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Peixuan Wu, Yuetian Wang, Zhehang Li

Abstract

Urban stream and wetland restoration is a popular branch in the study of river restoration all over the world, especially in China where so many of its cities are highly urbanized. Compared to restoration projects in a rural setting, urban streams serve much greater social value. Houtan Wetland Park is a riverfront restoration project in Shanghai on the east bank of the Huangpu River. We conducted a Post-Occupancy Evaluation (POE) of the park by compiling social connectivity maps including longitudinal, lateral, vertical, and visual connectivity inside the park. A series of plans, section drawings, and site photos were presented to illustrate the landscape types and possible human movements. We also used GIS as a tool to evaluate the social accessibility outside the park on the city scale by comparing the travel time through various types of transportation tools. To understand how different amenities and zones were used by visitors, we went to the site to observe human behavior and water qualities in different zones. We converted them into behavior mappings. We interviewed visitors and an expert to get their opinions of the park on both personal and professional levels. To expand the scope of collecting public opinions, we analyzed the data from Chinese social media and rating applications. In the end, we compared the physical condition of the park, the landscape design in different parts of the park, and various activities in each area, and discussed the disparity of what the designers' initial goals and what they actually achieved and missed. In this way, designers can acquire data support and find drawbacks in reality usage for their further restoration in Houtan Park.

Introduction

To promote Shanghai into the new era, build the modern city figure and play the radiation role of the central city, Shanghai Urban Planning Administration proposed to plan the space along the Huangpu River in 2002. The vision of this project was to bring the green to the Huangpu River and encourage residents to touch nature. Therefore, as we can see in figure 1, according to the land use and the Upcoming Expo, which was proposed to hold in May 1, 2010, the designer divided the space on the both sides of the Huangpu River into three sections, including the Leisure and Entertainment Section, Commercial Section and Expo and Culture Section(Yu, 2002). The Expo and Cultural Section contained the proposed site of the World Expo and our research site, Houtan Park.

Houtan Park is the main component of the 2010 Shanghai World Expo Campus designed by Turenscape Company. It is on the south bank of the Huangpu River, north of the World Expo and the west of the Expo Park. This park is a strip park with a length of 1.18 mile and an area of 46.95 acre. The original site of this park was a heavily polluted industrial brownfield. Therefore, to show the city's figure and the healthy living environment during the Expo, the government proposed to construct the Houtan Park using ecological technology to restore the contaminated land. The project used landscape as a living system and utilized contemporary landscape design techniques to build a comprehensive ecological system with water purification, rainwater storage, biological production, biodiversity conservation, and aesthetic enlightenment on the brownfield with garbage and serious pollution.

Our goals of this project were to review whether the design of this park meets the current ecological condition and people's needs. Our research questions were: 1) What were the ecological problems needed to be solved in this park and the ecological technology applied there? 2）How do people use this park spontaneously and do the facilities and space in this

park meet people’s needs? 3）What are the people’s current views on the ecological condition of this park? We did the literature review and trip to review the first question and surveyed the second and third questions through the field trip, the questionnaires and the data analysis.

Site

Houtan Park is located in the original Houtan area of Pudong and is close to the Huangpu River. The site was sandwiched between the Huangpu River and the traffic arterial road (Puming Road). It was a long and narrow terrain and 1.18 miles long along the riverbank, generally between 164 to 262 feet in width, and only 98 feet at the narrowest point. In response to the challenges of many problems on the site, the core design concept of Houtan Park was positioned to take the landscape as a living body and design a living system.The park used "Two river beaches in harmony" as a structural medium to reproduce an urban wetland park landscape with strong regional characteristics through the protection and restoration of wetlands, soil, and flora and fauna. "Two river beaches" referred to the outer water beach and the inner water beach. The outer water beach mainly referred to the original floodplain adjacent to the Huangpu River. Through reconstruction, it will form a natural barrier against storm surges and reduce the risk of flooding. The “internal creek” mainly referred to the artificial linear wetland in the middle of the site, which would play the roles of water purification system, natural habitat , ecological conservation and science education (in Figure 3). The unique natural water purification system of Houtan Wetland Park aimed to purify the water of the Huangpu River in different purification zones composed of biological communities such as aquatic plants and animals instead of chemical agents or special equipment. (In Figure 4) The purified water from the Huangpu River could not only provide water circulation for the Expo Park, but also meet the needs of the Expo Park and Houtan Park's own green irrigation and road washing.

Based on the principles of safety, convenience and flexible capacity, the park has constructed a

one-ring, six-vertical, and multi-path trail network. Main trails were designed on both sides of the internal river to form a loop. The main roads on both sides were connected by trestle bridges. The ridges were used to form a "capillary" trail network, forming a flexible accessible space so that many tourists can penetrate into the park. In terms of the vertical connection with water, designers created a valley landscape to enrich the experience space of the floodplain. The valley landscape was designed with terraced fields. On one hand, it could accommodate more water when the rain flood came, and at the same time, it could create an urban rural landscape to evoke the residents' empathy of the rural agricultural civilization, and even could purify the surface runoff before it arrives at the river. In addition, open spaces such as "Sky Garden", Shuimen Pier Plaza, and renewed industrial buildings had been established. These spaces were combined with the trail network to form a complete and interesting space system.

Methods or Study Approach

(1) Literature Review

In this part, we tried to determine the optimal methodology for our project and figure out the context, design concept, strategies, and related post-constructed evaluation of Houtan Wetland Park done by other scholars. In this way, we could have a clear understanding of the positioning of the park and the maintenance status after completion, so that the next step of the research can be compared with the current situation. From the comparative analysis of past historical data records and field reconnaissance records, we could more scientifically summarize whether the park has reached the original design goals, what practical obstacles have been encountered, and what design loopholes have been discovered during the use of visitors. Through these analyses, proposing ways to improve the design strategy accordingly could show reliability.

We demonstrated the context of Houtan Park according to the *Ushering in the New Era of Riverside Development in Shen City -Introduction to the Planning and Optimization Plan for the Huangpu River Area (Yu, 2002).* This document stated the proposed plan along the Huangpu River in 2002, which helped us understand more about the background and goals of this park. We conducted the site study based on the “Shanghai Expo Park Houtan Wetland Park Design Plan ” published by Tu Ren Design Institution in 2010. This report showed the location map, design concept, plan of Houtan Wetland Park and explained the water purification system and the design of open space along the internal creek in Houtan Wetland Park Project. We reviewed two papers, including *Construction of Ecosystem and Water Quality Control of Houtan Wetlands Park in Shanghai Expo Garden* (Dong, et al., 2013) and *Two Kinds of Water Quality Evaluation Methods on the Water Quality Evaluation of the Houtan Wetland Park in Shanghai World Expo* (Dong, et al., 2013), to learn about the post-constructed water quality in Houtan Wetland Park, which made us better evaluate the rationality of the relationship between the waterfront space and water quality. We proposed the method to study the social connectivity of this park by referring to *The Social Connectivity of Urban Rivers* (Kondolf & Pinto, 2017).

(2) Social Connectivity Mapping

Houtan Wetland Park, used to be a brownfield, intended to be transformed into a ecological urban park to resist flood caused by storm surges and purify the water introduced from Huangpu River to the inland creek in ecological level, and to provide citizens with more accesses to the water safely and recreation, in social level. As we focused on whether the design in this park enhanced the social connectivities, we planned to utilize social connectivity mapping first inside and outside the park separately in order to know how exactly the park enhances the connectivity of citizens’ to water on a different scale.

A, Inside the Park

To analyze the physical connectivity of Houtan Wetland Park, we adopted concepts of social connectivity, which refers to the communication and movement of people, goods, ideas, and culture along and across rivers, recognizing longitudinal, lateral, and vertical connectivity, much as has been described for rivers for hydrology and ecology. (Kondolf & Pinto, 2017)

Longitudinal Connectivity	The major transportation or navigation route around the river.
Lateral Connectivity	The ease of crossing the internal river and the bridges.
Vertical Connectivity	The range of human's spontaneous activities related to the height above the water
Visual Connectivity	The water related sign and demonstration board

We conducted small-scale accessibility analysis with a field trip and cross-section surveys to the longitudinal connectivity, vertical connectivity, lateral connectivity, and visual connectivity in the park to analyze whether the design can facilitate social connectivity. Since the southern part of the site is under construction, we selected 5 sections in the accessible area for section drawing. (in Figure 5)

B, Outside the Park

Hansen first proposed the concept of reachability in 1959, which he defined as the size of the interaction opportunities between nodes in the transportation network. (Hansen, 1959) We used the network analysis method of GIS software to quantitatively explore the accessibility and service radiation range of the Houtan Wetland Park based on the three transportation modes of

pedestrian, non-motorized and motorized vehicles, in order to evaluate the social connectivity of the park.

According to the "(JTGB-2003) Technical Standard for Highway Engineering of the People's Republic of China", the average walking speed is set to 5 km/h; the speed of non-highway driving on any grade of road is 12 km/h; the acceleration speed is fast The passage is 80 km/h, the main road is 60 km/h, the secondary road is 40 km/h, and the branch road is 20 km/h.

(3) Behavior Mapping

Behavior mapping is an unobtrusive, direct observational method for recording the location of subjects and measuring their activity levels simultaneously. Results help researchers understand the behavioral dynamics of the built environment. (Cosco, Moore, Islam, 2010) Through this mapping, we could observe what spontaneous activities citizens would take along the creek and analyze how the water element in the environment make an influence on them. We conducted field observation and demographic study of Houtan Wetland Park in two days (11/7-11/8) from 11:00PM to 16:00PM. We observed 5 key areas two times a day with 10min length and 3-hour interval per area. The tested areas are listed below. Besides, we also conducted a demographic study (age and gender), recorded people's behavior, and made a behavior mapping. We divided people by age into 5 classes: toddlers, kids, youth. middle-age people and the elderly.

1	Platform on the inland creek where people can touch water
2	Platform on the Huangpu River where people can enjoy the scenery of other riverside
3	"Red-ribbon" path with leisure space
4	Bridge cross the inland creek
5	Small decks around the end pond

(4) Interview & Analysis of Social Media

Through interviews and analysis of social media, we could directly listen to users' real and subjective attitudes towards riverbank design along the creek and how they feel about the river purification process. In this way, it is possible to tell what the drawbacks and merits of Houtan Park after construction.

A, Interview of Professional

We concluded the problems and concerns we had after the site visit and compiled them into a questionnaire. We got in touch with Professor Heqin Cheng from East China Normal University who is an expert in Yangtze River watershed research project. The questionnaire is attached to the appendix.

B, Interview of Visitors

We conducted surveys and interviews to collect opinions from visitors toward ecological restoration in the park and how the environmental improvement exerts influence on their experience. For the surveys, we asked 40 visitors to fill out our questionnaires which included questions about demographics, travel distance and vehicles, sense of water, sense of water purification, and flood-resistant design. The questionnaire is attached to the appendix.

C, Data Analysis of Social Media

We utilized SELENIUM to monitor the behaviors on the Chrome browser and crawl the comments about Houtan Park from DIANPING (the most popular local life information and reviewing platform in China). And then we cut them into words and translated them all to English. The next step was that we counted the frequency of words and made 2 keyword maps by WORD CLOUD. The first one is about the general comment of the park and the second one is specifically about the comments related to water.

Results

(1) Social Connectivity Mapping

A. Inside the Park

1) Longitudinal Connectivity Analysis

The internal river of the Houtan Park flows from southwest to northeast. Huangpu River engaged in the internal river from the inlet, which located in the northwest of the park, through several purification stages, including the Gravel Beach Filtration Section, Plant Filtration Section, Plant Bed Filtration Section, Terrace Filtration Section, Heavy Metal Purification Section, Pathogen Purification Section, Nutrient Purification Section, and Water Stability Section, to purify the Level 5 water into the Level 3 water. According to the Environmental Quality Standard for Surface Water GB/T 14848-93 (GHZB), Level 5 water can be used in the cultivation area and general water area, and Level 3 can be used for the fish habitats, swimming area, and secondary protection area for drinking water.

According to the design plan of the Houtan Park project, we could see that the river goes through a water purification system from the inlet, and finally converging and forming a wide pool with a minimum width of 14m and the maximum width of 26m. According to the purification goal of this project, the water in the wide pool is Level 3, which can be touched and be designed as the water-interaction space. As we documented on our site visit, some parts of the river wetland on the northeast side were very shallow and even dry in the dry seasons, while others were surrounded by aquatic plants that were higher than people's eye levels. The current situation of the pond shows that the longitudinal connectivity of this internal river does not take advantage of the purified water in the park, does not take into account the water level change during the wet seasons and dry seasons, and does not pay enough attention to people's

interactive demand for water. How visitors interact with the water doesn’t fully align with the designer's goal.

As we can see from the survey of the transportation system along this river (Figure 7), there were two pathways with different elevations. The elevation of the wooden pathway was level with the water surface, connecting the waterfront recreational space along the rivers. The wooden pathway was a resilient area that can be submerged. The main road, which is 1.05m higher than the wooden pathway, was designed not to be submerged. The min road included the bicycle riding system, running tracks, which could provide citizens with space to cycle, run, and walk. Both two transportation systems had curving roads with reasonable width and a suitable distance from the river. Meanwhile, through the field trip, we observed that both two trails were used very frequently.

2) Lateral Connectivity Analysis

According to Figure 8, we can see the bridges which connect both sides of this internal river. There were 11 bridges in the river. Four of them, which were connected to the main roads, had an interval of 248m. Other bridges, which could be called secondary bridges, were connected to the wooden pathways. The distance between the secondary bridges ranged from 26-242m. It was inconvenient for tourists to reach the other side of the river because we had to detour a long way to reach there.

3) Vertical Connectivity Analysis

To do the vertical connectivity analysis, we chose the place near the attractions as the locations of the sections to observe whether it is convenient for people to use this river in these places where people are more crowded.（Figure 5） The park is 1.5 kilometers long and 150 meters wide. On the west end side of the park, the water quality is not clean enough and could not be

touched by people. In the part that water is not clean, shown in section A, B, C,D (Figure 9), most levees of the river were wooden platforms with an approximate width of 6m and about 0.27m above the water, discouraging people from making physical contact with the water. The most spontaneous activities of these parks were chatting, picnics, and camping. In the northeast part of the park, shown in section E (Figure 9), water quality met the standard. This part of the riparian was mainly wooden platforms, wetland, and rocky beaches with the slope of 33%. These types of riparian and the sloping of these riparian could provide more space for people to touch the water. The most popular activities of this part of this park were sitting on the rocks to take pictures, feeding fish, and playing with water.

Generally speaking, in this linear park, water-related activities were the main activities of the park. However, as we can see from the photos and cross-sections of the site, the most designs of the waterfront space were wooden platforms, and there was little difference of waterfront space between the area with good-quality water and bad-quality water. It is difficult for tourists to distinguish which part of the water is safe and clean from the landscape design; In which part can people touch the water and which can not; Which degree of interaction with water is allowed in different parts of the park. If the elevation, material, handrails, and slope of the revetment can be different designed, it will be safer for people to use these sites.

(4) Visual Connectivity Analysis

As we can see in Figure 10, the designers had designed the handrails along the part of the south bank of the internal river, where the wooden pathway was paved. These handrails were mainly used to prevent people from entering or touching the polluted water. At the same time,

some signs that say "No Swimming", “No Crossing”, ”No Fishing” and ”No Climbing” were hung on the handrails. On the northern bank of the internal river, there were no signs and handrails because there were no pathways along the river and people had no access to touch the water.

According to the design of the water purification system in the site, the water quality of the southwest part of the river does not meet the standard of Level 3. However, this section does not design the fences and signs, which make people easier to touch the water.

Because this park focuses on the water purification system of the internal river, the designers placed the demonstration boards on the platform to show the ecological principles of water purification applied in this park. The demonstration boards are shown in Figure 11.

B, Outside the Park

The network analysis module of ArcGIS software is to geography and model the geographic network and urban infrastructure network, which is mainly used for the optimal allocation of resources and the improvement of the network structure. This article uses an accessibility analysis method based on travel range, which uses a specific travel distance as an indicator to evaluate accessibility (Li, Song, Yu, 2008). To perform reachability calculations, it is first necessary to vectorize the basic data to construct a network data set, and then generate service area analysis layers under different transportation modes, and finally perform data statistics and analysis. First, through ArcGIS software, we extracted the transportation of the study area (Huangpu district and Jingan District), established network data, and then extracted the road network intersection points through calculations to obtain nodes. The source of urban road network geographic data was OpenStreetMap's latest urban map data. The vectorized road system was further divided into 4 levels: fast lanes, main roads, secondary roads, and branch roads, with different speeds and travel cost values. There are three modes of travel for

residents: walking, non-motorized vehicles (mainly bicycles), and motor vehicles. According to the "(JTGB-2003) Technical Standards for Highway Engineering of the People's Republic of China", the average walking speed is set to 5 km/h; non-motorized vehicles are 12 km/h on roads of any grade; motorized vehicles are The fast lane is 80 km/h, the main road is 60 km/h, the secondary road is 40 km/h, and the branch road is 20 km/h.

The establishment of green space accessibility evaluation criteria is closely related to city scale, green space resources and socio-economic background. The 10-minute Walk in the U.S. green space construction project is based on a park reachable within 10 minutes. (National Park and Park Association, 2019) By investigating the different sensory experiences of tourists in Houtan Park for different modes of transportation, we have divided the effective service range of various levels of park green space. According to time cost, accessibility is divided into 3 levels: 5 min, 15 min, and 30 min. The effective service range for walkability is 5 min, 15 min, the effective service range for bicycle accessibility is 5 min, 15 min, and 30 min, and the effective service range for motor vehicle accessibility is 5 min, 15 min, and 30 min. The accessibility grade distribution map of park green space is shown in the figure.

It can be seen from the land use map that all within a 15-minute walk of Houtan Park are the Expo Park. And because the park has been undergoing demolition works and blocked some of the surrounding roads, the feasibility in a small area is not good. Especially the north-south access capacity is much inferior to the east-west. The service area of the park for bicycles and cars is larger, covering the surrounding office areas and residential areas. Shared bicycles can be seen everywhere near Houtan Park. Because of the convenient subway, the service area of 30 minutes can even cover the Jing'an District across the Huangpu River.

(2) Behavior Mapping

Site	Form	Installation/Facilities	Vertical Connectivity	Scope	Safe Signs or Protections
1	Wooden Platform	Tree array with pleasant shadow	0-0.5m	From west the east of the internal river	×
2	Wooden Platform	Canopy, long bench, planting bed	>5m	The Huangpu River and the scenery of the opposite riverbank	√
3	Terraced Wooden Path	Long bench, wide stairs, post-industrial arch (sculpture)	0-0.5m	The internal river	√
4	Concrete Bridge	Big natural rock	0.5-1m	The internal river	×
5	Wooden Platform	Sunshade, long bench	0.5-1m	From east to west of the internal river	√

For observing visitors' behavior, we chose the top 5 popular open spaces with obvious characteristics, which could separately trigger different activities. Like Site#1, with the pleasant shadow of the tree array, many people were willing to gather, sit or lie here and enjoy the river winds, especially for those families with kids wanting to play around. But lack of protections towards polluted water was still a concern for most parents. As for Site#2, this was the only overhanging platform only for people to appreciate Huangpu River in the park and it was decorated with well-arranged facilities, canopy, and plantation to enrich the aesthetic value and convenience of this space. Many people were inclined to relax here, and even were camping here. For Site#3 and Site#4, they were all functional space to pass by, but the different distance from platform to water varied the activity types. The characteristic red-ribbon-like long bench attracted a lot of people to sit here and take selfies for Instagram as a trend. On the contrary, the distance between Site#4 and water was a little bit further with big rock close to it, there were a bunch of visitors climbing on them, taking photos or fishing. For the last one, gardeners planted lotus and other beautiful aquatic plantations here full of the pool, which attracted flocks

of waterbirds. Each season of lotus blossom or decay is a festival for shutterbugs to gather here and snap the natural beauty.

In general, the age distribution was not that clear because every site has the potential to trigger more than one activity to fit the needs of all people of various ages.

(3) Interview & Analysis of Social Media

A, Interview of Professional

After visiting the park with her student team, professor Cheng conducted a thorough response. Through observing, talking with the park restaurant manager and visitors, she stated that the park is highly liked by surrounding residents and people who work nearby. The abundance of office buildings nearby also provides many frequent visitors to the park. Cheng also stated that the flood control inside the park is promising and the water quality is overall satisfying despite not meeting the standard as the designer wished. However, professor Cheng pointed out that the park has some issues with maintenance as some parts of the landscape are full of weeds and partial water body's eutrophication is visible. Cheng pointed out that post-occupancy evaluation(POE) is still awaiting development. The responsible party for POE and resource of funding are not clearly identified. These factors hinder the POE of the park. The complete answer from Professor Cheng is attached in the Appendix.

B, Interview of Tourists

From the survey conducted at Houtan Wetland Park shown above, the gender majority of visitors were female(58.3%) and the age majority of visitors were those who were 21-35 (41.6%). Visitors from the destination far away from the park 0.5-3Mile were the major users in reality(75%). Over 70% of interviewees said they took public transportation to get there. Having a walk in a pleasant environment along the creek was preferred by visitors when being asked

what was their favorite activity in the park and nearly a quarter of them thought photography was also a good choice, thanks to the gorgeous scenery. In terms of the most beloved site we provided for them to choose, there were separately around 35% people choosing site#2 and site#3.

When asked about the general impression of them on this park, over a half of people attached “good” to the park but they also came up with some concerns and suggestions. Like 42% of people thought the water quality was only qualified to “Normal” and they feared that the absence of handrails will attract children to touch with those polluted water and feel skeptical about the usefulness of the purification process. And also a quarter of visitors felt that spaces having interaction with water were inadequate because some decks were so far away from the water level and the current water quality prevented them from playing with water.

C, Data Analysis of Social Media

As shown by the left map, we can find that the general attitude of comment towards Houtan Park is partially positive and most visitors had the pleasant impression of accessibility and gorgeous sceneries. And in terms of the water-related keyword, displayed from the right map, we can know that visitors were impressed by the suitability of the river bank to support various activities and the well-arranged longitudinal as well as lateral connectivity. But few of them mentioned the water quality and flood of the park.

Discussion

Houtan Park was a hit at the birth of the 2010 and won 2010 ASLA Professional Awards, the 2010 WAF Awards and the best landscape category at this year's world architecture festival in Barcelona 2010.

As the 2010 Professional Awards Jury of ASLA Appraised: "This is very powerful. It is done and anybody can go and see it. It's full of the right messages of our profession. The scope is exquisite. The presentation is excellent. Shanghai never has a blue sky, and recognizing this kind of sustainable project in that context is important." (ASLA, 2010)

And the jury from WAF also commented: "The judges selected Shanghai Houtan Park as a unanimous winner, among a very high-quality group of projects, for its masterful use of design strategies to transform the polluted waterfront of the Huangpu River into a living system." They were all impressed by the sustainable, low-maintenance ,and high-performance living system in Houtan Park. (WAF, 2010)

But from our reconnaissance, the non-correspondence of landscape design for people and ecological restoration made the current situation less high-performance. According to the behavior maps, the design of this park corresponds to the need of people. But we would like to discuss 4 points which need to be improved.

Firstly, the lateral connectivity of the internal river in the park is weak. In this park, the main bridges and secondary bridges connected both sides of the river and the distances of these bridges are 60- 240 meters. These distances were unreasonable for people, especially the elderly. For the elderly, 50 meters is the most comfortable distance. Therefore, the designers should design the distance between the bridges at 50 meters, so that people can reach both sides of the river quickly, which can enhance the lateral connectivity.

Second, the designs of different waterfront spaces are not relative to the various water quality in different ponds. As we can see in the image of sections, the waterfront space with water quality lower than Level 3 were composed by the wooden platforms, where tourists could have some activities that did not touch water, and the space with a Level 3 water quality was composed by the wooden platforms and natural levees, where people could be closer to the water. Although the designs of these waterfront spaces were a little bit different for different water quality, the designs of these spaces were similar and monotonous for tourists. We suggest that the designers can use more elements, such as topology and stairs, to increase the height difference between the space and the water level to reduce people's access to the water. Meanwhile, the designers can reduce the height difference in the space with the Level 3 water to increase people's opportunities to touch water.

Third, the distribution of the handrails is irrational. As Figure 10 showed, the handrails in this park did not envelop the parts of the river whose water was lower than Level 3, which meant that people could still touch the water. Therefore, we propose that the designer should design enough handrails to envelop the low-quality river, especially in the waterfront spaces. And the water related signs and visualized water quality monitoring are supposed to be placed in the waterfront space to make sure tourists can easily know about whether the water there can be touched.

Fourth, due to the demolition of the Shanghai Expo Garden, the entrance of this park was blocked by the construction site, and just left a simple pathway connecting the main road and the entrance, which reduced the accessibility and affected the use of the park. We issue that the park staff should set up more reminders in the pathway to inform tourists of the specific location of this park.

Conclusion

At the moment of the 2010 Expo in Shanghai, Houtan Wetland Park was restored for a perspective on the theme “better city, better life” and demonstrated a new urban living style where postindustrial design can provide multiple services for society and nature. It developed a “two river beaches in harmony” system and separately applied interval creek (linear wetland) with different purification zones composed of biological communities to purify the water introduced from Huangpu River and applied floodplain reconstruction to protect the whole park from flooding. After 10 years of use, it is inevitable to find some operational problems and design drawbacks, which are behind its glorious awards.

By interviewing the staff who have been working in Houtan Park for ten years, the outer floodflat did a great job to protect the park from any flood. However, due to the lack of tools, we cannot precisely measure if the purification system of the internal river can fulfill the objective to treat 2400 cubic meters (500000 gallons) per day of water from lower level Ⅴ to Level Ⅲ. So, in this project, we focused on how people’s spontaneous activity will happen based on the ecological technology of linear purification wetland in Houtan Park and discussed the disaccommodation between water quality and landscape design.

This paper presents systematic methods to achieve our goals like literature review, analysis of lateral, vertical, longitudinal, and visual connectivity, regional analysis, behavior mapping, interview, and data analysis of social media.

In general, shown as data and records from questionnaires, surveys, regional GIS analysis and data analysis of social media, this park does impress citizens positively and provide more accessibility for them to waterscape. As an urban public park, Houtan park is successful to a certain extent and could stimulate various spontaneous activities, bringing about more vitality. But there do exist some problems we should be aware of in further restoration. As for vertical

connectivity, we drew the conclusion from field research that designers didn't adapt each waterfront space to each reach with various water quality and didn't place correspondent visual signs to inform citizens of potential danger. It imbeds a risk for disguised people and cannot exert the function of education. And for lateral connectivity, bridges were inadequate and it was inconvenient for people to reach the other side. And because the pumping dam was unworkable, some reaches showed dry and still, which will cut off the mechanism of the purification system. We pointed out main issues in reality based on our site research and came up with some suggestions. Sometimes, the landscape design for people may be detached from ecological restoration and it will definitely decrease visitors' experience of nature for people and also lose the opportunity of making the best value of a flexible landscape. So, this research tried to find the gap and provide guidance for future designers to apply more optimal restoration in Houtan Park.

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Figures:

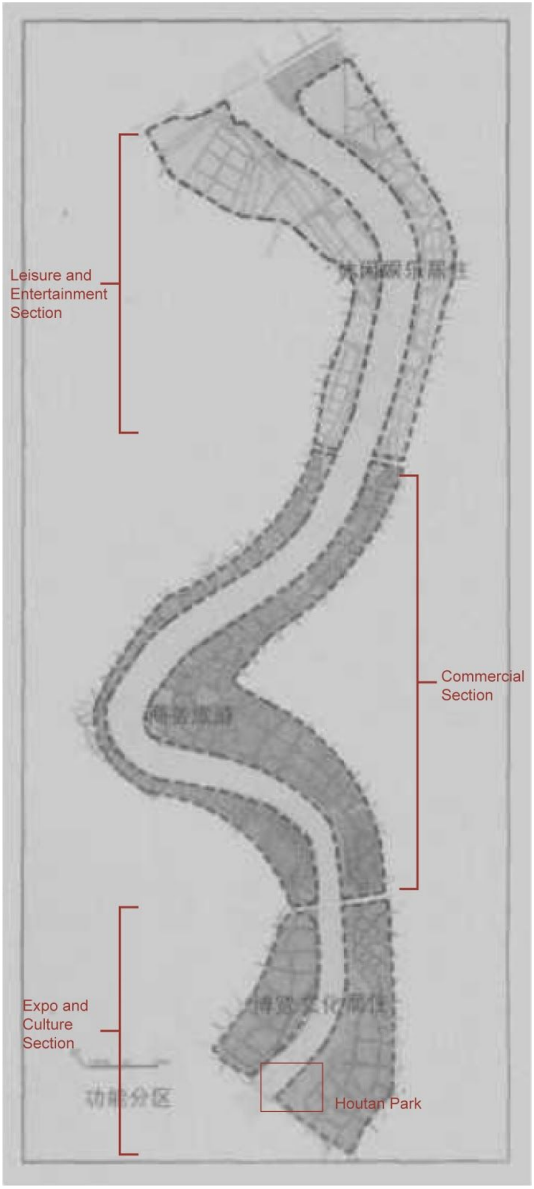

Figure 1: The Plan of Waterfront Space along the Huangpu River and the location of Houtan Park (Source: Yu, 2002)

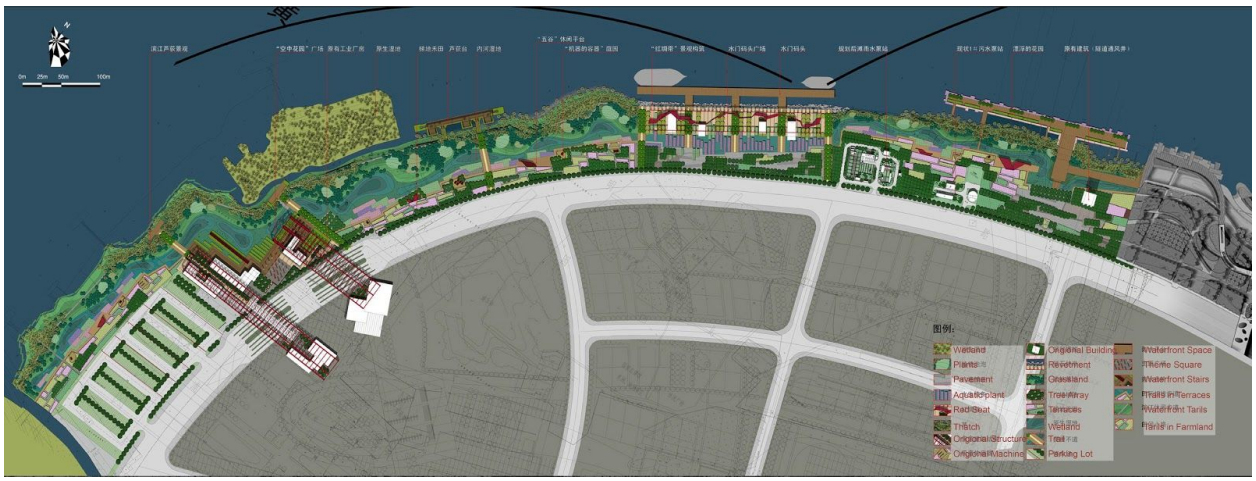

Figure 2: The Plan of Houtan Park （Source: Yu, Kongjian, 2015 Landscape as a Living System: Shanghai 2010 Expo Houtan Park)

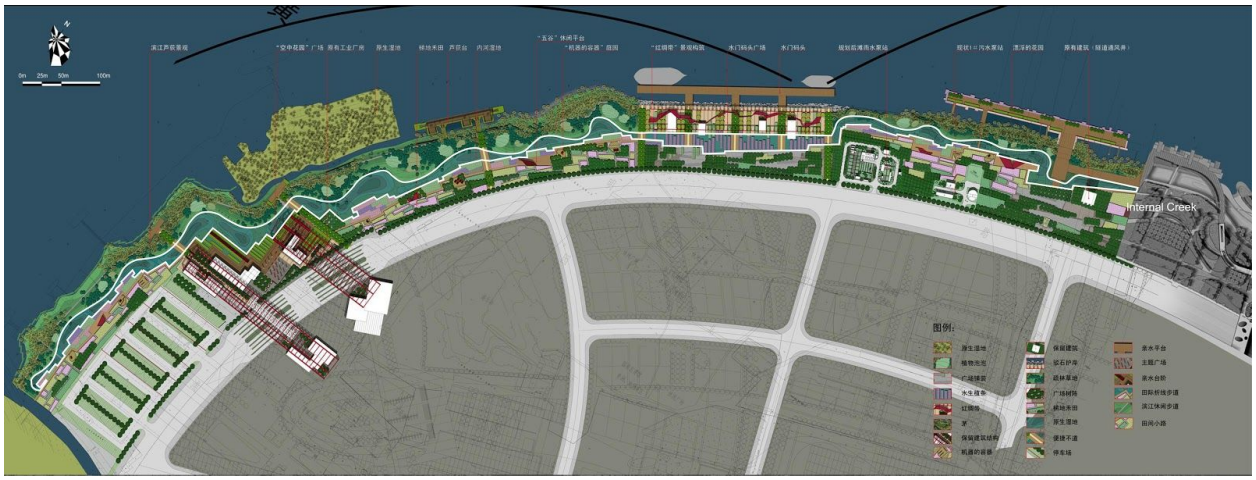

Figure 3: The internal river of Houtan Park (Source: Yu, Kongjian, 2015 Landscape as a Living System: Shanghai 2010 Expo Houtan Park)

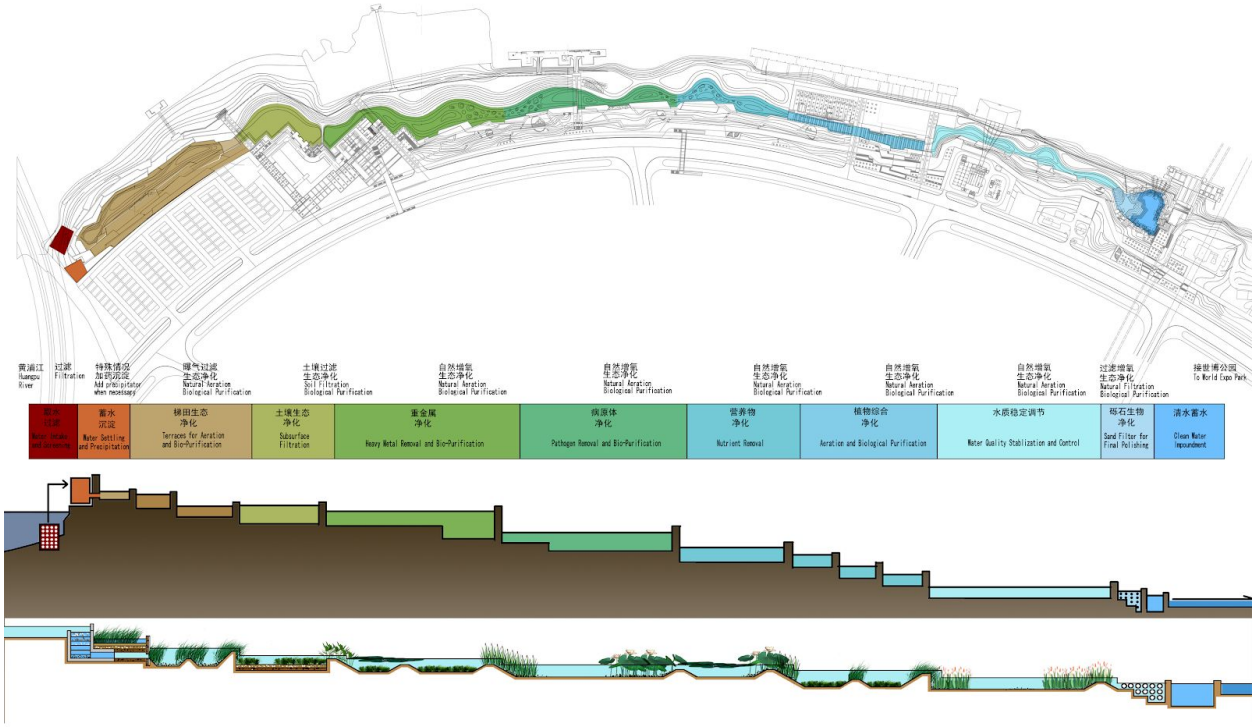

Figure 4: The Water Cleaning Mechanism of Manmade Wetland (Source:Yu, Kongjian, 2015 Landscape as a Living System: Shanghai 2010 Expo Houtan Park)

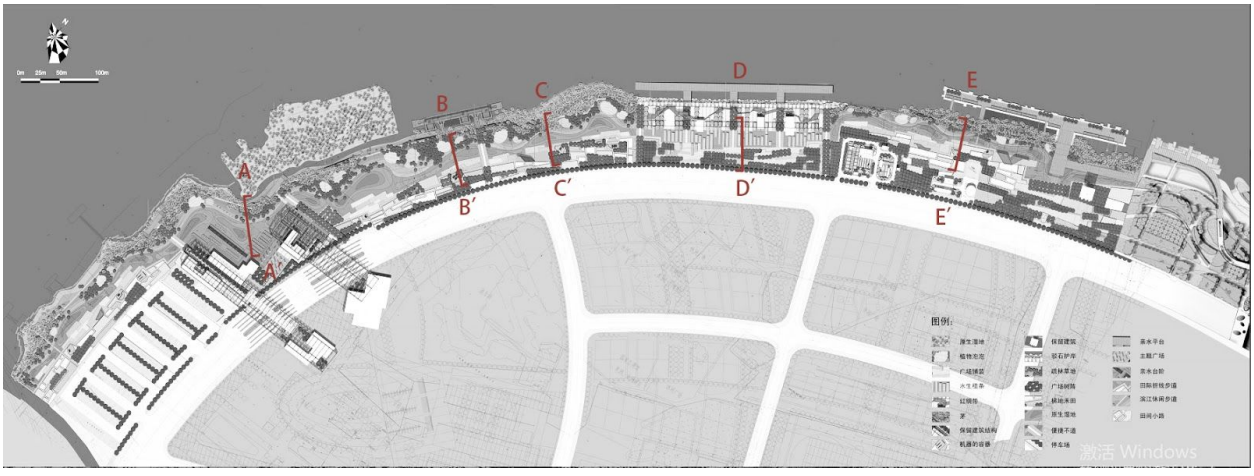

Figure 5: The Proposed Section of Houtan Park 1930 (Image Produced by Yuetian Wang)

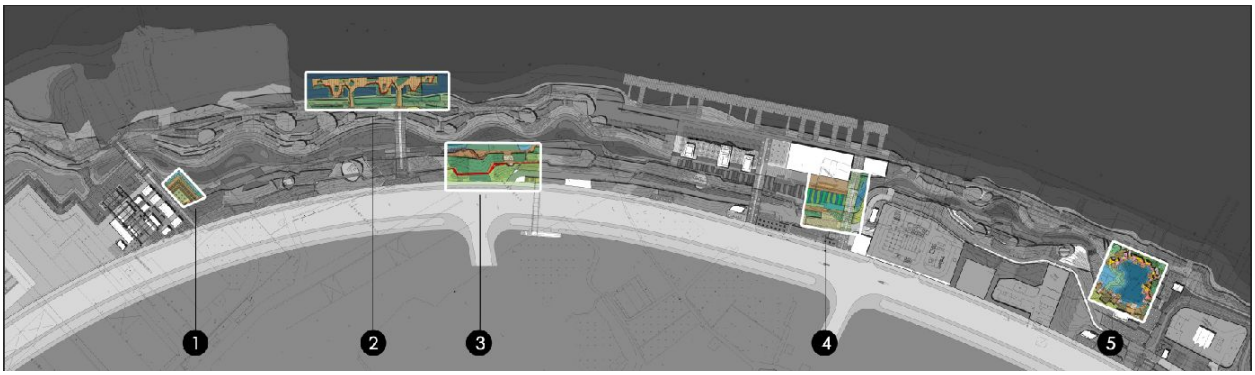

Figure 6: The Sites of Behavior Mapping (Image Produced by Yuetian Wang)

Figure 7: The Transportation Routes of Houtan Park (Image Produced by Yuetian Wang)

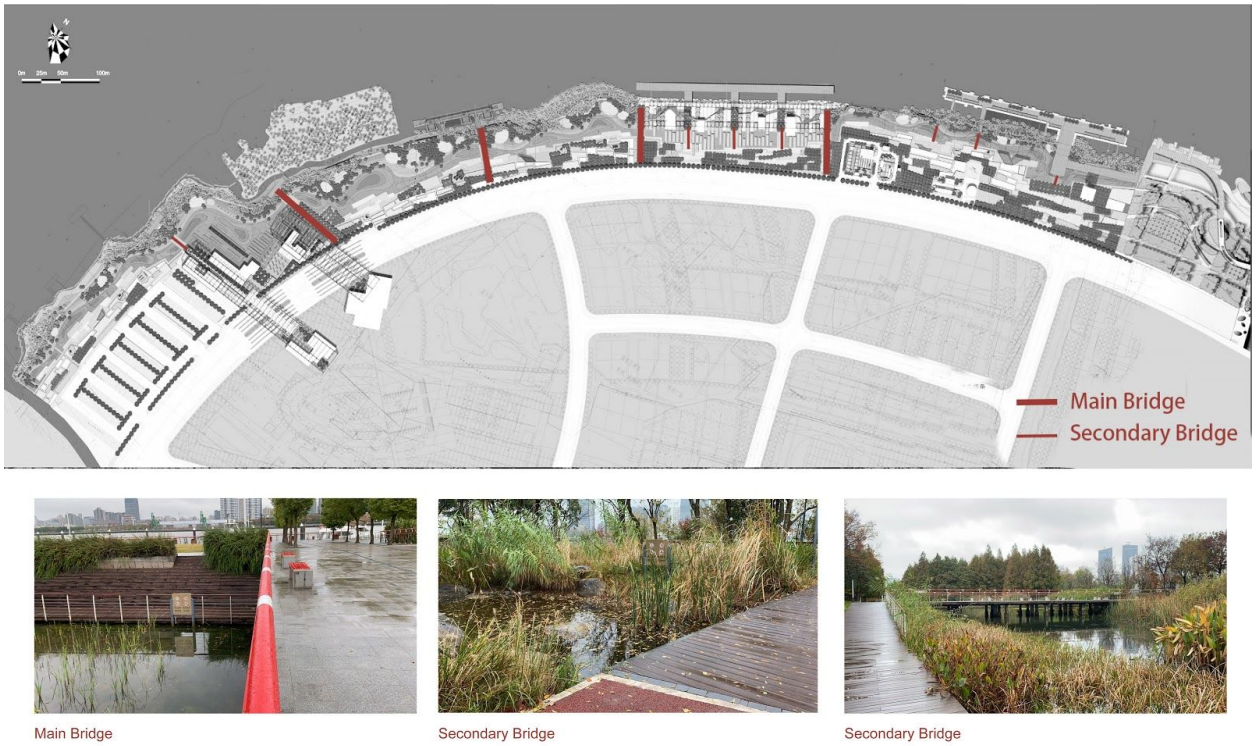

Figure 8: The Bridges of Houtan Park (Image Produced by Yuetian Wang)

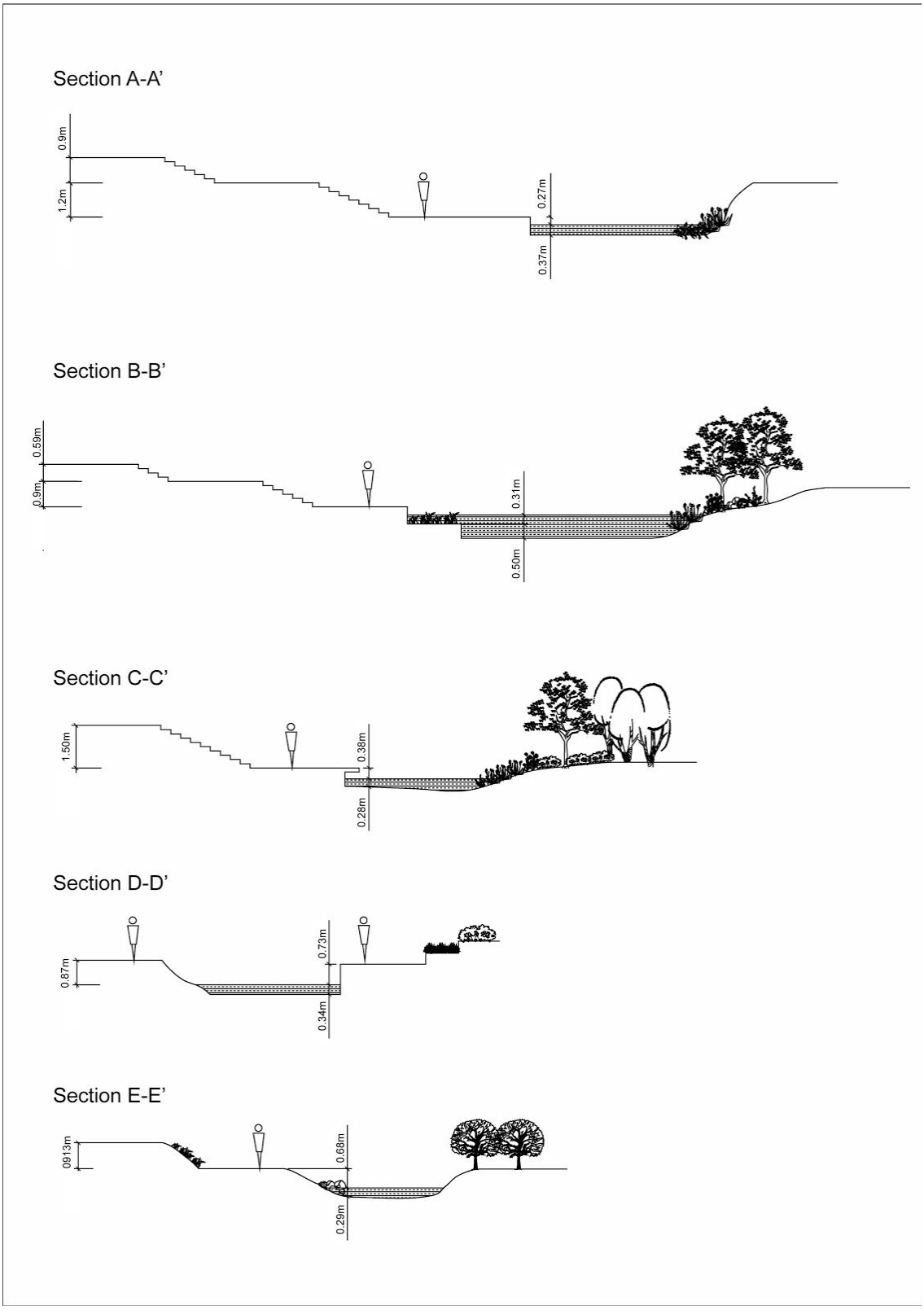

Figure 9: Sections of Internal River in Houtan Park (Produced by Yuetian Wang)

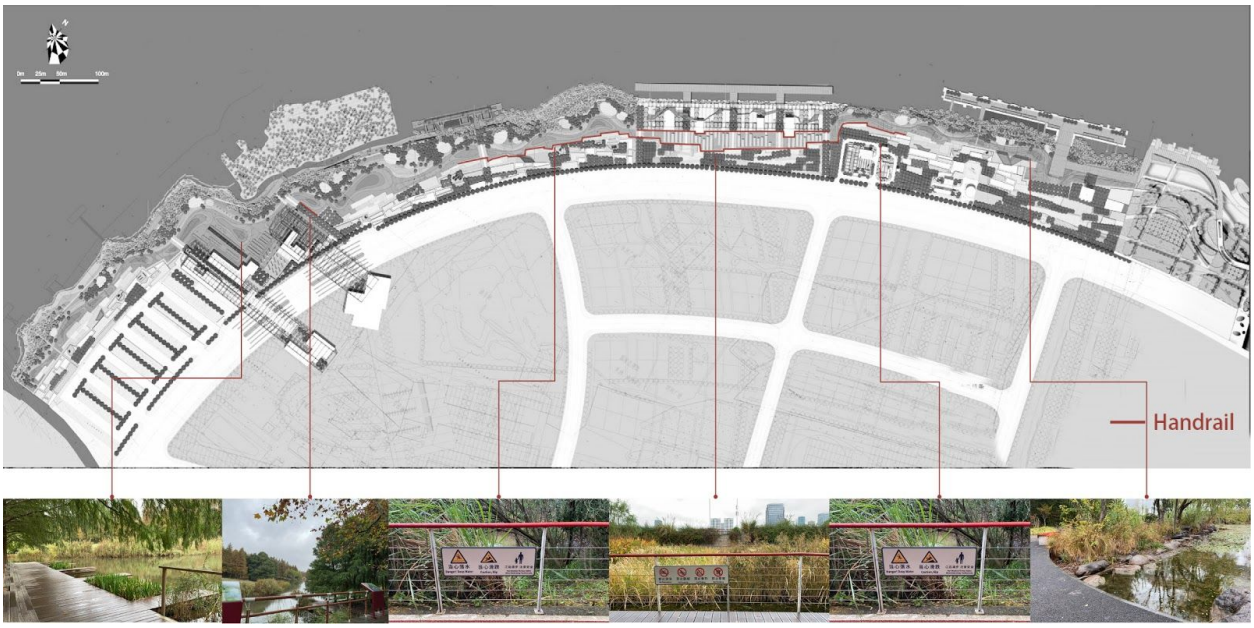

Figure: 10 The Handrail and Water Related Signages in Houtan Park (Image Produced by Yuetian Wang)

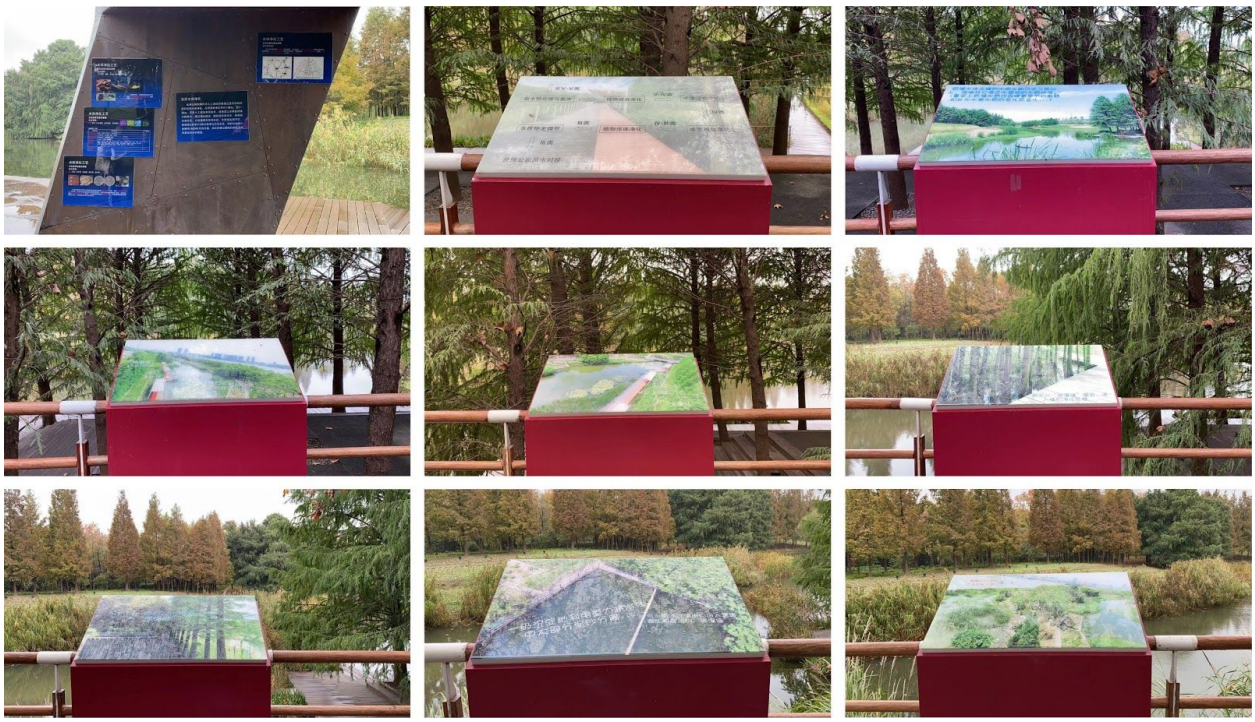

Figure 11: Demonstration Boards in Houtan Park (Photo Credit: Yuetian Wang)

Figure 12: Zoning Map (Gis Conducted by Peixuan Wu)

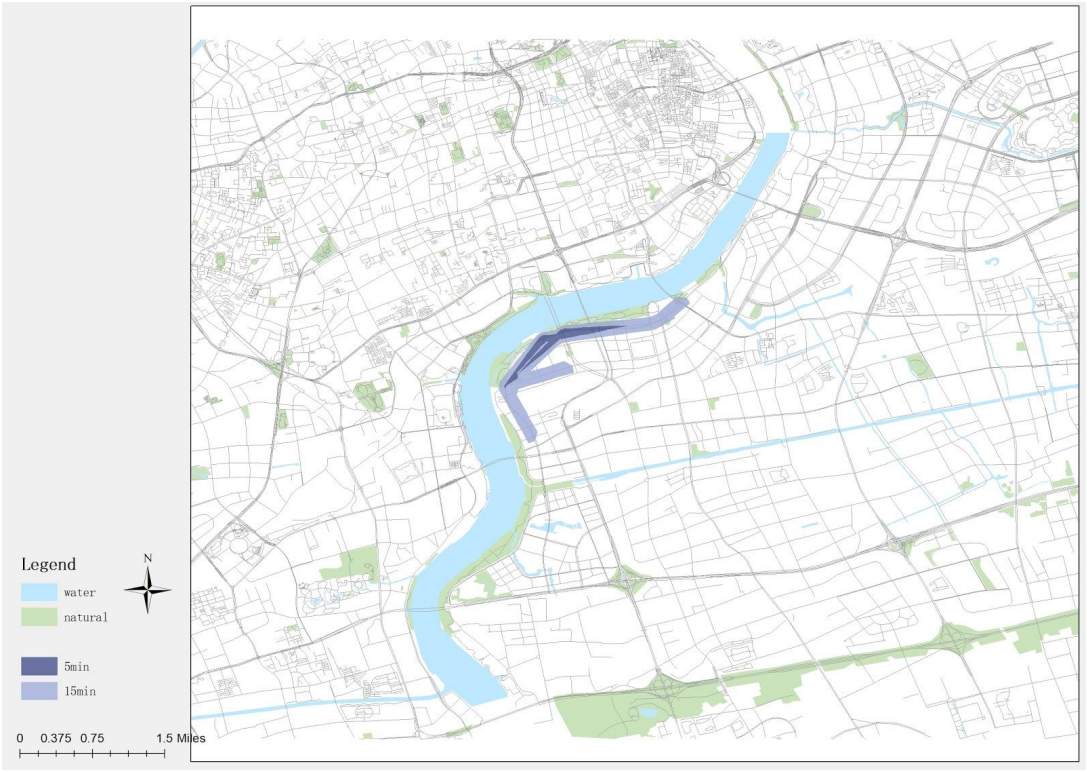

Figure 13: Walking Accessibility by Time (Gis Conducted by Peixuan Wu)

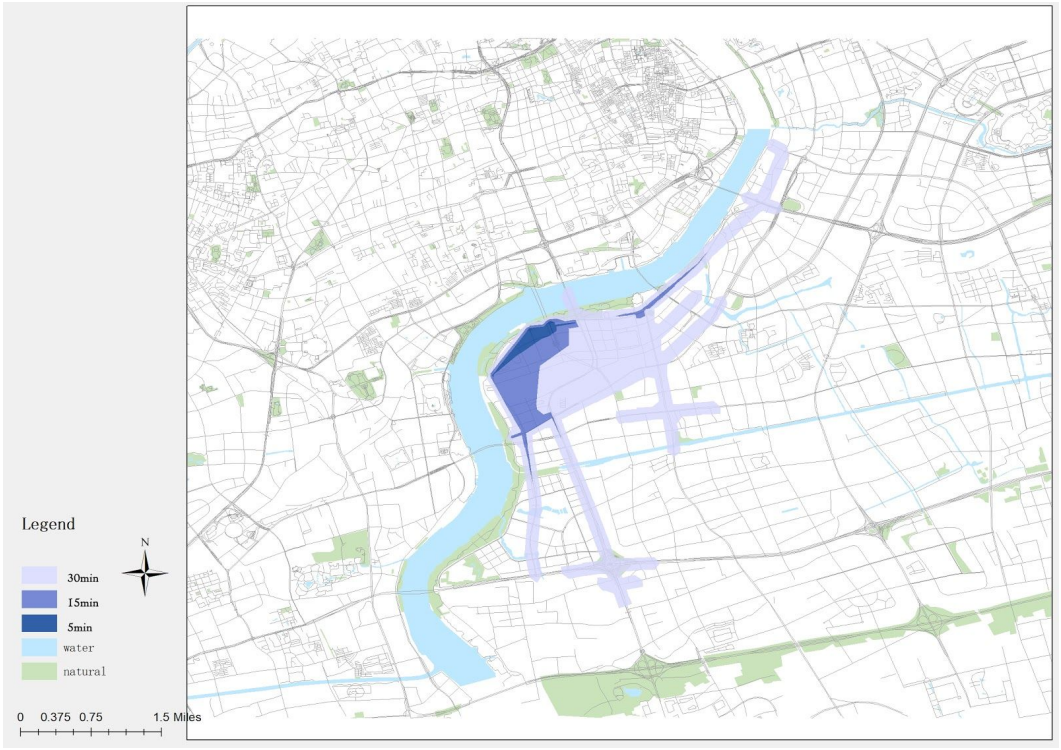

Figure 14: Biking Accessibility by Time (Gis Conducted by Peixuan Wu)

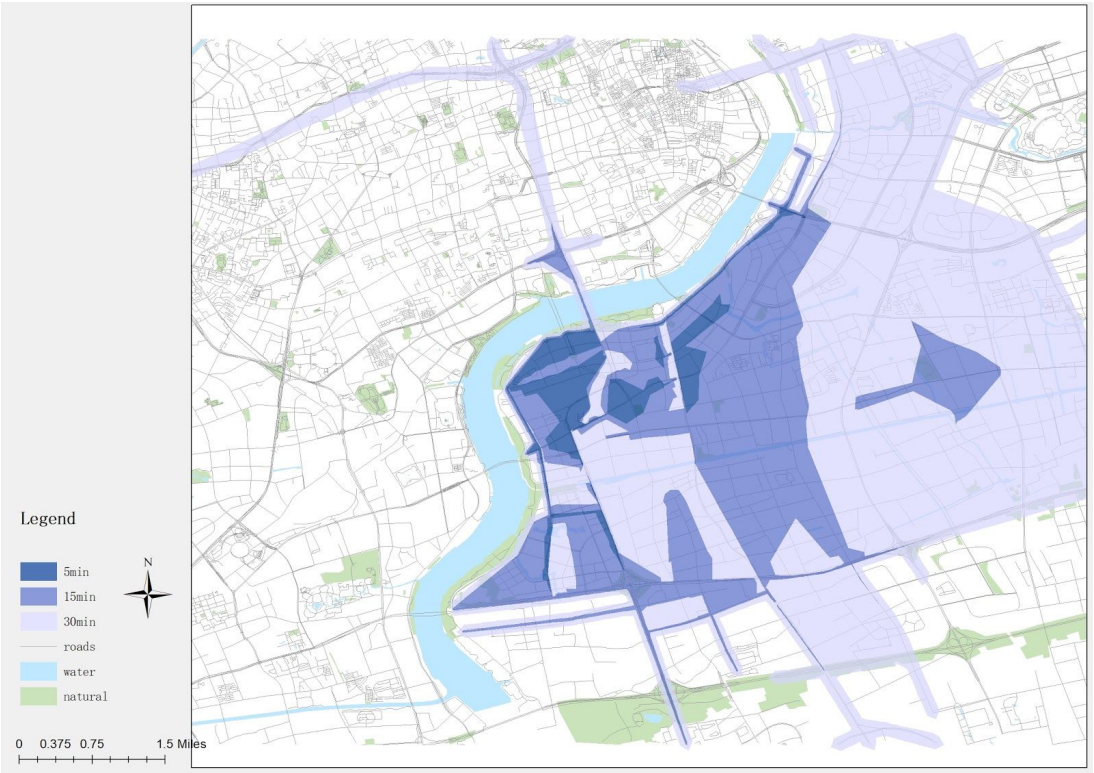

Figure 15: Vehicle Transportation Accessibility by Time (Gis Conducted by Peixuan Wu)

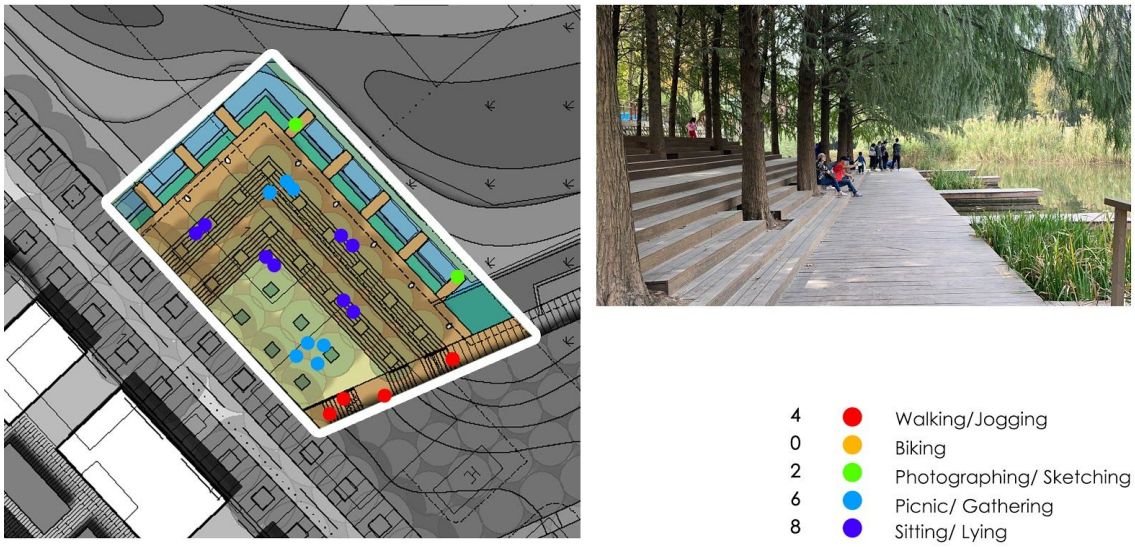

Figure 16: Site 1 (Produced by Peixuan Wu)

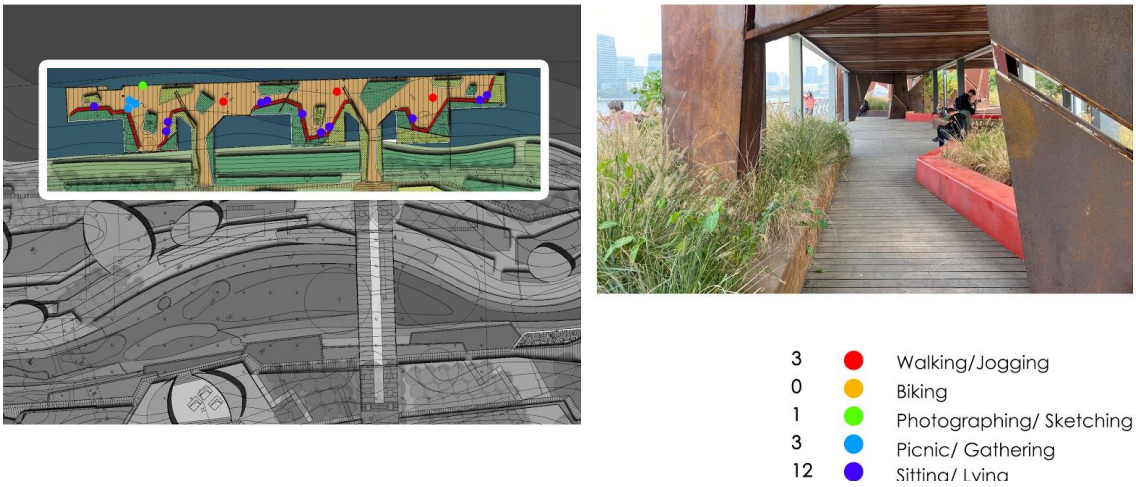

Figure 17: Site 2 (Produced by Peixuan Wu)

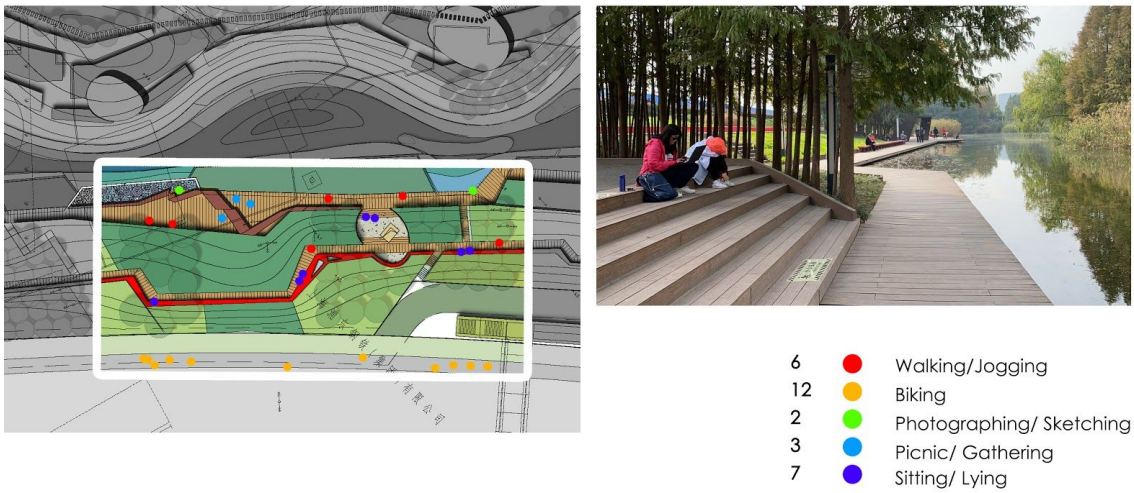

Figure 18: Site 3 (Produced by Peixuan Wu)

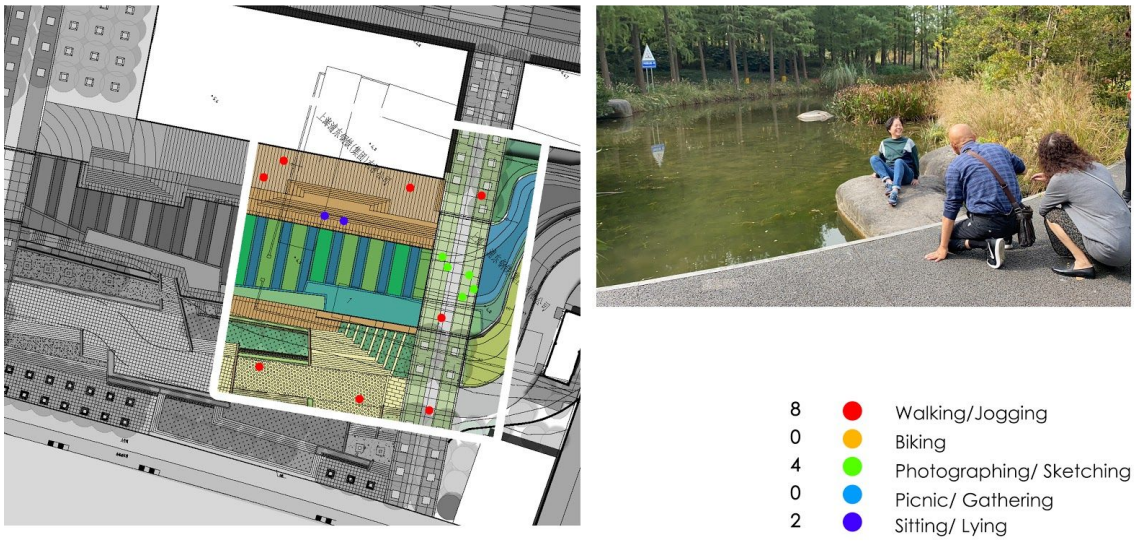

Figure 19: Site 4 (Produced by Peixuan Wu)

Figure 20: Site 5（Produced by Peixuan Wu)

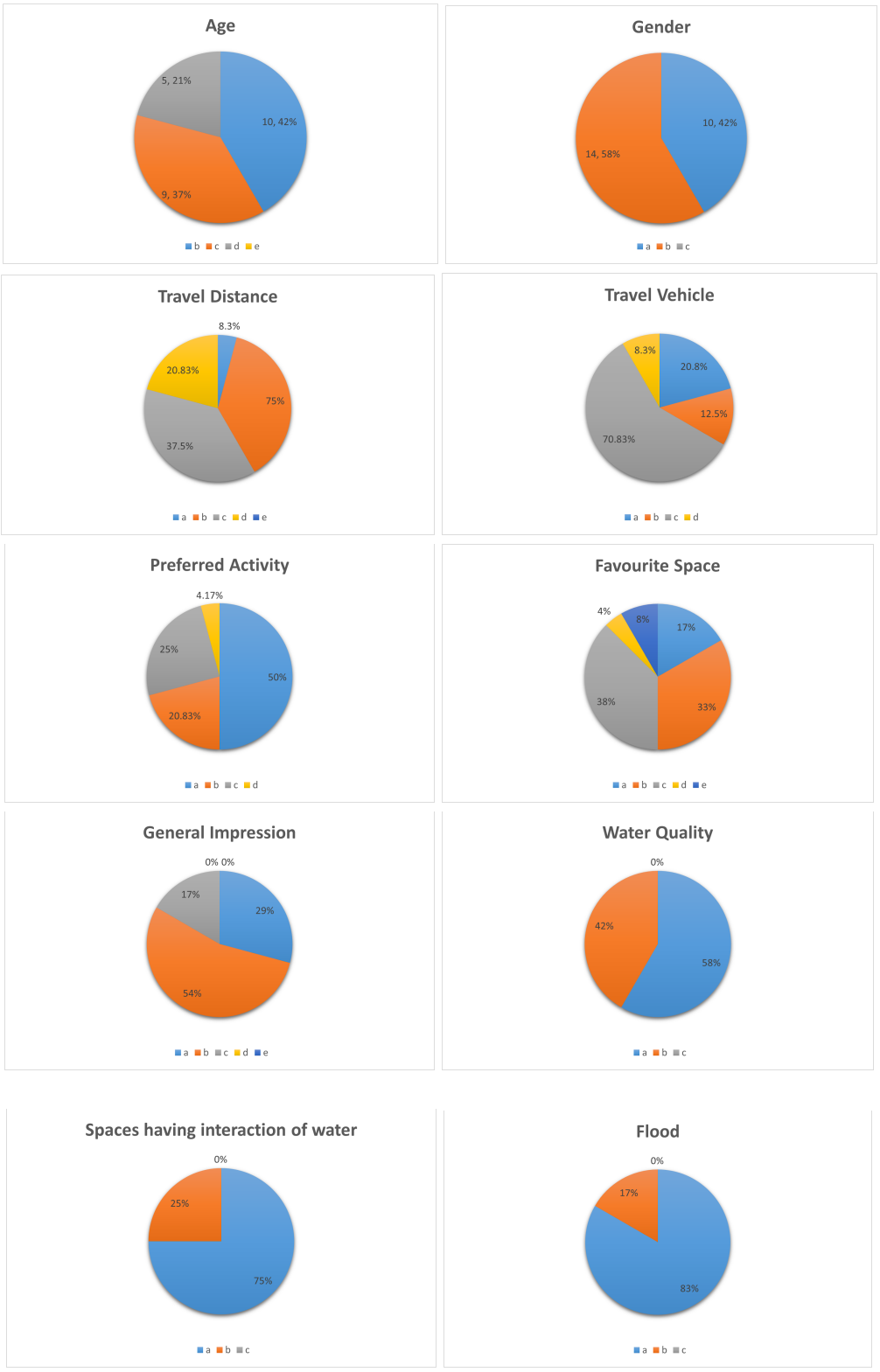

Figure 21: Visitor Survey Result (Conducted by Peixuan Wu)

Figure 22: Left: Platform on the Huangpu River where people can enjoy the scenery of other

Right: “Red-ribbon” path with leisure space

Figure23(Left): Keyword map of general comments from DIANPING

Figure24(Right): Keyword map of water-related comments from DIANPING

Appendices

Appendix A: Visitor Questionnaire

The Social Evaluation of the Interval Creek of Shanghai Houtan Wetland Park

1/ Age：

A, <20; B, 21-35; C, 36-50; D, 51-65; E, >65

2/ Gender：

A，Male； B，Female； C，Other

3/ Distance of your trip to Houtan Park：

A，0-0.5 Mile；B，0.5-1 Mile；C，1-3 Mile；D，3-10 Mile；E，>10 Mile

4/ Vehicle your picked of your trip to Houtan Park：

A，Walk；B，Bicycle；C，Public Transportation；D，Car

5/ What activities are you interested to take in Houtan Park:

A，Have a walk；B，visit/photography；C，sports；D，gathering；E，Else

6/ Which spaces having interaction with water are your favourite

A，Site#1；B，Site#2；C，Site#3；D，Site#4；E，Site#5；

7/ Your impression of the water environment design in Houtan Park (compared with other urban water environment design projects in Shanghai)：

A，Very good；B，good；C，normal；D，bad；F，very bad

8/ Your specific feelings on the water environment design of Houtan Park

（1） Water quality：A，clean；B，normal；C，polluted

（2） Space having interaction with water：A，sufficient；B，normal；C，scarce

（3） Flood situation：A，rare；B，frequent；C，usually

Thank you for your cooperation. Have a nice trip!

LAEP, UC Berkeley

Appendix B: Professional Questionnaire

Houtan Wetland Park Professional Survey
后滩公园专业问卷调查

Dear scholars and experts, we are a group of graduate students major in landscape architecture at UC Berkeley. We are currently doing research on the ecological & social functions of Houtan Park in Shanghai. We have raised six questions regarding some doubts we have during the research process. We hope you could answer them as best as you can. Thank you for participating in our survey.
尊敬的专家学者，我们是一组来自于UC Berkeley景观设计专业的研究学生。我们正在研究上海后滩公园的生态和社会功能与影响。在这份问卷中我们提出了六个在我们的研究过程中遇到的疑问，希望可以获得您的意见和建议。非常感谢你的参与和宝贵时间！

1. 请问您曾经参观过后滩公园吗？您对它的印象如何，比如它的空间是否疏朗友好适合游人开展丰富多彩的活动？这个公园的种植设计，河滩设计，装置设计等是否展现了美学价值？您觉得这个公园的社会可达性高吗？Have you ever visited Houtan Park? What is your general impression about it, like whether the space design is friendly for people to take part in various activities, whether the plant arrangement and riverbank design (ecological) shows aesthetic appeal to you, whether you feel accessible to get there?

2010年6月12日曾作为旅游者在世博会期间参观过后滩公园。收到UC Berkeley教授学生工作组问卷后，于2020年11月23日专程作为专业工作者对后滩公园进行了实地考察。后滩公园总体工作值得肯定。

园内设有多处望江驿，木质屋搭配落地玻璃窗，较精致美观（如图1-1）。望江驿内设有桌椅、自动售货机、直饮水、充电等设施，方便游客休息。园内分设散步、跑步、骑行车道，供周边居民运动健身（如图1-2至1-3）。游人可在宽阔的草地上聚会野餐。池塘边常有游人坐等拍鸟图（图1-4）。

On June 12, 2010, I visited Houtan Park during the World Expo as a tourist. After receiving the questionnaire from UC Berkeley professor-student working group, I made a field visit to Houtan Park as a professional worker on November 23, 2020. The overall work of Houtan Park deserves recognition.

There are many Pavilions in the park, and wooden houses with floor-to-ceiling glass Windows are exquisite and beautiful (As shown in Figure 1-1). The Pavilions is equipped with tables and chairs, vending machines, drinking fountains, charging stations, and other facilities, convenient for tourists to rest. The park is divided into walking, running, and cycling lanes for surrounding residents to exercise (See Figure 1-2 to 1-3). Visitors can gather and have picnics on the wide grass. There are often visitors sitting by the pond to take bird pictures (FIG. 1-4).

图1-1 望江驿

图1-2 骑行

图1-3 与晨练者交谈

图1-4 与观鸟者交谈

园内设有餐饮区（图1-5），菜品价格可接受，餐厅经理告知疫情期间来就餐的人员不多（图1-6）。
There are eating areas in the park (Figure 1-5). The prices of dishes are acceptable. The manager of the restaurant told him that not many people came to eat during the epidemic (Figure 1-6).

图1-5 餐饮区

图1-6 与餐厅经理交谈

临近江滩有游艇供娱乐使用（图1-7）。通过与在公园内散步的上班族交谈中得知（图1-8），他们及同事们都非常喜欢这个公园，空气清新适合放松心情。春夏季的公园景色非常美。

There are boats for recreational use near the river beach (Figure 1-7). Through talking with office workers walking in the park (Figure 1-8), they and their colleagues like the park very much, and the fresh air is suitable for relaxing. The park is very beautiful in spring and summer.

图1-7 江滩游艇

图1-8 与园内上班族游人交谈

然而，溪边芦苇丛多且杂，植被层次性较差（图1-9），且某些区段树木稀疏（图1-10），冬季树秃（图1-11），没能实现四季常绿的效果，影响美观。河滩植被缺乏层次感，美观度较差（图1-12）。However, there are many and miscellaneous reeds by the stream, with poor vegetation hierarchy (FIG. 1-9), sparse trees (FIG. 1-10) in some areas, and bare trees in winter (FIG. 1-11), which fail to achieve the effect of evergreen in the four seasons and affect the aesthetics. River beach vegetation lacks gradation and poor aesthetics (FIG. 1-12).

图1-9 植被杂乱

图1-10 植被稀疏

图1-11 树木凋零

图1-12 河滩植被

公园中设置的金属制大红色方形长凳，尽管其颜色设计可能是为迎合世博会的中国红，但与周边的植物风景相比有点突兀（图1-13）。商业用房玻璃用量居多，美观性较差（图1-14）。

The large red square metal benches in the park, though probably designed to match the Chinese red of the Expo, are a bit out of place compared to the surrounding botanical landscape (Figure 1-13). The amount of glass used in commercial houses is mostly, with poor aesthetics (Figure 1-14).

图1-13 大红长凳

图1-14 玻璃房

后滩公园社会可达性较高。据访问，周末公园游人较多。非周末的游人偏少，上班时段以当地居民的中老年人为主，主要进行健身、拍鸟图、照看小孩子游玩等活动。工作日的中午时分园内人员骤然增多，是附近写字楼的办公人员饭后在此散步。因为后滩公园旁边是央企基地，包括招商银行、国电、商飞、宝武等央企，上班族较多，免费开放的后滩公园为忙碌的工作人士提供了运动减压的途径。外滩公园周边交通便利，附近有直达的公交地铁站。而且，园内有一条道路直通陆家嘴东方明珠，为道路沿线居民来园提供了便利。目前，公园正在进行改扩建工程，工程建成后，将会吸引更多游人前来参观。

Houtan Park has high social accessibility. According to the visit, the park has more visitors on weekends . There are few tourists outside the weekend. During the working period, the middle-aged and elderly local residents are mainly engaged in fitness activities, taking bird pictures, and taking care of children to play with. At noon on weekdays, the park staff suddenly increased, is the office workers in the nearby office buildings after dinner to take a walk here. The park is adjacent to the base of central enterprises, including China Merchants Bank, Guodian, Comac, Baowu, and other

central enterprises. There are many office workers, and the free open Houtan Park provides a way for busy workers to exercise and relieve pressure. Bund Park is conveniently located, and there are direct bus and subway stations nearby. Moreover, there is a road directly leading to the Oriental Pearl of Lujiazui, which provides convenience for residents along the road to the park. At present, the park is undergoing renovation and expansion projects, which will attract more visitors when completed.

2.这个公园设计之初的概念是“双滩谐生”，外滩负责抵御黄浦江的涨潮，保护公园免于洪水；内滩设计了一系列的生物净水池并形成一条小溪。通过水利设施将黄浦江江水泵入过滤，使过滤后的水质达到三类水的标准且可以达到日净化水量达2400立方，供公园灌溉和清理。这个愿景是非常吸引人的。请问您作为旅客或者学者，觉得建成后的效果达到了最初的设想吗？抑或是背道而驰徒有虚名？The first ecological vision of this park is to protect the park from floods. The second one is to pump in some water from the Huangpu river and let it flow through an inland creek with a series of biological purification pools to purify polluted water for park irrigation and cleaning. This vision is intriguing, but what do you think about the after-construction reality as a visitor or a scholar? Does it fulfill the original vision or does it just go beyond the expectation?

外滩多采用块石抛石护坡和斜坡种植植被进行潮水防护（图2-1），生态海堤的防护形式取代了传统的高墙式海堤（防汛墙，图2-2）防护，将人与自然的距离拉近，也起到了较好的防护作用。据访问临江餐饮店的管理者，外滩的防护效果良好，在2020年流域长期洪水叠加几个风暴潮期间的长期高水位期间并未威胁到沿岸基础设施，且水位上涨时海水可经由洞口疏散到其它地方。因此，最初关于“双滩谐生”的生态防汛功能效果达到了最初的设想。

The Bund mostly adopts block stone riprap slope protection and slope vegetation planting for tide protection (Figure 2-1). The protection form of ecological seawall replaces the traditional high-wall seawall (flood control wall, Figure 2-2), which shortens the distance between humans and nature and also plays a better protective role. According to managers who have visited restaurants in Linjiang, the Bund is well protected and does not threaten coastal infrastructure during the long period of high water levels during the long-term floods in the basin combined with several storm surges in 2020, and the seawater can be evacuated to other places through openings when the water level rises. Therefore, the original ecological flood control effect of "Two beaches Harmonic generation" has reached the original idea.

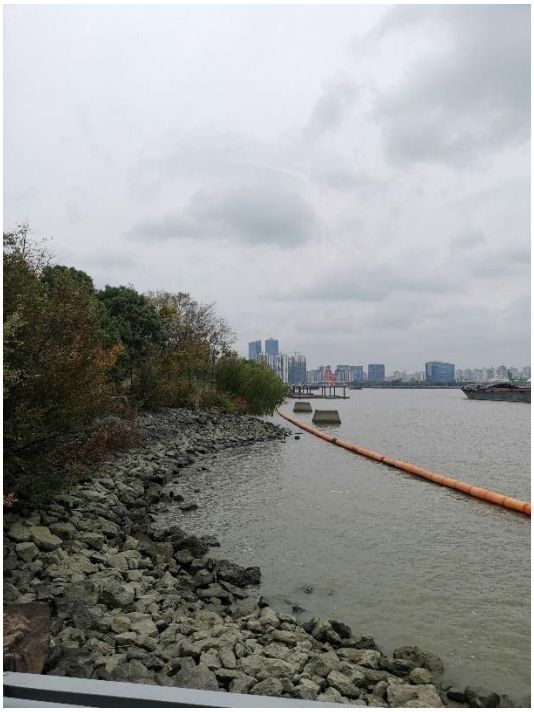

图2-1 外滩防护

图2-2 防汛墙

另外，餐厅营业产生的污水不会直接排入江中或溪流中，而是集中排放到污水池，由专门的抽水车定期将污水抽走并进行处理。在园中能看到有关生态水质净化过程的宣传栏（图2-3）。

In addition, the sewage generated from the restaurant business will not be directly discharged into the river or stream, but the centralized discharge to the sewage pool, by the special pumping trucks regularly to remove the sewage and treatment. In the garden, you can see the information column about the process of ecological water purification (Figure 2-3).

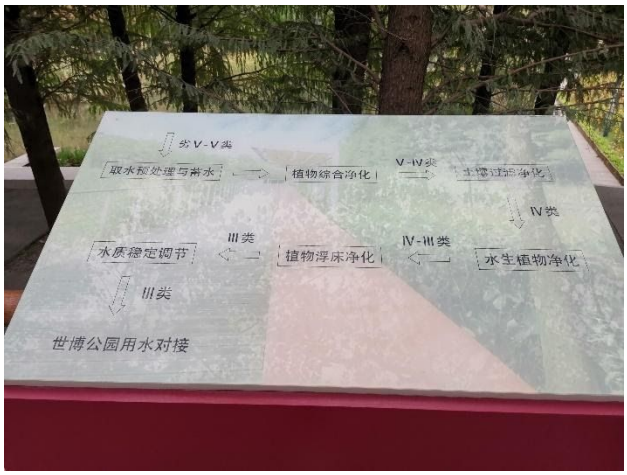

图2-3 生态净水宣传栏

公园中的小溪西南段流水潺潺，溪水清澈，有鸭子在水中嬉戏，溪中的水草也可进一步净化水质（如图2-4，图2-5）。然而东北处有一段溪流，水体污染较混浊，浮游植物覆盖水面（图2-6，图2-7），甚至出现了枯季无水的区段（图2-8）。所以内滩的净水工程实际情况比最初的设想要差，但并非背道而驰。In the southwest part of the brook in the park, there is a murmuring stream with clear water. Ducks are swimming in the water. The water grass in the brook can also further purify the

water quality (See Figure 2-4, Figure 2-5). However, there is a section of the stream in the northeast where the water pollution is cloudy and phytoplankton cover the water surface (FIG. 2-6, FIG. 2-7), and even a section with no water in the dry season (FIG. 2-8). So neitan's water purification project is worse than originally thought, but not in the opposite direction.

图2-4 鸭游

图2-5 水草净化水池

图2-6 污染水体

图2-7 较差水质

3.公共公园设计的生态效益会随着尺度大小不同千差万别，对于后滩公园这样尺度的公园，是更应该强调生态效应，例如水质、生物栖息地，物种多样性的发展，还是要更多的关注人对此空间的体验以及此公园给人带来的价值。For the parks with the scale of Houtan Park, is the ecological effect, like the water quality, biodiversity, and species habitats, or the value this park brings to residents, including the activities and the scenery the park provides, should be more emphasized?

公园在发挥生态功能的同时，应该充分发挥对人的生态服务功能。后滩公园属于小尺度公园，位于用地较为紧张的上海市浦东区。受空间尺度限制，它无法创建许多大型基础娱乐设施供游客使用，所以在某些空间体验方面，无法与一些大型公共公园相比，但这并不意味着人的体验感不重要。它需要强调生态效应，保持良好的水质和丰富的物种多样性，通过展示有层次、有美性、可持续发展的生态景观，营造清新的空气氛围，吸引游客驻足观赏。因为这是城市生态公园，一个生态环境不佳的公园难以让人为之向往，一个没有人文气息的公园也失去了它作为城市公园的存在意义。在实际操作中，可通过科学地划分公园功能区来平衡生态与人的关系。对于需要充分保障生物栖息场所、实现原生态保护的区域，可以通过划定红线保护区来避免人类对自然的干扰。红线区之外，可通将自然景观设置与人类休闲娱乐设施相结合，实现人与自然的和谐发展。

While playing the ecological function, the park should give full play to the function of ecological service to people. Houtan Park is a small-scale park, which is located in Pudong District of Shanghai, where land use is relatively tight. Limited by the scale of the space, it cannot create many large basic recreational facilities for tourists, so it cannot be compared with some large public parks in terms of some spatial experiences, but this does not mean that the sense of human experience is not important. It needs to emphasize the ecological effect, maintain good water quality and rich species diversity, and create a fresh air atmosphere to attract tourists to stop and look at it by displaying a hierarchical, beautiful and sustainable ecological landscape. Because this is an urban ecological park, a park with poor ecological environment is hard for people to yearn for, and a park without humanistic atmosphere also loses its significance as an urban park. In practice, the relationship between ecology and human beings can be balanced by scientifically dividing the park function area. For areas that need to fully guarantee biological habitats and realize original ecological protection, red line protection zones can be established to avoid human interference with nature. Beyond the red line area, natural landscape Settings can be combined with human leisure and entertainment facilities to achieve the harmonious development of man and nature.

4.关于这类型的生态公园的后期管理现状，您有什么建议吗？生态公园的后期管理是不是比普通公园更困难？事实上现在这个公园拥有一些后续维护不利导致的问题，像是部分河道干涸，一些公园设施被损坏？Regarding the sustainable post-maintenance of this ecological park, do you have some suggestions? Is the maintenance of ecological parks more difficult than ordinary neighborhood parks? Actually, this park has some problems, such as part of the river was dry and some facilities in this park were damaged.

公园存在多处杂草丛生、土地利用率不高的问题，建议重新规划荒草荒地区，可以引种本地的经济作物。在树种选择时，建议引种一些结果实的树木，以增强公园的生活气息。玻璃质房屋美观性较差，建议改建或部分替代成木制小屋，与周边环境相适应。公园东北部的池塘水质较差、流动性不佳，水中富营养化较明显，需要结合水生生物的管理与人工物理净化水体以稳定水质。在园中观察时，只发现了一名清洁工师傅在清洁落叶和一名园林绿化师傅，虽然该公园设计理念就是减轻人力物力的管理维护工作，但偌大的公园在秋冬季节修整枯树处理杂草是项较大工程，人力不足会影响维护进程和效果，进而影响公园的美观。所以，对于公园内植被的维护工作应加强落实。

生态公园后期管理比普通公园更困难，尤其是像外滩公园这种大城市中的临海生态公园，因为需要保证公园生态效益的发挥。通过实地调研，部分河道干涸现象的确存在，公园内也存在多处废弃场

所（图4-1），亲水通道的观水台未及时维护显得老旧且已经关闭（图4-2）。虽然有几位游人在等待拍鸟，但其实公园内很少会看到鸟的身影，需要反思是什么原因导致鸟类稀少。

There are many problems in the park, such as overgrown weeds and low land utilization rate. It is suggested to replan barren grass areas and introduce local cash crops. In the selection of tree species, it is recommended to introduce some fruitful trees to enhance the life atmosphere of the park. The glass house is poor in aesthetic quality, so it is suggested to rebuild or partially replace the wooden cabin, which is suitable for the surrounding environment. The water quality of the pond in the northeast of the park is poor, the fluidity is not good, and the eutrophication in the water is obvious, so it is necessary to combine the management of aquatic organisms with artificial physical purification to stabilize the water quality. Observed in the garden, only found a cleaner in cleaning the fallen leaves and a master landscape master, although the park design concept is to reduce manpower management maintenance, but large park in the autumn and winter season dressing or fruit processing weed is a large project, shortage of manpower will affect the maintenance process and effect, and effect the beauty of the park. Therefore, the maintenance of vegetation in the park should be strengthened.

It is more difficult to manage ecological parks in the later stage than ordinary parks, especially the ecological parks near the sea in big cities like The Bund Park, because they need to ensure the play of ecological benefits. According to the field survey, part of the river course does dry up, and there are also many abandoned places in the park (Figure 4-1). The viewing platform of the water-wet passage is old and closed without timely maintenance (Figure 4-2). Although a few visitors are waiting to photograph the birds, they are rarely seen in the park and need to reflect on what is causing the scarcity.

图4-1 弃用建筑

图4-2 观水台

5.针对这些后期管理维护的问题，我们发现后滩相关的POE研究非常有限。或者说借助POE去指导后续设计和维护本身还不是很普遍。但是毕竟，一个动态发展的景观公园是不会在建成后维持静态，也不能单单靠日常维护和清洁永葆“青春”。你怎么看待POE在实际项目中的作用和地位？在中国推行POE的现实局限有哪些？若缺乏POE，会带来怎样的影响？（针对后滩公园而言，或者针对一个宽泛的现状）。In terms of these maintenance issues, we found that research related to

POE(post-occupancy evaluation) of Houtan is limited. Or maybe lack of POE to guide further design or adjustment is popular right now. After all, a dynamic landscape cannot stay static after construction and maintain its best condition only relying on routine maintenance and cleaning, especially facing urgent climate change. What do you think about POE in real practice; what is the limitation of POE to operate now in China; and what is the influence of it?

运用POE方法在项目完成后对其进行综合评价是非常重要的，这种反馈机制是吸取教训总结经验以及改善整个项目体系的关键环节。虽然POE在西方国家被广泛推广，但中国的规划体制与思维习惯与西方国家有差异，POE在中国的推行受到一定的限制，需求市场不完善，技术体系也不成熟。原因之一是在经费来源方面尚未形成共识。谁应该来支付POE研究这笔额外的开支？是建设方还是施工方亦或是使用方？例如后滩公园，POE花费是公园的管理者支付还是政府规划者支付？他们是否愿意担负这笔项目之外的开支？目前有关这方面的问题探讨较少。所以，需要借鉴西方国家POE实施策略，建立中国POE运行体制。其次，公众参与度相对较低。公众是使用者的主要来源，他们的使用评价和反馈意见对POE研究至关重要。公众参与在中国提出较晚，虽然近些年已经逐渐发展起来，但与西方国家群众参与度相比仍有差距，使得POE研究在中国的发展较缓慢。因此，在中国需要拓展群众参与的途径，通过国际交流合作，创新公众参与方式，为POE的信息搜集做好铺垫。

若缺乏POE，无法获取到项目的实际使用情况，设计的目标是否达到也不清楚，存在的问题被忽视。如后滩的生态水质净化工程，其理念设计是很完美的，但在实际操作中，如果不能及时获得实施情况反馈，那么就不能立马采取措施解决出现的问题，比如局部水域污染问题和干涸问题。不仅降低了周边环境的美感，影响了游人的赏景心情，也不利于设计者进行经验总结的精益求精。

It is very important to use POE to conduct comprehensive evaluation after completion of a project. This feedback mechanism is the key link to learn lessons, summarize experience and improve the whole project system. Although POE has been widely promoted in western countries, the planning system and thinking habits of POE in China are different from those in western countries. The implementation of POE in China is limited to some extent, with an imperfect demand market and immature technical system. One reason is that there is no consensus on funding sources. Who should pay for the additional cost of POE research? Is it the builder or the builder or the user? For example, for Houtan Park, is the cost of the POE paid by the park manager or by government planners? Are they willing to pay for more than this? At present, there is little discussion about this aspect. Therefore, the implementation strategy of POE in western countries should be used for reference to establish the operating system of POE in China. Second, public participation is relatively low. The public is the main source of users, and their use evaluation and feedback are critical to POE research. Public participation was proposed late in China. Although it has developed gradually in recent years, there is still a gap between the public participation and that in western countries, making the development of POE in China slow. Therefore, it is necessary to expand the ways of mass participation in China, innovate the ways of public participation through international exchanges and cooperation, and pave the way for the information collection of POE.

In the absence of a POE, the actual use of the project cannot be obtained, and it is unclear whether the design goals have been achieved, and the existing problems are ignored. For example, for the ecological water quality purification project in Houtan, its conceptual design is perfect. However, in practical operation, if the implementation feedback cannot be obtained in a timely manner, measures cannot be taken immediately to solve the existing problems, such as local water pollution and drying up. It not only reduces the beauty of the surrounding environment, affects the tourists' mood of enjoying the scenery, but also goes against the designer's pursuit of excellence in experience summary.

6.俞孔坚说“这座公园的管理成本极低。后滩是为城市和生态做贡献的公园，它建成后低成本自然生长，它采用的乡土湿地植物，生长、开花、结籽，落地重新生长。”但事实上，我们发现这个公园有建立水坝用于在低水位时期抽水以维护公园河道保持有水的状态。同时，公园内有一些用于商业的小房子使用大量玻璃，这些都在公园建设和后期维护上带来极大的成本。你是否认为这些支出是必要的，还是设计者在设计河道高程和建设材料的时候有所失误。When introduced the Houtan Park, Kongjin Yu said," As the part that aimed to contribute to the city and ecology, it has extremely low management cost. All plants it uses are native wetland plants, which do not need to be pruned and replanted manually." But actually, we notice that he designed the water pump to pump water from Huangpu River to keep the internal river with water during the dry seasons. Meanwhile, some commercial buildings in this park use glass, which is brickle and expensive. Do you think the cost of these designs is necessary or just because the designers did not consider carefully when designing the elevation of the river bed and the construction material?

从此次公园考察来看，缺乏人力物力来维护的后滩公园存在很多因疏忽管理导致的问题，如之前提到的池塘水污染、杂草丛生和土地利用率低等问题，影响了其生态效益和美观性。让自然做功进行自我净化不代表不需要一定的人力干涉，对于未能较好地进行自我净化自我发展的自然区域，适当的人力管理和经费支出在维护公园正常运行中是必要的。

公园内滩设计了生物净水池并形成一条小溪，日净化水量可达2400立方，理论上可以满足河道水位需求，现在却建坝抽水维持水位状态，甚至出现了干涸区段。这可能是因为当初的设计未能充分考虑河道高程，但更有可能是因为后期管理不当，河道清理不及时，或者没能按标准执行当初的净水计划导致的。

后滩公园内的建筑的确较多采用了玻璃，且有许多废弃的房屋。玻璃建筑虽在造价上低于传统的钢筋混凝土结构，美观上强于板房，但其后期维护费时费力，冬冷夏热需要靠空调调节，导致能源消耗大。且成片的玻璃房与周边的自然植被环境显得欠协调。这些后期出现的问题或许在建材设计时是可以避免的。

From the perspective of this park investigation, houtan Park, which lacks manpower and material resources to maintain, has many problems caused by negligence of management, such as the water pollution of the pond, overgrowth of weeds and low land utilization rate mentioned before, which affect its ecological benefits and aesthetics. Letting nature do the work to purify itself does not mean that certain human intervention is not needed. For natural areas that fail to perform self-purification and self-development well, appropriate human management and expenditure are necessary to maintain the normal operation of the park.

In the park, a biological net pool is designed and a stream is formed on the beach. The daily purified water volume can reach 2400 cubic meters, which theoretically can meet the water level demand of the river. However, now the dam is built to pump water to maintain the water level, and even the section has become dry. This may be because the original design did not take full account of the river elevation, but it is more likely to be due to mismanagement, late river cleaning, or failure to implement the original water purification plan in accordance with standards.

It is true that there are a lot of glass facades in the buildings in Houtan Park, and there are many abandoned houses. Although the cost of glass building is lower than that of the traditional reinforced concrete structure, and it is better than the board house in appearance, the later maintenance of glass building is time-consuming and laborious, and the cold in winter and hot in summer need to be adjusted by air conditioning, resulting in high energy consumption. And the glass house into pieces and the surrounding natural vegetation environment appears uncoordinated. The problem that appears in these late periods perhaps can be avoided when designing building material.