children and grandchildren" was 56.0%. And the ratio of samples for a more beautiful living environment is 38.0%.

Conclusion: It is indicated from the data that the vast majority of people have the willingness to protect the lake, but 5.6% of the people choose "do not need to", indicating that a small number of people have weak awareness of lake protection. There is still a need to invest in propaganda to raise their awareness of the importance of protecting the lake.

### Question 9

What is the main source of knowledge about your lake's environmental protection?	
Television broadcast	 44.8%
The internet	 52%
School classroom	 25.6%
Newspapers and magazines	 22%
PSAs	 34%
Related activities	 21.6%
other	 8%

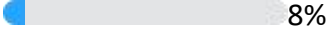
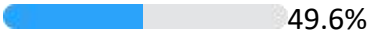
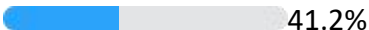

**Figure 4.1- 9 Environmental protection knowledge survey scale chart**

Analysis of the results: reflected in the choice of the interviewed population, the public have a wide range of channels to understand the knowledge of lake environmental protection, most people have learned about environmental protection from the network or television broadcast.

Conclusion: It can be seen from the analysis of the results that it is very important to make good use of the medium of the network, and to use the advantages of the network to publicize, for example, by using WeChat public tweets and online advertisements. Secondly, we must make full use of publicity advertisements such as TV public service advertisements, school classrooms, newspapers and magazines, etc., so as to promote the issues, and strive to maximize the importance of lake protection and the scope and efficiency of lake science knowledge.



**Question 10**


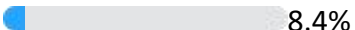
Which one do you think is more important for economic development and lake environmental protection?	
The economy is more important, we must first do a good job in economic development and then carry out environmental protection in the lake.	 8%
Protecting lakes is more important, and any economic development cannot be at the expense of the environment.	 49.6%
Both aspects are important, both need to be balanced	 41.2%
Depending on the circumstances, the premise of gaining benefits	 1.2%

**Figure 4.1- 10 Economic development and environmental protection survey scale**

Analysis of the results: About 50% of the people in the sample consider that “protecting the lake is more important, and any economic development cannot be at the expense of the environment”. In addition, many consider that both aspects are important, and the ratio of the two needs to be taken into account.

Conclusion: Explain that most residents recognize the importance of lake protection and its relationship to economic development; economic development cannot be predicated on sacrificing the environment, and so the economy has been sacrificed in the past two or three decades. Moreover, the number of people who chose "both considerations" also reached 41.2%, indicating that most of the people have a clear understanding of the balance.

**Question 11**

Will you respond to the Wuhan Lake Protection Policy and use your own actions to protect the ecological environment of rivers and lakes? (Multiple choice questions) (If “Yes”, skip question 13. If “No”, skip question 12)	
Yes	 91.6%
No	 8.4%

**Figure 4.1- 11 Citizen participation volunteer service survey scale**

Analysis of the results: Most of the samples were selected as “conference” residents, accounting for 91.6%. More than 90% of the residents indicated that they would respond to the Wuhan Lake Protection Policy and protect their ecological environment by rivers and lakes.

Conclusion: This shows that the masses pay attention to the protection of lakes, have enthusiasm for participation, and have awareness of environmental protection issues. However, if they raise awareness to the action level, they still need channels from relevant

departments, and other means, to increase publicity. And yet nearly 10% of the residents said they would not respond to the lake protection policy in Wuhan. This shows that some residents still pay insufficient attention to lake protection, and/or feel that lake protection participation is too much trouble, so it is necessary to strengthen the message about protection of lakes, and try to eliminate the misunderstandings of residents.

**Question 12**

If you are willing to participate in the protection of lake activities, what will you do to protect the lake?	
Actively engaged in the protection of the lake	41.2%
Understand lake environmental knowledge and publicize it to the public	56.4%
Provide protection advice and advice to the lake management department	26%
Actively abide by the government's policy on lake protection	40.4%
(blank)	4%

**Figure 4.1- 12 Citizen participation service survey map**

Analysis of the results: Many people who are willing to participate in the protection of lake activities have chosen to take the initiative to understand the environmental protection knowledge of the lake and publicize it to the public, actively participate in the protection of the lake and actively comply with the government's policy on lake protection, and choose to protect the lake management department. The residents of opinions and suggestions are relatively small.

Conclusion: Explain that a few residents choose to retain their opinions over official information and data. However, the good opinions of the masses have a great effect on the governance and protection of the lake. This requires the relevant departments to open more communication channels to let the policies better reach the masses. The ill-informed opinions have to go.

**Question 13**

The reason you are not willing to participate in the protection of lake activities may be	
Not interested in	11.2%
Need at your own expense	13.6%
No time to	50%
Think that the activity is meaningless	11.2%
I think the activity is very hard	4.8%
(blank)	30.4%

**Figure 4.1- 13 Citizens not participating in service reasons survey scale**

Analysis of the results: 50% of the people are unwilling to participate in the protection of lake activities say it is because they don't have time, and a few others said that the activities are meaningless, or they simply were not interested in the activities.

Conclusion: It shows that when official organizations and non-governmental organizations organize lake protection activities, they must not only consider the positive impact of this activity on lake protection, but also consider the feelings of volunteers participating in the event, and strive to make the activities rich and colorful, so that they enjoy participating. Strive to give the volunteers a sense of gain, don't waste their enthusiasm, and ensure they earn a little face; then maybe more people will participate in the future activities of lake protection.

**Question 14**

What actions would you take if you saw that the lakes around you were being vandalized?	
Does not matter	11.6%
Report to the news media	31.6%
Report to management	48.8%
Take the initiative to stop	48.8%

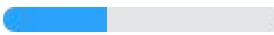
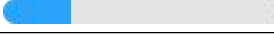



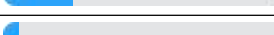
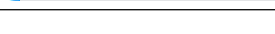
**Figure 4.1- 14 Citizen reporting channel survey scale chart**

Analysis of the results: When the lakes around them are being vandalized, nearly 50% of the residents will choose to report to the management department and take the initiative to stop it. In addition, 31.6% of the people choose to report to the news media, indicating that to most people the lake is still very important. 11.6% of the residents feel indifferent.

Conclusion: Combined with the above-mentioned questions about citizen participation in volunteer service, it can be concluded that citizens have the willingness to participate in the activities of love lake protection, but don't know how to raise opinions or how to report illegal behaviors. Therefore, in the education system, we must also strengthen the cultivation of the legal consciousness so that every citizen can understand the law and be a law enforcer.

**Question 15**

Which of the following government initiatives to manage lakes are more effective?	
Promulgated the "Wuhan City Water Resources Protection Regulations", "Wuhan Lake Remediation Management Measures"	43.2%
The 166 lakes in the city have set up "lake chiefs", which are served by the chief executives of the locality. They are responsible for the protection of the lake and publicize it to the public.	51.6%

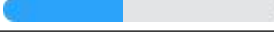
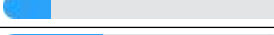



New restaurants are not allowed around the lake	 37.2%
Six lakes connected	 24.4%
Lake contaminated sediment restoration	 23.6%
Aquatic plant reconstruction	 30%
Constructed wetland construction, etc.	 24%
Interception, connection trench repair	 25.2%
Don't understand	 6%

**Figure 4.1- 15 Environmental protection system satisfaction ratio map**

Analysis of the results: Residents believe that the more effective government measures to control the lake include “establishing the lake chief system” and issuing the “Wuhan Water Resources Protection Regulations” and “Wuhan Lake Remediation Management Measures”.

Conclusion: The first measure is a new initiative initiated by the government established during the 19th National Congress, and indications are that the public is more satisfied with this measure, and the measures are more effective in implementation. The second and third measures are some laws and regulations promulgated and implemented by the government. The satisfaction of the masses is also quite high for these. It shows the importance of measures to protect lakes with regulations and laws, for example, it is forbidden to build new restaurants around the lake. Replanting aquatic plants, and some restoration work on the lake has effectively managed the lake, indicating that both policy and governance work are indispensable.

**Question 16**

What do you think is the most effective lake protection measure?	
Legislative protection	 42.8%
Ecological Protection	 17.6%
Citizen participation	 35.6%
PSAs	 3.6%
other	 0.4%

**Figure 4.1- 16 Environmental protection system satisfaction ratio map**

Analysis of results: It is believed that the most effective lake protection measures are legislative protection, citizen participation and ecological protection.

Conclusion: Since many people now lack environmental awareness, and often gain economic benefits by sacrificing the ecological environment, the general public thinks that it is necessary for the government to adopt legislation to prevent these people from destroying the lake. At the same time, “citizen participation” is also a high proportion, indicating that enthusiastic residents should participate in some public welfare activities to protect Lake Lake and contribute to the protection of the lake.

**Question 17**

How do you think the current environmental protection work in the lake is doing?	
Very poor, need to strengthen	18.4%
A lot of room for improvement.	76%
Very good, no need to further strengthen	5.6%
It doesn't matter, it doesn't matter to me.	0%

**Figure 4.1- 17 Protection measures citizen satisfaction survey scale chart**

Analysis of the results: 76% of the residents feel that the current environmental protection work in the lake has been okay, but needs to be improved. 18.4% of the residents believe that the current environmental protection work in the lake is poorly done and needs to be strengthened.

Conclusion: In general, the current environmental protection work of lakes has not reached the satisfaction level of most residents, indicating that the management of relevant departments still needs further efforts, and must strive to achieve the satisfaction of more residents in the environmental protection work of the lake. We need ecological construction methods to meet the needs of the modern residents' good life.

**Question 18**

How many times have you gone to Lake Park on average a week?	
0 times	8.8%
1-2 times	50%
3-4 times	24.4%
5-7 times	16.8%

**Figure 4.1- 18 Citizens going to the lake park frequency map**

Analysis of the results: It can be seen from the table that half of the people go to the lake park 1-2 times a week, 24.4% go 3-4 times a week, and 16.8% go 5-7 times a week.

Conclusion: The data shows that due to the improvement of economy and living standards, people pay more and more attention to exercise and self-cultivation. Most people like to go to the lake park to carry out some entertainment activities to enrich their lives.

**Question 19**

What do you do when you go to the lake park? (multiple choice)	
Exercise	62.8%
Walking the dog	44%
dancing	8.4%
play cards	7.6%
reading	6.8%
Read newspapers	3.2%


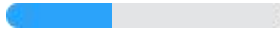



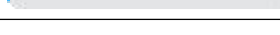
other	 13.2%
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**Figure 4.1- 19 Lake park entertainment mode survey map**

Analysis of the results: It can be seen from the table that 62.8% of people go to the lake park to exercise, and 44% of people walk the dog. The data shows that people are doing various recreational activities in the lake park.

Conclusion: It can be seen from this question that the lake park serves many life and entertainment needs in the lives of Wuhan citizens, and it also highlights the importance of protecting Wuhan lakes.

**Question 20**





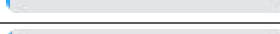
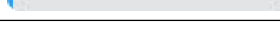
What do you think of the park's infrastructure?	
Great	 7.6%
Better	 38%
Average	 46%
not so good	 6%
very bad	 1.2%
Did not notice	 1.2%

**Figure 4.1- 20 Lake infrastructure satisfaction survey**

Analysis of the results: People who think that the park's infrastructure is better accounted for 38%, and those who think that it's average accounted for 46%, and those who think that they are great accounted for just 7.6%.

Conclusion: The above data shows that the infrastructure construction of Wuhan Lake Park is still unable, to some degree, to meet the needs of most of the citizens who come for leisure. It is necessary to increase the infrastructure construction of the park to meet the people's growing material and cultural needs.

**Question 21**

Do you think the park development plan is reasonable?	
Very reasonable	 4.8%
Fairly reasonable	 45.6%
Moderately reasonable	 38.8%
Not very reasonable	 6.4%
Very unreasonable	 1.6%
Did not notice	 2.8%

### Figure 4.1- 21 Lake park development satisfaction survey scale

Analysis of the results: It is considered that the park development plan is fairly reasonable, accounting for 45.6%, and moderately reasonable accounts for 38.8%.

Conclusion: Nearly 90% of people are supportive of the idea that the park development plan is reasonable. It shows that with the strong support of the Wuhan government, the park development planning problem is very good. After all, the rationality of the park development plan is not only of great significance to the protection of lakes in Wuhan, but also provides a suitable place for people to entertain themselves.

#### Question 22

Do you have any good suggestions for lake management? You can write your suggestions below.

number	Answer text
5	To legislate to strengthen publicity, focus on protection rather than development
10	Plant that purifies water
11	Increase governance
15	Strengthening the development of public green space and wetlands
16	improve publicity
17	Call for more people to participate
20	Enhance the guiding work, avoid uncivilized behavior
26	Strengthening the management of uncivilized phenomena
53	National participation
62	Don't build a house to fill the lake
64	Do not occupy the lake
71	Planned ecological protection
76	Legislative protection
86	I hope everyone pays attention to protection
92	Strengthen patrol management
98	improve publicity
101	Convenient transportation will be better
105	Less commercial development
108	Integrated management

112	Lake garbage cleaned up
115	Legislation to protect lakes
116	Strengthen management legislation
119	System implementation
120	Strengthen protection awareness
125	More publicity
126	I hope to use my own actions to drive more people.
132	Strengthen patrol
135	Managers must fulfill their duties, invest funds, and increase their efforts.
142	Continue to protect and increase publicity
146	There are too few trash cans, there will be garbage and I don't know where to throw.
164	Regularly clean up algae
165	Lack of management
169	Just protect and improve the quality of citizens
171	a lot of lake garbage
174	Management is not in place
175	Eliminate sewage
176	Promote publicity and improve quality
177	no
180	Public facilities maintenance is not in place
182	no
183	Regular management
184	Strengthen management
187	no
191	no
225	Relevant departments should strengthen their work
226	Strengthen department management
237	It is strictly forbidden for factories to dump sewage into lakes.
241	More ecological planning



### Figure 4.1- 1 Citizenship recommendation summary

Conclusion: According to the above-mentioned citizen opinions, citizens still hope that the government departments will increase publicity and call on more citizens to join the ranks of practicing ecological civilization, and cultivate citizens' awareness of environmental protection. Moreover, through legislation and other methods, the behavior of citizens is restrained, so as to improve the ecological environment of lakes in Wuhan and enhance the image of Wuhan.

## 4.2 Problem analysis process

### contingency table analysis

In order to explore feedback from respondents of different occupations, and whether they will respond to the Wuhan Lake Protection Policy and protect their ecological environment by rivers and lakes, we used SAS software to analyze the contingency table.

Analysis of the contingency table on occupations and response policies:

**Figure 4.2-1 Frequency distribution table for different occupations and whether or not to respond to policies**

	student	Agency cadre	worker	teacher	company staff	science and technology personnel	other
Yes	80	10	20	13	46	4	56
no	3	0	3	1	6	1	7
Statistics			Degree of freedom	Value	Probability		
Chi-square			6	6.2026	0.0409		
logarithmic likelihood-ratio			6	7.2374	0.0294		
Mantel-Haenszel chi-square			1	3.7512	0.0028		
Phi modulus				0.1575			
Number of columus				0.1556			
Cramer V				0.1575			
WARNING: 43% of cells have an expected count of less than 5. The card side may not be a valid test.							

It can be seen from the figure that the p value corresponding to the statistic value of the chi-square test, the likelihood ratio chi-square test and the continuous-corrected chi-square test is less than the significance level of 0.05, and the fisher exact test corresponds to the p value of 0.0234, so rejecting the null hypothesis indicates that there is a significant relationship between different occupations and whether they respond to the lake protection policy in

Wuhan.

A contingency table analysis of the biggest problems with lakes and the biggest factors in lake environmental damage:

**SAS System  
FREQ Process**

Frequency percentage	problem	element					total
		1	2	3	4	5	
	1	9 3.60	12 4.80	13 5.20	8 3.20	3 1.20	45 18.00
	2	3 1.20	22 8.80	24 9.60	6 2.40	2 0.80	57 22.80
	3	6 2.40	11 4.40	18 7.20	21 8.40	5 2.00	61 24.40
	4	6 2.40	11 4.40	20 8.00	26 10.40	12 4.80	75 30.00
	5	1 0.40	1 0.40	3 1.20	0 0.00	7 2.80	12 4.80
	total	25 10.00	57 22.80	78 31.20	61 24.40	29 11.60	250 100.00

Statistics	Degree of freedom	Value	Probability
Chi-square	16	62.0816	<.0001
logarithmic likelihood-ratio	16	54.5143	<.0001
Mantel-Haenszel chi-square	1	21.8482	<.0001
Phi modulus		0.4983	
Number of columns		0.446	
Cramer V		0.2492	

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Fisher exact test	
Table probability ( P )	< .0001
Pr <= P	

It can be seen from the figure that the p-values corresponding to the statistic values of the chi-square test, the likelihood ratio chi-square test and the continuous-corrected chi-square test are all less than 0.0001, that is, less than the significance level of 0.05, and the fisher exact test corresponds to p. The value is 0, so the null hypothesis is rejected, indicating that the largest problem in the lake is significantly related to the largest factor in lake environmental damage.

2. Logistic model for the factors affecting whether to go to the lake park

In order to explore whether the citizens will go to the lake park, we separately analyzed the lake protection work, the lake park infrastructure, the lake park development planning rationality as an independent variable, and whether the qualitative variables go to the lake park as the dependent variable. Using spss software, a logistic regression model was established. The results are shown in the table:

effect	Model fitting condition	Likelihood ratio test		
	Simplified model -2 log likelihood	Chi-square	Degree of freedom	Statistical significance
intercept	44.389a	0	0	.
Q17	46.009	1.62	2	0.145
Q20	48.387	3.997	5	0.05
Q21	50.355	5.966	5	0.01

The chi-square statistic is the difference between the -2 log likelihood between the final model and the simplified model. A simplified model is formed by omitting an effect in the final model. The null hypothesis is that all parameters of the effect are zero.  
a. Because omitting this effect does not increase the degree of freedom, this simplified model is equivalent to the final model.

From the perspective of model test results, the lake protection work has not passed the test under the 90% confidence level, and the lake park infrastructure, lake park development planning rationality factor passed the test under 95% confidence, we get the following regression equation:

$$y = 44.389 + 46.009x_1 + 48.387x_2 + 50.355x_3$$

$$\hat{p} = \frac{\exp(44.389 + 46.009x_1 + 48.387x_2 + 50.355x_3)}{1 + \exp(44.389 + 46.009x_1 + 48.387x_2 + 50.355x_3)}$$

$\hat{p}$  is the probability of an event going to the lake park.

It can be seen from the formula that when the rationality of lake park development planning is improved and the lake park infrastructure is improved, the probability of people going to the lake park will increase greatly. Therefore, it is recommended that the government make improvements in the development of the lake park's planning rationality and infrastructure. Only when people love the environment around the lake will they love to protect the lake.

## Research Conclusions and Recommendations

### 5.1 Research conclusions

1. Most of the citizens are environmentally conscious, but they have great resistance to action.

According to the survey and analysis of the volunteer team, most of the citizens in Wuhan have environmental awareness. They have a clear understanding of the relationship between the economy and the environment. Most people have the concept of "environmental priority", which is more than the previous economic development path. The concept of "economic priority" has been greatly improved. However, they have great resistance to action and cannot restrain themselves well. They also have the misunderstanding that "outdoor participation in activities is the practice of ecological civilization".

2. The government has a large effect, and the policy implementation also has an effect.

In the course of the survey, most citizens believed that only the government took the lead, and the project implementation effect was obvious. For example, the implementation of the "Six Lakes Connected" project in Wuhan greatly improved the water environment in Hanyang, and by the use of government power many problems can be resolved. According to the survey, the public is satisfied with the effect of the "river and lake system" and the policy has

achieved good results in the implementation process.

3.The living standards of the citizens are raised, and the environment for the lake is higher.

With the rapid development of China's economy, the living standards of ordinary citizens are constantly improving, and the yearning for a better life is becoming stronger. Therefore, attention is paid to the construction of living environment and infrastructure. It is precisely because of this that the Wuhan citizens demand the improvement of the lake park, not just the need for water quality improvement, but also the need to keep up with the infrastructure construction of the lake park.

4. Public satisfaction on the protection of lakes in Wuhan still needs to be improved.

Although Wuhan has invested heavily in lake protection in recent years, the public's satisfaction with the protection of lakes in Wuhan still needs to be improved. According to the multi-faceted research of the volunteer team, it is concluded that there are many work plans being implemented in Wuhan. It takes time for the work plan to get the corresponding effect; it has a certain lag, so it is now in the waxing period of citizen satisfaction.

## 5.2 Research recommendations

First, the government is the key

After a survey of Wuhan citizens, as well as a visit to the Lake Authority, the Love Protection Volunteers Association, and the Research Lake Park Management Office, it was discovered that the initiation and implementation of a lake protection work was led by the government to drive lower-level units and civilians. Organize relevant activities, and at the same time the supervision of the lower-level departments can be implemented to achieve good results.

Second, the government and the public communication channels need to be better publicized.

Although the Wuhan Love My Hundred Lakes Volunteers Association was established under the joint promotion of Wuhan Water Affairs Bureau and Changjiang Daily Newspaper, it has developed into a huge influence in Wuhan. At the same time, it has opened the "message board" function on the network. However, how to get the public to embark on the road of proposing their own opinions still requires the government departments to vigorously publicize this to promote awareness among the citizens. At the same time, the communication channels between the government and the public still need to increase.

Third, the promotion of environmental awareness still needs to increase its efforts

Regarding the promotion of environmental awareness, it is necessary not only for government departments to place public service advertisements on TV channels and other publicity work in government departments, but also to involve various social forces, such as the folk love lake organization and the school's love lake protection. Through the implementation of environmental protection public welfare projects, the Lake team drives the family, the family drives the society, and causes environmental protection effects in the society to drive more people to participate in the practice of ecological civilization.

## Appendix 1: Questionnaire on Lake Management and Protection Status in Wuhan

The vast Yangtze River rushes past, hundreds of lakes are scattered - Wuhan, so it is called "Jiangcheng", "the city of Baihu", which is the pride of the city. Lakes not only maintain a natural ecological balance, but also provide urban development and civic life along with river water resources as part of our lives.

We are HBUT Dandelion Volunteer Service Team and HBUT-China. In order to thoroughly implement the spirit of the 19th National Congress of the Communist Party of China, we will fully implement the lake system and further strengthen lake management. We will investigate the current situation of lakes in Wuhan and the status of lake management. To be concerned about the ecological environment protection of the lake is to care for ourselves; I hope everyone will actively cooperate with us. Your valuable answer will be our vital information. Thank you for your cooperation!

1. Do you live in Wuhan for a long time: [Multiple choice questions] \*

- Yes
- No (temporary residence)

2. Your occupation: [Multiple choice questions] \*

- Student
- Office cadres
- Worker
- Teacher
- Company staff
- Technical staff
- Other

3. What is your overall impression of the Wuhan Lake? (Multiple choice questions) [Multiple choice questions] \*

- Beautiful environment

- Serious damage
- Generally
- Scenery is no longer

4. Do you think the lake environment has changed in recent years? (Multiple choice questions) [Multiple choice questions] \*

- Changed, getting better and better
- Changed and became worse
- No change
- No attention

5. What uncivilized behaviors have you seen around the lake? (Multiple choice questions) [Multiple choice questions] \*

- Dump construction waste, construction dregs or other waste
- Climbing, nailing forest trees, damaging green spaces, lawns, or picking flowers, fruits, and bamboo shoots without authorization
- Unauthorized fishing of water and plants
- Fishing and swimming outside the designated area, time zone
- Smear on the scenery and facilities, or hang the items that affect the landscape without permission
- Incineration of goods, open-air barbecue, or use of open flames in the mountain forests
- Other

6. What do you think is the biggest problem with lakes at this stage? (Multiple choice questions) [Multiple choice questions] \*

- The number of lakes is reduced
- Lake area shrinks
- serious pollution
- Water quality deterioration and eutrophication
- Other

7. What do you think is the most destructive factor to the lake environment? (Multiple choice questions) [Multiple choice questions] \*

- Natural factors such as climate change
- Filling the lake and making fish in the lake
- A boom in municipal construction, tourism and real estate development
- The lake is heavily polluted and then landfilled
- Other

8. What do you think is the protection of the lake? (Multiple choice questions) [Multiple choice questions] \*

- In order to make the living environment more beautiful
- Nothing, no need
- In order to live in harmony with nature, think for our children and grandchildren
- Other reasons

9. What is your main knowledge of lake environmental protection? (Multiple choice questions) [Multiple choice questions] \*

- TV broadcasting
- Network
- School class

- Newspapers and magazines
- Public service advertisement
- Related activities around you
- Other

10. Which do you think is more important for economic development and lake environmental protection? (Multiple choice questions) [Multiple choice questions] \*

- The economy is more important, we must first do a good job in economic development and then carry out environmental protection in the lake.
- Protecting lakes is more important, and any economic development cannot be at the expense of the environment.
- Both aspects are important, both need to take care of both
- Depending on the circumstances, the premise of gaining benefits

11. Will you respond to the Wuhan Lake Protection Policy and use your own actions to protect the ecological environment of rivers and lakes? (Multiple choice questions) (fill in "No" to skip 12 questions, fill in "Meeting" to skip 13 questions) [Multiple choice questions]

\*

- Will
- No

12. If you are willing to participate in the protection of lake activities, what kind of work will you do to protect the lake (multiple choice questions) [multiple choice questions]

- Take the initiative to protect the lake
- Understand lake environmental protection knowledge and publicize it to the public
- Proposing protection opinions and suggestions to the lake management department
- Actively abide by the government's policy on lake protection

13. The reason why you are not willing to participate in the protection of lake activities may be (multiple choice questions) [multiple choice questions]

- Not interested
- Need to pay at your own expense
- No time
- Think that the event is meaningless
- Think the activity is very hard

14. What actions would you take if you saw that the lakes around you were being vandalized? (Multiple choice questions) [Multiple choice questions] \*

- Does not matter
- Reflected to the news media
- Report to management
- Take the initiative to stop

15. Which of the following government initiatives to manage lakes are more effective? (Multiple choice questions) [Multiple choice questions] \*

- Promulgated the "Wuhan City Water Resources Protection Regulations", "Wuhan Lake Remediation Management Measures"
- All the 166 lakes in the city have set up "lake masters", which are the chief executives of the locality. They are responsible for the protection of the lake and publicize it to the public.
- New restaurants are not allowed around the lake
- Six lakes connected

- Lake contaminated sediment restoration
- Aquatic plant reconstruction
- Constructed wetland construction, etc.
- Sewage and connection trench repair
- Don't understand

16. What do you think is the most effective lake protection measure? (Multiple choice questions) [Multiple choice questions] \*

- Legal protection
- Ecological protection
- Citizen participation
- Public service advertisement
- Other

17. How do you feel about the current environmental protection work in the lake? (Multiple choice questions) [Multiple choice questions] \*

- Very bad, need to strengthen
- Generally, you can strengthen it.
- Very good, no need to further strengthen
- It doesn't matter, it doesn't matter to me.

18. How many times do you go to Lake Park on average a week? (Multiple choice questions) [Multiple choice questions] \*

- 0 times
- 1-2 times
- 3-4 times
- 5-7 times

19. What do you do when you go to the lake park? (Multiple choice questions) [Multiple choice questions] \*

- Exercise
- walking the dog
- Dancing
- Playing cards
- Reading
- Read the newspaper
- Other

20. What do you think of the park's infrastructure? (Multiple choice questions) [Multiple choice questions] \*

- Very good
- Better
- General
- Not very good
- Very bad
- Not paying attention

21. Do you think the park development plan is reasonable? (Multiple choice questions) [Multiple choice questions] \*

- Very reasonable
- More reasonable
- General



- o Not very reasonable
- o Very unreasonable
- o Not paying attention

22. If you have any good suggestions for lake management, you can write your suggestions below. [fill in the blank]

---

Sincerely thank you for participating in this survey. I hope that you will continue to pay attention to our research activities, actively participate in the team to protect the lake, and contribute to beautifying the river city and purifying the lake!

**Appendix 2: sas program:**

**(1)**

```

data ww1;
do job=1 to 7;
do act=1 to 2;
input num@@;
output;
end;
end;
cards;
80 3
10 0
20 3
13 1
46 6
4 1
56 7
;
run;
proc freq data=ww1;
tables job*act/chisq measures norow nocol;
weight num;
run;

```

**(2)**

```

data ww2;
do problem=1 to 5;
do element=1 to 5;
input num@@;
output;
end;
end;
cards;
9 12 13 8 3
3 22 24 6 2
6 11 18 21 5
6 11 20 26 12
1 1 3 0 7
;

```

```
run;  
proc freq data=ww2;  
tables problem*element/chisq measures norow nocol;  
weight num;  
run;
```