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People's Republic of China: Institutionalization of Urban-Rural Environmental Master Planning to Guide Environmentally Sustainable Urbanization in the People's Republic of China

(Financed by the Technical Assistance Special Fund and Urban Environmental Infrastructure Fund)

Report 4: Domestic Pilots and International Best Practice Cases of Urban-Rural Environmental Master Planning

Prepared by the consultants of TA 8537-PRC: Institutionalization of Urban-Rural Environmental Master Planning to Guide Environmentally Sustainable Urbanization in the People's Republic of China

For the Ministry of Environmental Protection

Asian Development Bank
TA8537 (47061) PRC

Technical Assistance Consultant Report:

Institutionalization of Urban-Rural Environmental Master Planning to Guide Environmentally Sustainable Urbanization in the People's Republic of China

Protecting the PRC's Green Land from Urban Development, Urban Sprawl and Overdevelopment

Report 4

DOMESTIC PILOTS AND INTERNATIONAL BEST PRACTICE CASES OF UREMP

Asian Development Bank
TA8537 (47061) PRC

Institutionalization of Urban-Rural Environmental Master Planning (UREMP) to Guide Environmentally Sustainable Urbanization in the People's Republic of China

A note on the outputs of this project

The Asian Development Bank Technical Assistance Project TA8537 (47061) PRC, Institutionalization of Urban-Rural Environmental Master Planning (UREMP) to Promote Environmentally Sustainable Urbanization in the People's Republic of China, delivered the following **four reports**.

Executive Report: Summary of UREMP in the PRC - Protecting China's Green Land from Urban Development, Urban Sprawl and Overdevelopment provides a comprehensive summary of UREMP and of the issues to be addressed in protecting China's Green Land in the context of continued rapid urbanization. The report provides a description of the methods and techniques to be used, recommendations for policies and for institutionalising urban-rural environmental master planning at various levels of government in the PRC, and lessons from successful examples of environmental protection in China and elsewhere.

Report Two: Technical Guidelines of UREMP provides technical details in the form of a manual and step-by-step guide for how to practically plan and implement UREMP, including approach, methods and techniques for mapping, analysing, assessing, zoning and evaluating Green Land within and surrounding urban areas where environmental assets may be at risk from development.

Report Three: Recommendations for Policies and Institutional Arrangements of UREMP provides details on procedures for setting up a legal framework and administrative regulations, and an institutional framework to enable UREMP to become an effective and operational instrument.

Report Four: Domestic Pilots and International Best Practice Cases of UREMP (this report) offers lessons from best practices in the PRC and elsewhere as a basis for possible solutions for protecting the PRC's Green Land, using theory, policies, institutional arrangements, methods and techniques from best practice cases.

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Contents

1 Background

The fundamental environmental issues have become key constraints on the development of new-type urbanization in China. However, traditional environmental planning is hard to meet the requirements of the new situation, so the development of UREMP has become inevitable.

1.1 Problems faced by China

1.1.1 The constraints of resource environmental bearing capacity are hard to implement, and there's a lack in connection with development of urbanization and industrialization

With the rapid development of urbanization, the pressure and load keep increasing on the environmental bearing capacity, pollution purification and ecological balance maintenance in the cities and surrounding areas. According to preliminary statistics, the urban construction of China accounts for 70% the GDP of the whole country and around 80% the fiscal revenue of the country. For each increase of urbanization rate by 1%, it will increase an urban population of 13 million people, 300-400 million sqm of housing, a land consumption of 1800 sq.km. and energy development of 640 million kwh. However, quite some cities expand the city size limitlessly, enhance the development and utilization intensity of environmental resources, the current urban planning and environmental planning are difficult to include the development and utilization of resources and energy and the environmental bearing capacity into the plan as rigid constraint devices, which have resulted in excessive development of quite some cities, over-consumption and low-efficiency utilization of environmental resources.

1.1.2 The environmental and space management is hard to implement and there's a lack in corresponding mentalities, devices and policies

The urban plans such as urban construction, economic development and resources development are mainly spatial planning, while the environmental planning mainly refers to the task planning of each element and each field. There's a lack in the philosophy, mentalities, devices and corresponding implementation guarantee policies for the environmental space management. There's not a unified dialogue platform between environmental planning and urban planning. As a result, it's hard for urban construction and economic development to connect with the environmental requirements in space. The environmental planning should shift from the elements and tasks based planning to the spatial and guidance planning, gradually build up the philosophies, mentalities and implementation framework for environmental space management, confirm the mode of environmental space regulation and control, and implement the structure, process and functional requirements of the environmental system itself.

1.1.3 Ecological service function and environmental quality deteriorate, lack of measurement

With the rapid process of urbanization and industrialization in China, the service functions of urban ecological environment keep degrading while the urban environmental quality keeps worsening. From the perspective of scientific researches, the solving of many problems will be supported by adequate theoretical basis and strict technical approaches. However, in the specific urban environments, it's hard to unify the issues such as how to confirm the target boundary of ecological functional services and how to define the urban development standard and situation. Planning is a decision-making science. In the planning, it requires further exploration in technical approaches and practice of theoretical application to reasonably grasp the scale and transform the ideal and rigid scientific scenes into the more scientific and feasible requirements on ecological environmental protection in the cities.

1.1.4 The environment priority is difficult to implement and there's a lack in technical platform and institutional carrier

Due to the non-equivalence in legal basis and status of planning, the environmental protection planning has always been under a disadvantaged status in the urban construction development and the status of environmental priority is hard to be guaranteed. In the coming 20-30 years, China will continue to be in the a rapid development phase of urbanization, the urbanization rate will be enhanced by 70-80％ and the process of urbanization will be completed basically. During the period, the urbanization development mode of extensional expansion will continue and the internal pattern and functions of cities will also keep adjusting. Under such a context, it's an urgent need to establish the UREMP system, lay down the pattern for urban environmental protection from the source, construct a fundamental framework for urban development that's consistent with the regional environmental pattern and the ecosystem management mode and promote the healthy development of urbanization.

1.2 Connotation and Characteristics of UREMP

To address the above-said environmental problems in urban construction and development, the UREMP should grasp the following characteristics.

Firstly, it's the fundamentality. Currently the environmental planning is a dedicated planning in the urban construction and is difficult to bring into a play the master planning effect of environmental protection. The UREMP should jump out of the existing limit of dedicated planning, break the separation and segmentation between each environmental element, focus on solving the underlying, pattern and strategic significant environmental issues that affect the urban environment, form a medium-and-long-term scheme for the coordinated development of environmental protection and economy that is master, systematic and coordinated, promote the interaction between environmental protection department and departments of urban construction and industrial development, etc. and lay down a fundamental framework for the environmental protection.

Secondly, it's the bottom line. One of the causes for the environmental protection problems is there's not a clear bottom line and effective constraint on the environmental protection. It's an important guarantee for supporting the development of new-type urbanization in China to take the sustainable development of cities and maintaining the urban environmental quality as the aim, confirm the spatial boundary for urban construction and development and clarify the threshold values of environmental resources development and utilization. The UREMP should put forward guidance requirements on the urban positioning, construction scale and layout and mode of economic development, etc. in advance from the perspective of environment.

Thirdly, it's the space. That the requirements on environmental protection cannot get the space related policies implemented and lack in the approaches and platforms that connect with the urban planning and land planning is one of the most important constraints to involve environmental protection in the comprehensive development decision making. Currently, the space control in the urban planning system has already a quite solid legal basis. The contents and requirements on space control based on the division of "four areas" and regulation of "seven lines" have been set for the master urban planning and detailed control planning; the land planning has also confirmed the concepts of spatial division such as the construction prohibited area and construction limited area. The UREMP is in an urgent need to connect mutually with the urban planning and land planning in the aspects of related mentalities, technical approaches and modes of expression for spatial management and build up a fundamental platform to involve environmental protection in the comprehensive development decision-making of the cities.

1.3 Key Issues to Be Addressed

Targeting the above issues, the UREMP explores to establish resource environmental bottom-line constraints on the economic and social development of cities, implement the environmental space management approaches, and maintain the channels for enhancing the services and functions of ecological environment, so as to seek the double interests of urban development and environmental protection.

Firstly, we should confirm the bottom line of resource environmental constraints. The sustainable development of cities requires that the economic and social activities be controlled within the limits of resources and environmental development and utilization. The UREMP should actively explore into the bottom-line constraints of resources and environment, which will be folded around the following issues: firstly, it's still not clear how to transform the technical approaches of current environmental capacity into the application devices of planning. the UREMP should actively explore how to transform related environment capacities into realistically feasible management devices and establish the relevancy between the fundamental theories of environmental capacities and the social and economic development; secondly, at the level of technical research, the transmission and responsive relationship between environmental capacities, resources bearing capacity and environmental quality is still not clear, and the time and spatial dynamic characteristics of environmental capacities have caused it to separate from the environmental quality, so the UREMP should make exploration and researches in related technical approaches.

Secondly, we should establish the environmental space management system. We hold that as a kind of resource, the environment, like the ecosystem, has areas that require a strict protection. The environmental space control is imperative, which will be carried out around the following issues: firstly, the health maintenance of ecosystem has established management systems such as natural reserve areas and tourist attractions. The environmental space control should actively extend towards the environmental space on the basis of the ecosystem space control and confirm the scope and boundary of environmental space control. Secondly, the technical approaches for spatial analysis of urban and rural ecosystems such as ecology study and landscape ecology study at home and abroad have been relatively mature, but in the field of environment, the analytic method and technical framework for the regional spatial difference of elements such as atmosphere and water have not been established, which is the key reason that the environmental requirements are difficult to be implemented. Therefore, the UREMP should explore the establishment of a technical framework for environmental spatial analysis and management.

Thirdly, we should enhance the ecosystem functions. Maintaining and enhancing the ecosystem functions is the basic starting point for environmental protection. Combining the research and exploration experience at home and abroad, it will be carried out around the following issues: Firstly, under the context of rapid urbanization development, it's not feasible to achieve a total protection on the ecosystem. The ecosystem protection should be under a goal, namely, what kind of ecological environmental functions and patterns the cities need to maintain and the functions to be maintained by the ecosystem should be positioned. Secondly, a lot of explorations and researches have been made into the measurement of ecological functions and values at home and abroad, but there's not a unified method for a precise and quantitative measurement of ecological functions, so the UREMP should carry out technical explorations actively. Thirdly, under the existing positioning goal of the ecosystem, the reasonable construction and selection of a maintenance scheme for ecological environmental pattern should strengthen the technical breakthrough of ecological value measurement and selection of multiple schemes on the basis of confirming the technical innovation of ecological functions positioning.

Fourthly, we should build up an institutional framework for UREMP. Other than the technical framework and approaches exploration for UREMP, targeting the problems such as lack of policies and a poor legal basis for the implementation management of UREMP, the UREMP should explore the management policies and mechanisms for implementation, supervision and assessment, and confirm the roadmap for the medium-and-long-term institutional construction. It mainly includes: in the aspect of technology, we should further explore the technologies and publish the technical guidance for compilation of plans as soon as possible; in the aspect of management system, we should establish the review and management measures for compilation of plans; in the aspects of policies and other systems, we should fill the gap of management policies and systems and adjust the contents of related existing policies. On this basis, we should confirm the roadmap for promoting the institutionalization of "13th 5-Year Plan".

2 Institutional experience

2.1 Comparison of Domestic and Foreign UREMP Systems

Though there're no relevant plans abroad, some similar plans have some referential values for the UREMP of China. Earlier, we already sorted and summed plans and systems of countries such as the UK, Netherlands, the US and Germany. For comparison, we will analyze the UREMP of China, green belt of the UK, space planning of Netherlands, spatial plan of Denmark and urban growth boundary of the US from the perspectives such as legal basis, management system, coordination mechanism and supervision on implementation.

In the perspective of legal basis, similar plans abroad have an excellent legal basis, like, Netherlands has enacted a law concerning spatial planning, while Denmark has enacted a law of planning and a special spatial plan 2007. Since the UREMP of China was only put forward in recent years, its legal basis is not solid. To further bring it into play, we need to strengthen the legal basis work.

In the perspective of management system, foreign plans have confirmed the subject to implement the plan, like, the green belt plan of the UK is implemented by the planning bureau, while the spatial planning of Netherland is implemented by the municipal administration. Among the pilot cities of UREMP in China, currently it's implemented by local environmental protection bureau.

In the perspective of coordination mechanism, currently there are many spatial plans and general plans in China, which are compiled and implemented by different departments. Though in the course of compilation, it has asked for advice from the departments and the public, different plans do not coordinate with each other and even conflict with each other in spatial arrangement. Similar plans abroad stress the involvement of departments and the public in the course of compilation, like, in the urban planning of Netherlands, the public that are devoted to public welfare will closely participate in the decision-making process. Though the process is relatively long, it's smoother for implementation.

In the perspective of implementation supervision, the implementation of similar plans abroad are supervised by related institutions, like, the Environment Assessment Agency of Netherland is responsible for assessing the spatial planning of Netherland while the land use regulatory system of Oregan State of the US is supervising and controlling the urban growth boundary of the state. The UREMP of China is still under a pilot phase, so there's still no supervision on implementation at present. China can learn from similar plans abroad and improve the supervision and management on the implementation of UREMP.

Table 2-1 Comparison of Domestic and Foreign Plans

	Legislation	Connection	Implementation	Supervision
UREMP in China	No legislation yet, the technical requirements on the compilation of UREMP (provisional)	A pilot exploration of "integration of several plans" is under progress, but there's still no mechanism for connection.	The mechanism for compilation, implementation and management of plans has been established basically	There's still no mechanism for supervision
Green belt of the UK	National Planning Policy Framework, Law of Planning	The coordination between planning department and environmental department is a compulsory provision in the regulation. The UK has no UREMP, but should include the strategy of solving environmental issues into the urban planning	The green belt is implemented by local planning authority with active means of planning.	A dedicated Planning Inspectorate is established in England and Welsh to be responsible for checking the local planning and dealing with appeals
Spatial planning of Netherlands	Law concerning Spatial Planning	The planning department and environmental department are the same department (Housing, Spatial Planning and Environmental Department)	The municipal administration is responsible for implementing. The urban land use and construction scale will be subject to the control of an annual plan while the urban planning will be reviewed and approved based on an environmental assessment.	The Mobility Expertise Center of Environmental Assessment Bureau of Netherland will monitor the infrastructure and spatial planning.
Spatial planning of Denmark	Law of Planning, Spatial Planning 2007 (the national planning directive of the Greater Copenhagen region)	The environmental bureau is responsible for natural planning of Denmark, including the spatial planning law that ensures the urban and rural quality. The plan balances and integrates the interests of each party involved in land use. The spatial planning of Copenhagen is under the charge of municipal administration. The regional urban development must coordinate with the master infrastructure of Copenhagen, especially the public transport service.	Three of the seven environmental centers under the environmental department will coordinate with each city on spatial planning, so as to integrate the interest of the whole country. The implementation of Copenhagen spatial planning is based on the assessment of development of the whole region, which must be consistent with the principle of the whole urban structure.	The planning system of Denmark is decentralized in authority. The municipal council is responsible for city level and local comprehensive land use requirements, while the regional council formulates the spatial development strategic plan for each region, and the environmental department ensures the national interests by establishing the national plan. The environmental department head ensures that the municipal planning

				meets the national requirements.
（UGB） Urban Growth Boundary of Oregan State, the US	Decree concerning the Land Use Planning of Oregan State	UGB is the growing areas around the cities. The land might belong to the jurisdiction of adjacent town, which needs to be coordinated by the land protection and development committee of the state.	Metro is a regional institution that formulates and manages UGB, namely, the regional government and metropolis planning organization. Metro is a regional governmental body, covering the urban areas of three prefectures.	The land use supervision system of the state. The local government will submit the UGB proposal, while the land protection and development committee will approve it.

2.2 Summary and Inspiration

China is now under a rapid process of urbanization. Since 2000, the urbanization rate has been enhanced by about 1.35%. The long process of urbanization of Western countries accompanied with industrialization has been much shortened in China. After a long period of exploration and practice in the urbanization process, developed countries in Europe and America have accumulated a lot of beneficial experience in achieving a win-win situation in urbanization and environmental protection, which can provide references for the formulation of UREMP.

Firstly, we should highlight the priority of planning and strengthen its legal status. The planning of spatial control and environmental protection in the national level should have a relatively long planning period (20-30 years) and related laws and regulations should be enacted to enhance the compulsory legal status of the plan and ensure that the implementation of the plan is subject to a relatively strong binding effect. Japan has enacted a lot of complex policies and regulations for urban green land. This is because the earliest laws did not take into account the nature of land use and diversity of rights to use, which lacked in foresight and integrity, but later it had to enact remedial laws and regulations.

Secondly, we should strengthen spatial control and implementation of space related policies. Spatial control is an effective device for resource regulation and control. As a feasible path for enhancing the use efficiency of resources, intensive development has gradually become an important part of urbanization and urban planning. Practices at home and abroad such as greenway, green belt, growth boundary and ecological zoning all indicate that if the plan cannot have the space related policies implemented, they will become empty words and greatly affect the implementation effect.

Thirdly, we should coordinate the urban development pattern and the resource environmental bearing capacity. We should follow the resource environmental bearing capacity, confirm the urban atmosphere and water environmental bearing capacity, put forward the control indicators for use degree of environmental capacity, thereby providing scientific guidance for optimizing the industrial pattern, pollution discharge pattern and urbanization development direction. In the course of urbanization, developed countries such as Europe and America and Japan have formulated some management measures, planning strategies and economic policies, controlled the urban expansion and introduced the coordinated development between smart growth and resource environmental bearing capacity.

Fourthly, we should pay attention to enhancing the ecosystem service functions. The key to enhancing of ecosystem service functions lies in enhancing the quality of original ecological land, retaining and increasing the existing ecological land. We should refine the management of ecological resources

consumption, make the channels for the public to benefit from ecosystem and perfect the mechanism for ecological compensation.

Fifthly, we should strengthen the institutional improvement and achieve an integration of several plans. We should strengthen the coordination between space control department and environmental protection department at the institutional level, reduce the cost for the interaction between administration departments and enhance the efficiency of plans compilation and implementation. At the early period of plan compilation, we should pay attention to the coordination and consistence between various plans, fully reflect the philosophy of ecology priority and avoid the embarrassment in the implementation stage of plans.

Sixthly, we should strengthen the social impact assessment and stress public involvement. UREMP not only should stress the ecology, but also stress its economy and humanistic care. The environmental plans that obviously limit economic growth and lack in analysis of social impacts cannot be implemented effectively. The international experience indicates that the plans can only be implemented smoothly when we respect the interests of each involved party, strengthen the public involvement and promote the implementation of UREMP with the aid of regulatory system and power of the public.

3 Pilot cities for UREMP in the People's Republic of China

In 2011, Ministry of Environmental Protection started the formulation of UREMP, which served as an important system for environment protection in the "12th Five-Year Plan" or even longer time, and selected 24 pilot cities. At present, Fuzhou, Yichang, Guangzhou, Dalian, Weihai, Yichun, etc. have successively carried out the formulation of the overall urban environment planning, with theoretical system of the planning, overall thought, technical method and others constantly innovated in exploration, and the content and technical framework and management system basically established and constantly improved.

The selection of the pilot cities was mainly from the perspectives of three dimension, and based on three principles: firstly, the regional distribution, which should take into account the different regions including the eastern, middle and western areas; secondly, the urban scale, which should take into account the cities of large, medium and small scale; thirdly, the urban economic development, which should take into account different economic development level; fourthly, types and development characteristics of city, which should take into account the different characteristics of cities.

Table 3-1. Basic Situations of Pilot Cities (Guangzhou, Fuzhou, Yichang, Weihai)

	Regional Distribution	City Size		GDP (million Yuan)	City Type
		Area (km2)	Population (million)		
Guangzhou	Yangtze River Delta region	7434.4	1292	15420	International Central City
Fuzhou	Pearl River Delta region	11968	710	4678	Livable city; regional central city of western bank of the Taiwan Straits
Yichang	Upper stream of Yangtze River region	21227	408	2818	World famous hydroelectric energy base; regional central cities in middle and upper reaches area of Yangtze River
Weihai	Eastern coastal area	5797	280	2550	Coastal open cities; port and tourist city

3.1 Yichang Pilot UREMP

Yichang city is located in the west of Hubei Province, at the junction of the middle-upper reaches of the Yangtze River. The area of Yichang is 18000 km^2 with a population of 4.05 million, under the jurisdiction of 5 districts, 5 counties and 3 cities. It is our country's important endangered species habitat, resource library and shelter, but also the important city of maintenance water environment safety and takes the watershed environmental regulation function in the Yangtze basin. In the towns and ecological strategy pattern of Hubei Province, Yichang city is the sub-center city of Hubei Province, and also the leading city and the important fulcrum of the construction of ecological civilization in Western Hubei ecological circle.

3.1.1 Planning boundary

On account of cities' status in nationwide, regional and watershed ecosystems in China, based on research analysis of regional ecosystems, including its structure function, species diversity, biotic migration channel, etc. and combining with large scale remote sensing images and space geographic data, analyze cities' status in large scale ecosystem pattern and its significant ecosystem service functions and determine the target of urban ecological environment functional orientation and maintenance.

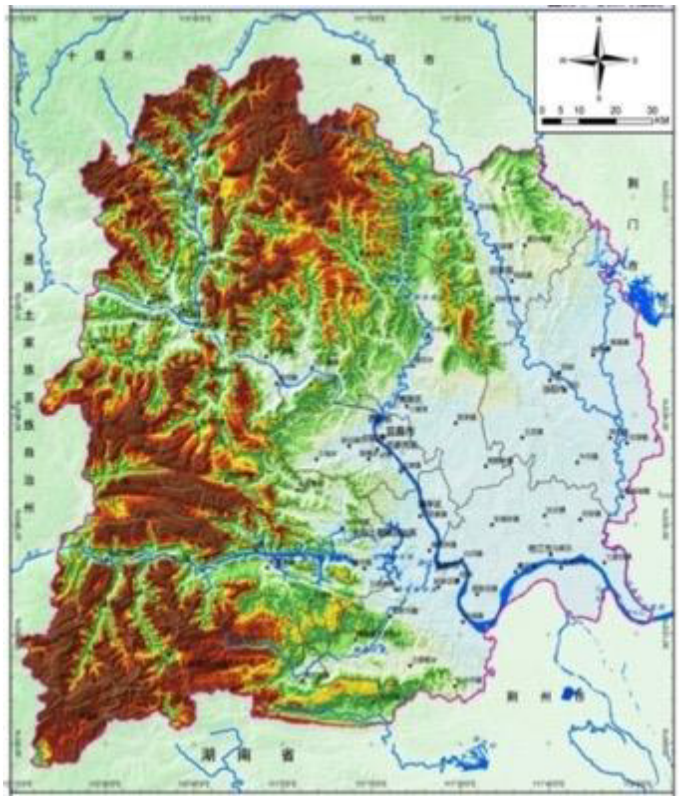

Figure. 3-1 Ground Elevation Map of Yichang

Figure. 3-2 Distribution Diagram of State-level Key Ecological Function Areas

Taking Yichang as an example, make sure ecological environment functional orientation of Yichang through analysis of large scale ecosystem pattern as follows: (1) it is an important nodal region to maintain water ecology and water environmental functions of overall Yangtze River drainage basin. (2) As a transitional zone from Qinling and Dabashan Mountains to Jianghan Plain, it is a typical example of complex ecological environment with strong environmental sensitivity, meanwhile, it plays an important role in guaranteeing ecological environmental security of the Three Gorges Reservoir Region and western areas of Hubei Province. (3) It is a gene bank to preserve endangered species of China and a crucial area to protect species abundance, having vital function in safeguarding national species security.

3.1.2 Indicative water quality protection zoning and mapping

Importance, vulnerability and sensitivity of water environmental system are analyzed. Water system important area, sensitive area and vulnerable area in administrative regions of a city are recognized, and grade control requirements are formulated.

3.1.2.1 Water Ecological Sensitivity Assessment

Drinking water source protection area, fishery water area, industrial water area, landscape recreational water area, agricultural water area, transition area, mixing area and other environment functional areas are adopted as foundation for assessment according to sensitivity of functional areas (Table 3-2).

Table 3-2 Sensitivity Assessment Table of Water (Environment) Functional Areas

Functional Area Type	Sub-item	Execution Standards	Extreme Sensitivity	Medium Sensitivity	General Sensitivity
Drinking water source protection zone			√		
Fishery water area	Precious fish protection zone	Type II	√		
	General fishery water area	Type III		√	
Industrial water area		Type IV			√
Landscape entertainment water area	Natural beach and swimming area with direct contact with human body	Type II	√		
	Landscape recreational water area with non-	Type IV and Type V			√

	direct contact with human body				
Agriculture water area		Type V			√
Transition area and mixing area					√

Extremely sensitive control unit is designated as water environment red line area, including drinking water source protection area, precious fish protective area in fishery water area, natural beach, swimming area, etc. with direct contact with human body in landscape recreational water area. Moderately sensitive control units are designated as water environment yellow line area, including general fishery water area in fishery water area. General sensitive control unit is designated as water environment green line area; including industrial water area not belongs to extreme sensitivity and moderate sensitivity, landscape recreational water area with indirect contact with human body in landscape recreational water area, agricultural water area, transitional area, mixing area, etc.

3.1.2.2 Water Environment Pollution Vulnerability Assessment

Qualitative and quantitative combined method is adopted for analyzing main factors affecting process vulnerability such as water hydrological characteristics, river conditions, water exchange conditions, etc. Impact of salt tide, morning and evening tides, etc. also should be considered for coastal city. Ares with difficult diffusion of pollutants, water flow exchange ability weakening and prominent reduction of water pollutant expansion speed and water environmental capacity due to significant flow capacity reduction, prominent flow speed lowering and sudden river narrowing are regarded as essentially vulnerable areas of water environment.

Water environment COD and ammonia nitrogen environmental capacity are regarded as indexes of vulnerability assessment, and they are divided into three assessment levels, namely extremely vulnerable, moderately vulnerable generally vulnerable levels. The part with unit waterway length natural COD capacity <1t/km•a and natural ammonia nitrogen capacity <0.1t/km is extremely vulnerable, which is designated as water environment red line area; the part with unit waterway length natural COD capacity 1-400t/km•a and natural ammonia nitrogen capacity 0.1-10t/km•a is moderately vulnerable, which is designated as water environment yellow line area, and the remaining water section control units are designated as water environment green line area.

3.1.2.3 Assessment of Water Environmental Function Importance

Certain upstream area of water source has important function on water source conservation and protection, which is designated as extremely important area. River and lake with water quality maintaining at class II or class I has important significance on maintaining urban and rural water environmental quality, which are designated as very important areas. Areas with direct impact on habitat, breeding grounds and feeding grounds of rare, endangered and mainly protected aquatic species (mainly referring to scope 1km along the shores on the left and right of protected water body, and 10km on upstream part), which has important significance to aquatic biodiversity conservation, and is designated into water environment red line area.

Assessment units with water quality lower than targeted requirements of the function area due to anthropogenic pollution and difficultly guaranteed river ecological flow, general fishery water areas, catchment areas of other habitat, breeding grounds , feeding grounds for rare, endangered and mainly protected aquatic species are designated into water environment yellow line area.

Table 3-3 Importance Assessment of Water Environment Function

Water Type	Extremely Important	Moderately Important	Generally Important
Source water	√		
Water quality maintained at class II or class I	√		
Habitat, breeding grounds and feeding grounds of aquatic species	√		
It is more difficult to protect the ecological flow.		√	
General fishery water area		√	
Other water types			√

3.1.2.4 Water Environment Grading Methods and Control Measures

Water ecological sensitivity, water pollution absorptive degradation vulnerability, water environment functional importance and other factors are integrated for dividing urban and rural area into water environment red line area, water environment yellow line area and water environment green line area for management at different grades.

Water environment red line area should not be provided with sewage outfall. New construction, renovation and expansion of emission pollutant construction projects should be prohibited (completed projects should be removed or disabled). Construction project approval should be suspended, water environment pollution prevention and control should be strengthened, and industrial point-source pollution with larger impact on water environment should be gradually reduced.

Strict approval standards should be implemented in water environment yellow line area. Comprehensive and systematic water environment monitoring network is established for guaranteeing safety of water environment. Meanwhile, total control and total replacement measures are implemented. Emission of water environment pollutants should be gradually reduced.

Water environmental quality compliance should be actively promoted in water environment green line area in accordance with requirements of relevant economic and social development planning as well as environment protection planning.

1）Delineate 2545 small watershed

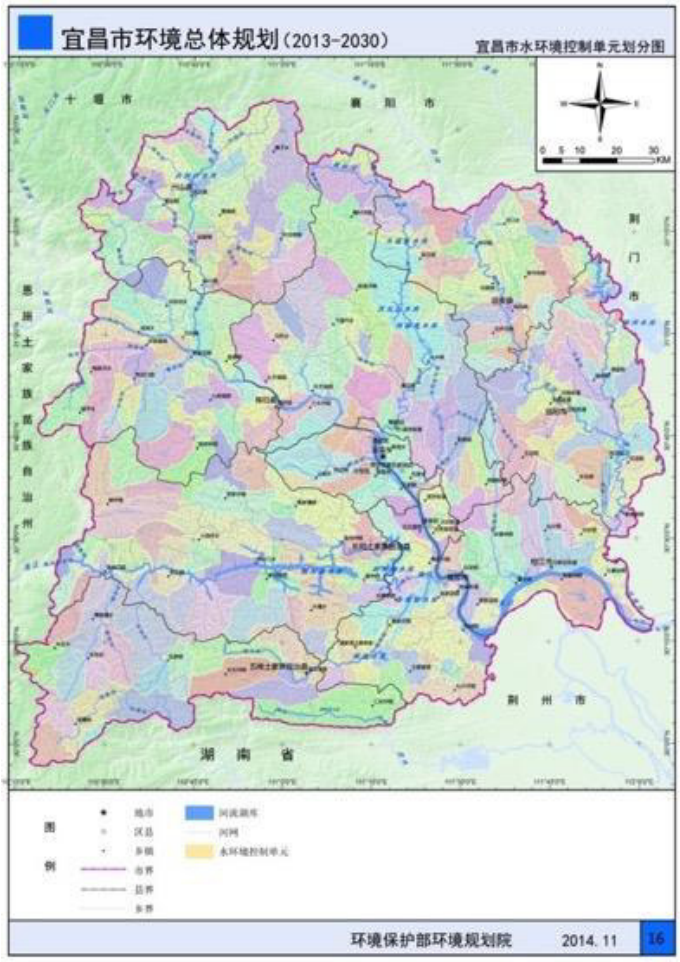

Figure 3-3 Water environment control unit zoning

2）Investigate all the industry produce water pollutants

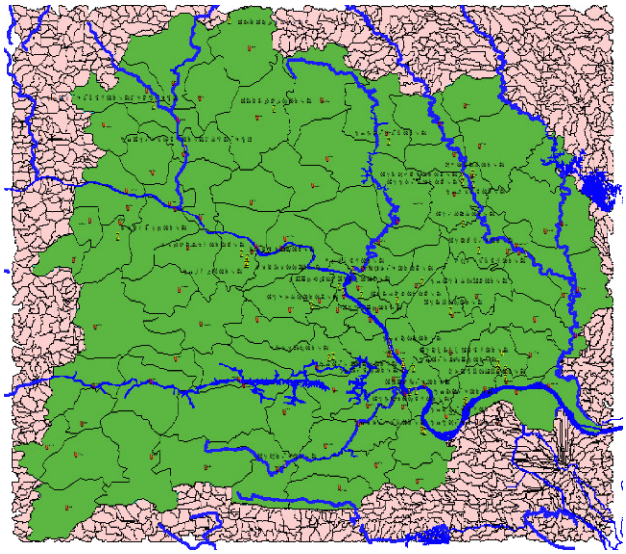

Figure 3-4 location of 95 countries with 57 industry in Yichang

Figure 3-5 286 surface water environment functional area

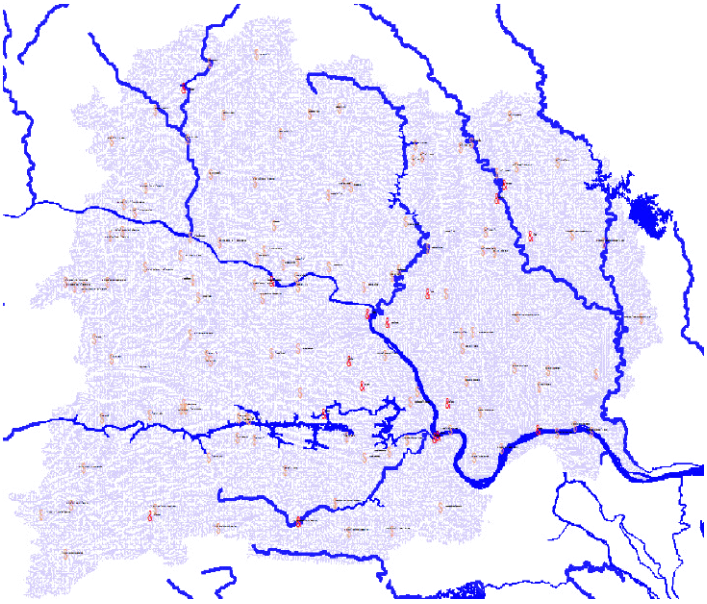

Figure 3-6 135 drinking water source protection area

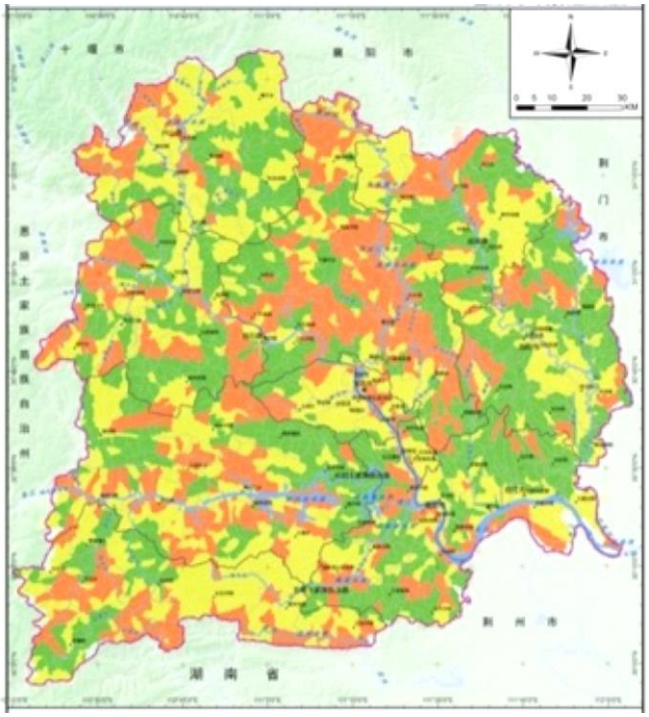

Figure 3-7 Water environment red line zoning

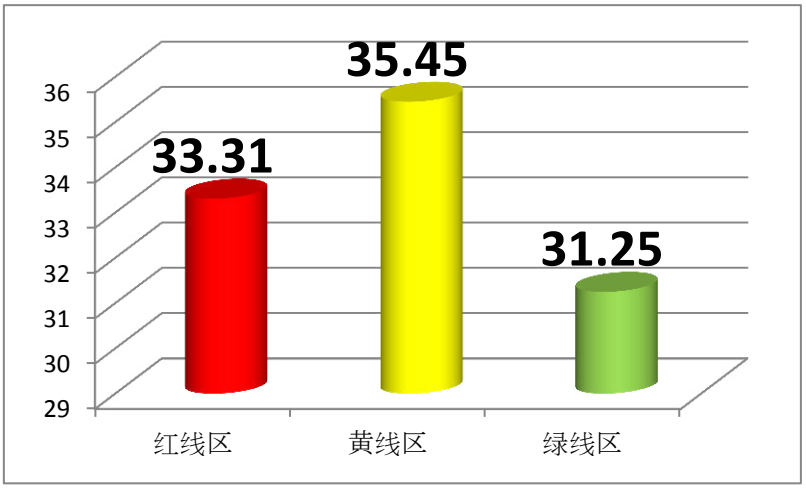

Figure 3-8 the proportional rate of red-line, yellow-line and green-line area

3.1.3 Indicative air quality protection zoning and mapping

3.1.3.1 Develop a regional atmospheric flow model

Table 3-4 Method for atmospheric System Analysis and Delineation of Spatial Control

	Yichang
Selection of air model	CALPUFF
Evaluation method	Concentration vulnerability, layout sensitivity and receptor importance
Evaluation accuracy	Concentration vulnerability, (3 km * 3 km), layout sensitivity (3 km * 3 km)
Evaluation object	SO_2

3.1.3.2 Develop a regional atmospheric absorptive model

The spatial pattern of environmental capacity of SO2, NOx and Primary Particulate Matter of districts and counties in Yichang have been calculated respectively. Based on the environmental capacity, current pollutant discharge and estimated pollutant discharge, the spatial pressure of atmospheric environment at different regions were determined. Based on three basic principles, such as: atmospheric environmental quality of all districts and counties should not be degraded, emissions in month with bad weather conditions should not be overloaded and the air environmental quality is continuously improving, the constraint goals for pollutant emission in atmospheric environment were determined.

3.1.3.3 Indicative air shed quality protection zoning and mapping

1) 3D simulation of wind field in full region and analysis on airflow field

Wind field of Yichang was simulated at the resolution of 3 km; combining with the terrain data of Yichang, the features of atmospheric flow field in Yichang were simulated at the resolution of 1 km, with wind directions and wind speed emphasized.

2) Analysis on layout sensitivity

The CALPUFF model was used for quantitative simulation the sensitivity of spatial layout of pollution source, identifying the districts with higher affected scope and degree under equal pollution emission.

3) Analysis on concentration vulnerability

The CALPUFF model was used for quantitative simulation of the transmission and concentration characteristics of air pollutant and identifying the easily concentrated areas.

4) Analysis on importance of receptors

Functional zones of atmospheric environment, existing built-up area has relatively large influence to people's health.

5) Map of Grade Control of Atmospheric Environmental Space in Yichang

Through the above-mentioned processes, based on the spatial difference on layout sensitivity, concentration vulnerability and importance of receptors of atmospheric environmental system, the whole administrative area of Yichang was divided into red line area, yellow line area and green line area of atmospheric environment quality to conduct space control of atmospheric environment.

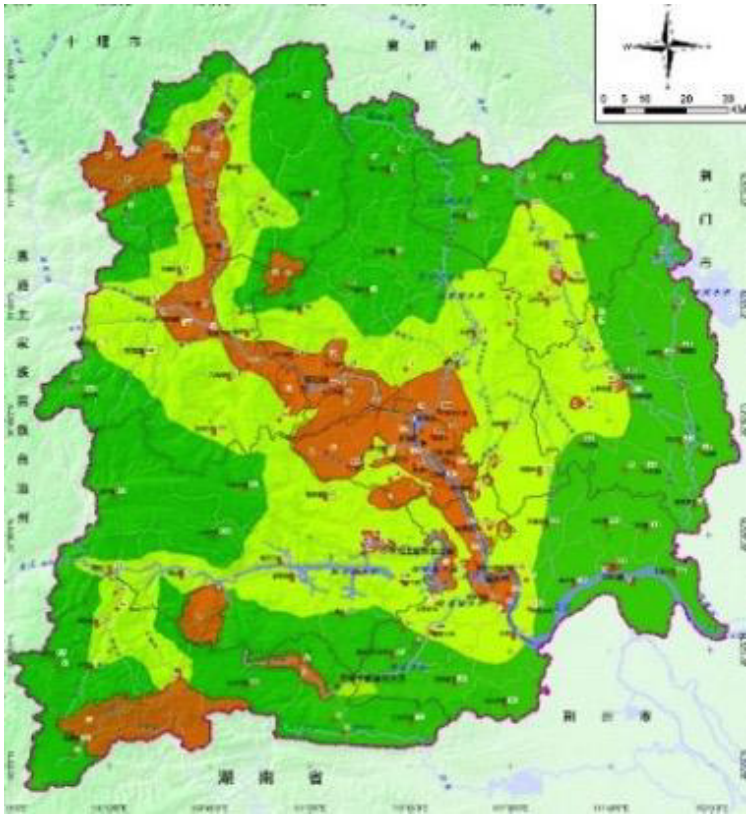

Figure.3-9 Map of Grade Control of Atmospheric Environmental Space in Yichang

3.1.4 Indicative ecosystem protection zoning and mapping

1) Technical evaluation

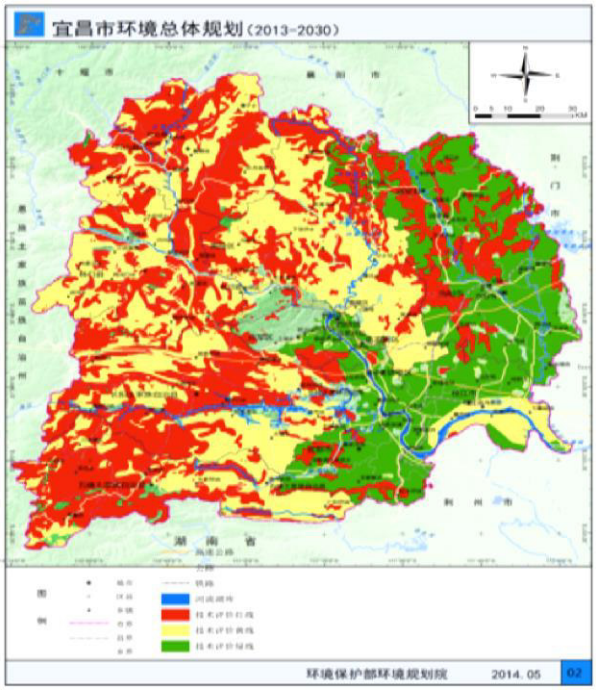

Figure.3-10 Map of importance evaluation of ecosystem in Yichang

2) **Legally established and binding Environmental Protection Area**

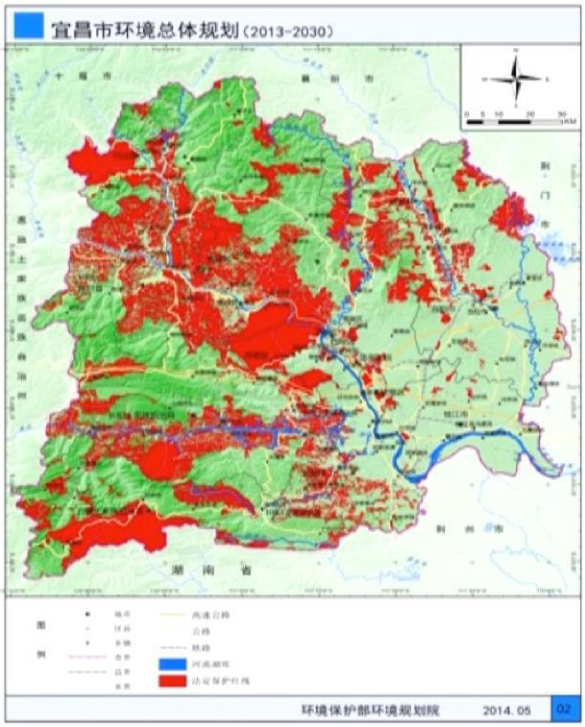

Figure.3-11 Map of importance evaluation of ecosystem in Yichang

3) **Other planning**

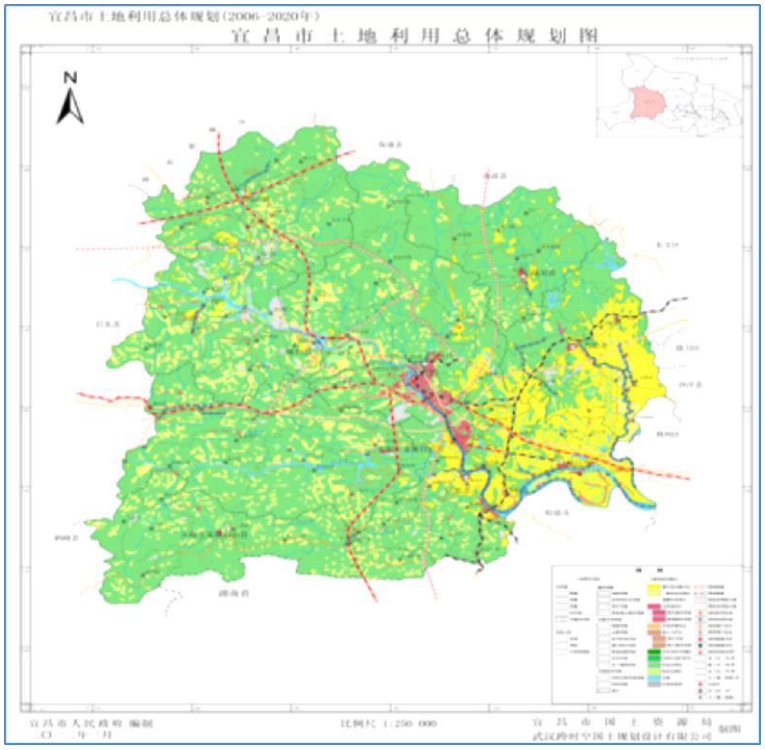

Figure.3-12 Land use master planning map of Yichang

Figure.3-13 National key ecological functional area of Yichang

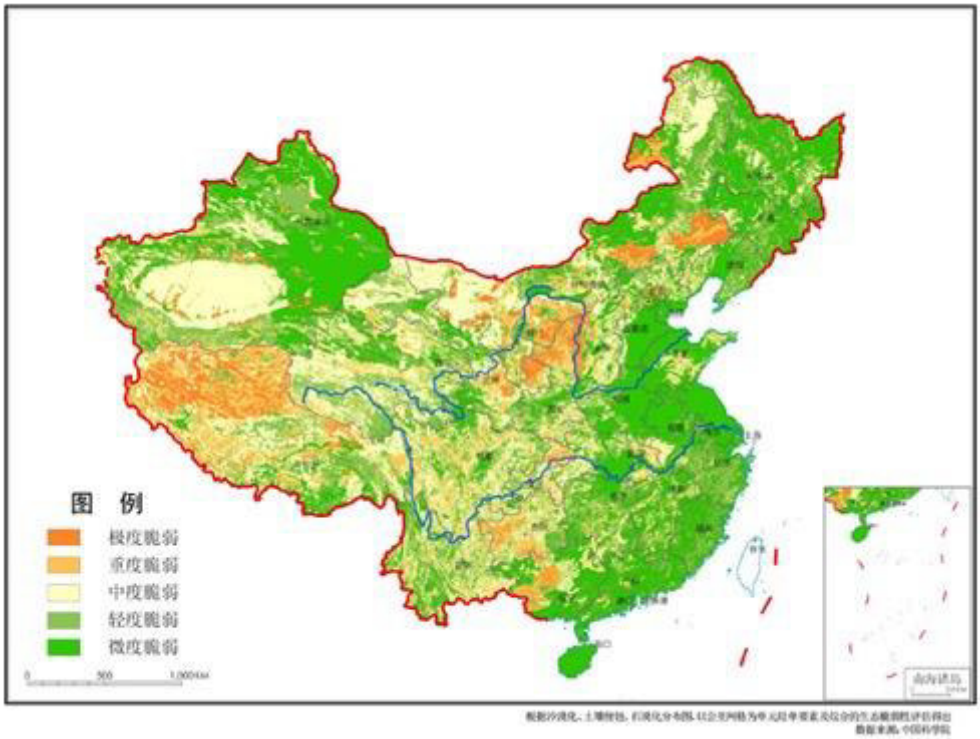

Figure.3-14 Ecosystem fragile area of Yichang

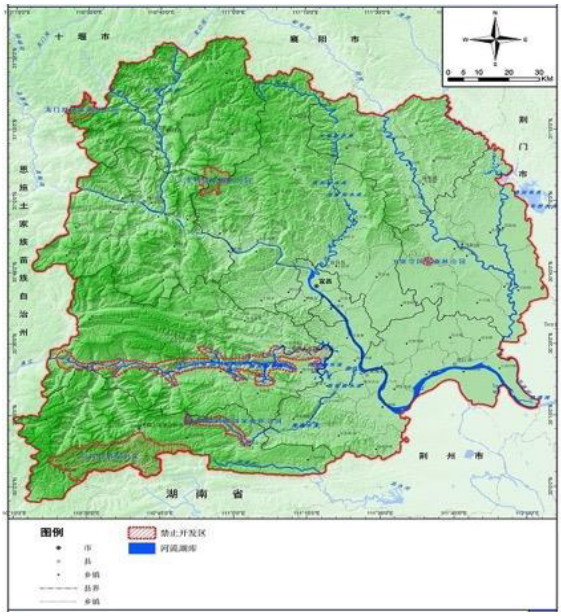

Figure.3-15 Forbidden develop area of Yichang

4）Ecological protection redline

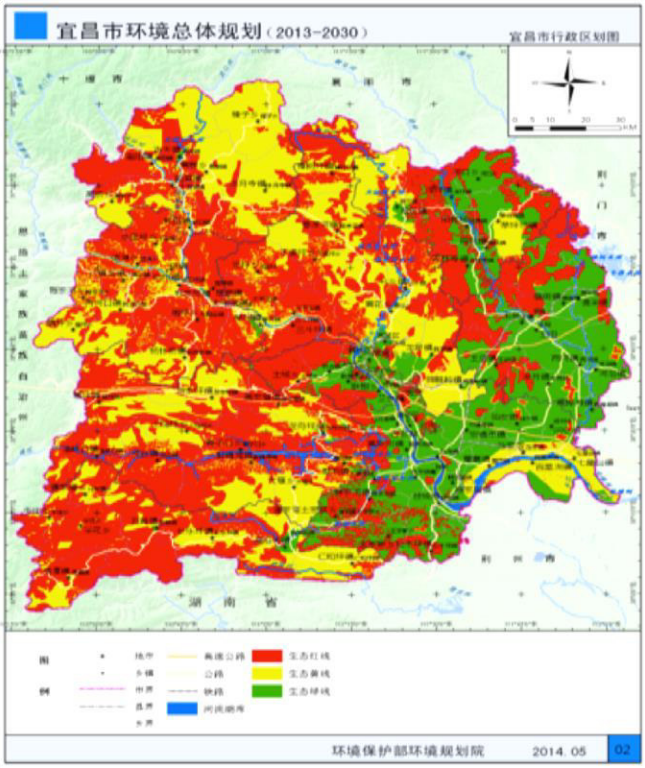

Figure.3-16 Ecosystem protection red-line zoning of Yichang

Table 3-5 The proportional of red-line, yellow-line and green-line area in Yichang

	Area（km^2）	Proportional（%）
Red-line area	10475.14	49.37
Yellow-line area	6749.56	31.82
Green-line area	3990.2	18.81

3.2 Fuzhou Pilot UREMP

3.2.1 Delineation of urbanized areas.

Fuzhou city is located in the frontier area of the southeast mountain ecological barrier and the downstream of the Minjiang River. The area of Fuzhou is 12000 km2 with a population of 7.1 million, under the jurisdiction of 5 districts, 5 counties and 2 cities. Fuzhou city is an important city of the southeast coastal economic zone and it has important ecological functions as international migratory nodes. Fuzhou city as the capital of West Strait Economic Zone Center City, in the national strategy pattern of speed up to construct West Strait Economic Zone, bears the cross straits exchanges and cooperation platform construction, Haixi comprehensive traffic network center, the southeast coastal advanced manufacturing base, China's important natural and cultural tourist center and other important tasks. On April 25, 2013, the planning outline of Fuzhou UREMP passed experts argumentation. On April 26th, vice minister Mr. Jian Zhou of MEP chaired a forum of UREMP, and 31 provincial Environmental Protection Departments (bureau), 12 pilot city government of the first batch, 10 representative from departments of MEP attended.

There are 5 central urban divisions in Fuzhou including Jin'an and Mawei, etc. According to the overall urban development strategy of Fuzhou, it will actively implement the "Big Fuzhou" strategy to promote urban development in a way of "along the river and facing the sea", and the Changle City will serve as an important expansion region of central urban area in the future. Therefore, other than the five central urban divisions, Changle will be incorporated into key region of urbanization in the UREMP of Fuzhou; the whole administrative region of Fuzhou will be delimited into three levels of central urban region, planning region and municipal region according to the different orders of urbanization. Environmental protection strategy should be formulated in accordance with the three different spatial scales for determination of planning goals and solving key problems.

Figure.3-17 Delimitation of urbanization region at different levels of Fuzhou

3.2.2 Determination of scope of the environmental impact

With the continuous expansion of Fuzhou and other cities at west bank of the Taiwan strait, and the contiguous urban development in the region, subjected to the dual role of atmospheric circulation and atmospheric chemistry, the interaction effect of air pollution between cities becomes significant, and

the pollutant transmission influence between adjacent cities becomes gradually prominent. Taking into account the data of terrain and elevation, the WRF+CALMET meteorological models were adopted to simulate the three-dimensional atmospheric flow field of the west bank of the Taiwan Strait at a resolution of 3km. The result shows that, as the west bank is mainly dominated by the northeast wind, so Wenzhou, Zhejiang Province and Ningde, Fujian Province at the northeast direction have relative large influence to the air quality of Fuzhou; in the meanwhile, the air quality of Fuzhou will also affect that of Putian and Quanzhou and other cities in the south. Therefore, other than atmospheric environment, research on atmospheric environment related issues should also take Wenzhou, Ningde, Putian and Quanzhou into overall consideration.

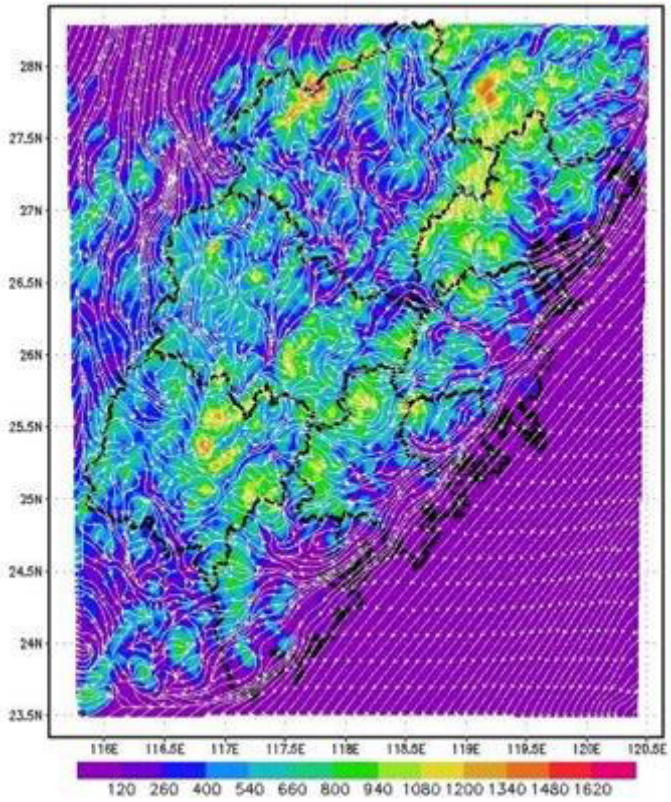

Figure.3-18 Result of Simulation of 3d Flow Field of Atmospheric Environment at West Bank of the Taiwan Strait

The three main rivers of Minjiang River, Dazhangxi River and Longjiang River in Fuzhou have relatively good water environment quality. The result of pollutant transmission analysis of water environment shows that, other than Mingjiang River, the regions of Dazhangxi River and Longjiang River with water quality affected are all in the administrative region of Fuzhou. Since Minjiang River is the largest single stream flowing into the sea (East China Sea) of Fujian Province, it flows over 50 km into the sea after passing through Fuzhou, so the water quality of up-stream of Minjiang River is relatively good and stable in the long run, therefore, the up-stream area will not be taken into consideration into the research for now, while the offshore area of Fuzhou will be taken into overall consideration in the research.

3.2.3 Determination boundary of biodomains

According to the ecological function zoning of Fujian Province, the ecological function zoning of Fuzhou covers four biodomains of "medium and low height mountain area-low height hilly and valley basin-coastal tableland and hills-offshore area"; Fuzhou covers the types of ecological maintenance of

water environment of sea and land areas and the ecological function zones mainly for serving urban development, etc., involving protection of fisheries and wetlands, maintenance of water environment and reservoirs and the landscape around them, the guarding of water quality of source of drinking water, etc.

The biosubdomain of coastal zone and off-shore area in east Fujian, the biosubdomain of coastal tableland and hill plain and off-shore area in southeast Fujian, as well as the medium and low height mountain plateau area in the east and middle Fujian are the three biosubdomains overlapped with neighboring cities. The biosubdomain of coastal zone and off-shore area in east Fujian and the biosubdomain of coastal tableland and hill plain and off-shore area in southeast Fujian have relatively significant functions of maintaining the off-shore ecology; from the perspective of ecosystem maintenance, the biosubdomain of the medium and low height mountain plateau area is closely related to the ecosystem of Fuzhou. Furthermore, given the consistency of the overall topography, in the biosubdomian of the medium and low height mountain plateau area, Putian, west Quanzhou and Fuzhou are all in the Jiufeng Mountain-Daiyun Mountain chain, and they are the first barrier for the maintenance of mountainous ecosystems in southeast China. Therefore, for the research on ecosystem related issues, in addition to Fuzhou, adjacent cities of Putian and Quanzhou are included in the research.

Figure.3-19 Biodomains and Biosubdomains of Fujian Province

3.2.4 Determination of boundary of comprehensive research

Based on the above analysis, overlapping the urbanized regions, atmospheric environment affected scope, water environment affect scope and boundary of biodomains, taking into account the linkage of environmental management, the boundaries administrative divisions are selected and adjusted, to determine the boundary of comprehensive research of UREMP of Fuzhou. Other than the whole administrative region of Fuzhou, the boundary of comprehensive research also covers Ningde in North Fuzhou and Putian and Quanzhou in South Fuzhou.

3.2.5 Indicative water quality protection zoning and mapping

(1) Computation on water environmental capacity:

Runoff volume method needs not much data for calculating idea water environmental capacity, and is capable of calculating the environmental capacity of whole water system in one shot, and more convenient and high efficient than cross-section method.

(2) Comparative analysis on water environmental capacity and pollution emission:

The ratios of master pollutant discharge and water environmental capacity for all sub-watersheds are calculated for judging the differences on bearing conditions. Evaluation standards: bearing rate of water environment= pollution discharge/water environmental capacity; for areas with bearing rate over 1.5, they are called saturated area, for that in 0.8-1.5, basically balanced area, and that smaller than 0.8, surplus area.

(3) Change the calculation results into management means:

--change into guidelines for industrial regulation

For overloaded control unit, new pollution discharge should be strictly restricted, "replacing small units with large ones", "substitute with material of less pollution" and "reducing pollution by replacing project with half pollution" should be implemented.

--change into the targets for total amount control of pollutant

Control targets determined: the overloaded part of pollution discharge in overload area should be cut 50% by 2020, and the discharge amount in overload units and basically balanced units should be controlled within 90% of water environmental capacity, and discharge amount in other units should not increase in principle.

Table 3-6 Targets for Discharge Amount Control of Water Pollutant in Fuzhou (Expected)

Watershed	Current values in 2012（t/a）		Control targets for 2020（t/a）		Control targets for 2030（t/a）	
	COD	Ammonia nitrogen	COD	Ammonia nitrogen	COD	Ammonia nitrogen
Minjiang River	54924	7559	48043	5060	46286	4439
AoJiang River	1551	467	1137	261	1137	119
Longjiang River	6668	1434	3310	717	3000	600
Dahangxi River	2706	354	1617	163	1587	89
Qibuxi River	1048	144	733	81	733	49
Area for discharge in sea	——	——	35733	5686	31373	4771

(4) Evaluation and Application for water resources capacity in Fuzhou

Based on conceptual model of carrying capacity of water resources, Fuzhou has established a multi-objective indicator system for carrying capacity of water resources, which combines the indicator evaluation and analytic hierarchy process to calculate the index of carrying capacity of water resources in many years for all districts and counties in Fuzhou, with water resources distribution advices proposed.

3.2.6 Indicative air quality protection zoning and mapping

3.2.6.1 Develop a regional atmospheric flow model

Based on the simulation of atmospheric circulation characteristics and atmospheric environment quality, carry out systematic analysis of diffusion sensitivity and concentration sensitivity of air pollution, as well as pollution sensitivity of reception body, identify areas where air environmental pollution is easily to aggregate, and the influence exerted by air pollutants is large, and delimit level I and II control areas of atmospheric environment.

Mesoscale WRF + CALMET meteorological model is adopted in the overall environmental planning of Fuzhou, and quantitative analysis on the sensitivity of spatial arrangement of pollution source is conducted based on the range and influence of air pollution sources; the spatial clustering features of pollutant concentration when pollutant is evenly discharged in Fuzhou are simulated and the concentration sensitivity of pollutant is analyzed with air quality model.

Table 3-7 Method for atmospheric System Analysis and Delineation of Spatial Control

	Fuzhou
Selection of air model	WRF +CALPUFF
Evaluation method	Concentration vulnerability, layout sensitivity and receptor importance
Evaluation accuracy	Concentration vulnerability, (3 km * 3 km), layout sensitivity (3 km * 3 km)
Evaluation object	SO_2

3.2.6.2 Develop a regional atmospheric absorptive model

The spatial pattern of environmental capacity of SO2, NOx and Primary Particulate Matter of districts and counties in Fuzhou have been calculated respectively. Based on the environmental capacity, current pollutant discharge and estimated pollutant discharge, the spatial pressure of atmospheric environment at different regions were determined. Based on three basic principles, such as: atmospheric environmental quality of all districts and counties should not be degraded, emissions in month with bad weather conditions should not be overloaded and the air environmental quality is continuously improving, the constraint goals for pollutant emission in atmospheric environment were determined.

1) Measurement and calculation on atmospheric environmental capacity

Taking annual average concentrations of the three pollutants reaching class I standard and Class II standard as constraint conditions, the 1km ventilation coefficient was calculated based on WRF-CALMET model; A-value method was adopted for calculating the maximum allowable emissions of SO2, NOx and primary particulate matter in 4 typical months of January, April, July, October and the whole year, with the spatial pattern of environmental capacity of the three air pollutants in districts and counties analyzed.

2) Change the calculation results into management means

Change into the goals for controlling pollutant: based on three basic principles, such as: atmospheric environmental quality of all districts and counties should not be degraded, emissions in month with bad weather conditions should not be overloaded and the air environmental quality is continuously improving, the minimum requirement line for utilization of atmospheric environment was determined (seen in the following table).

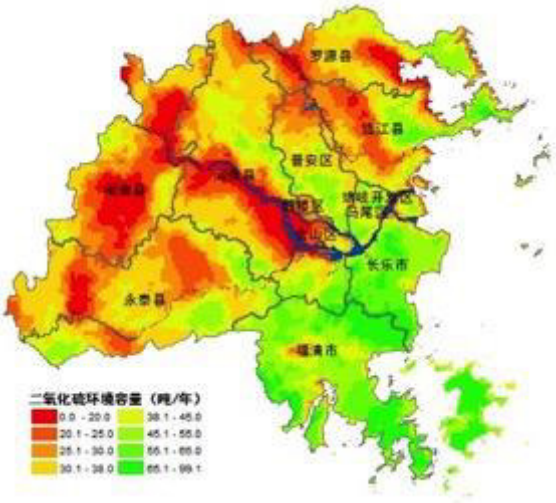

Figure 3-20 SO_2 water environmental capacity

Table 3-8 spatial distribution of environmental capacity of sulphur dioxide in Fuzhou

Region	Control targets for 2020		Control targets for 2030	
	SO_2	NOx	SO_2	NOx
Municipal District	0.17	0.21	0.17	0.21
Fuqing	0.93	2.58	0.9	2.58
Changle	2.31	1.63	2.3	1.36
MinHou	0.18	0.05	1.6	0.5
Lianjiang	0.72	1.53	0.72	1.27
Luoyuan	1.56	0.54	1.56	0.54
Minqing	1.35	1.63	1.35	1.36
Yongtai	0.01	0.003	Does not increase	Does not increase

3.2.6.3 Indicative air shed quality protection zoning and mapping

Based on the spatial difference on layout sensitivity, concentration vulnerability and importance of receptors of atmospheric environmental system, the whole administrative area of Fuzhou was divided into red line area, yellow line area and green line area of atmospheric environment quality to conduct space control of atmospheric environment.

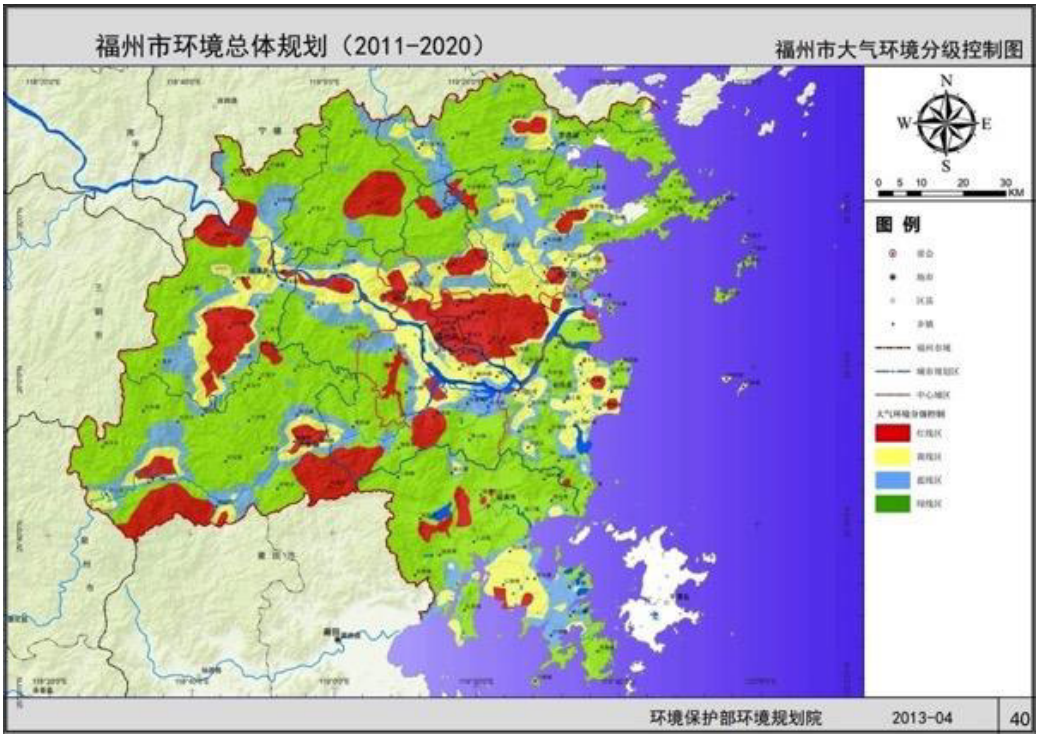

Figure.3-21 Map of Grade Control of Atmospheric Environmental Space in Fuzhou

3.2.7 Indicative ecosystem protection zoning and mapping

RS and GIS technologies are adopted. Digital terrain, topography, climate, soil, vegetation coverage, land use and other basic data are utilized, characteristic assessment factors are selected for assessing sensitivity, vulnerability and importance of urban and rural ecosystem. Core area, buffer area, ecological corridor, radiation channel and ecological strategic node maintained by ecosystem are recognized. Priority conservation scope is determined. They are divided into ecological environment red line area, yellow line area and green line area according to control requirements. Ecological environment control space can be designated for implementing management at different grades.

Table 3-9 Element Types Incorporated into the Environmental Space Control

	The pearl river delta area	**Fuzhou**
Control elements	Ecological system	Ecosystem, water environment, atmospheric environment
Basic theory and main technology	Landscape ecology related theory and technical methods such as patch, corridor and habitat, etc.	Evaluation model for ecological environmental system , analytical model for transmission of water environment pollutants, delimiting technology for control unit of water environment, simulation and analysis technology for high frequency meteorological field and air quality simulation model, etc.
Control results	Ecological red line	Red lines for ecological functions (including red line area, yellow line area, green line area); Red lines for water environment quality (including red line area, yellow line area, green line area); Red lines for air environment quality (including red line area, yellow line area, green line area);

Through practical exploration, the general technology route for establishing environmental space control includes: one is to establish the database of geographic space information, including basic information such as topography, vegetation, land use types, types of urban land use, etc. The second one is to analyze the air, water, ecological and other environmental systems, based on the structure, process and functional characteristics of environmental systems themselves, identify the sensitive area, important area and vulnerable area of all environmental systems, with the urban ecological red line system established, and the control space of ecological environment by elements and hierarchical management clearly determined. Based on different environmental elements and fields, environmental space control content includes atmospheric environment, control space for water environment, control space for ecological environment and control space for marine environment and so on. Based on different environmental protection requirements, environmental space control scope is classified into Class I Ecological Environment Control Area and Class II Ecological Environment Control Area, which will be managed according to the class. At the third, based on different control types and concrete control content, corresponding control policy should be equipped to guarantee the implementation.

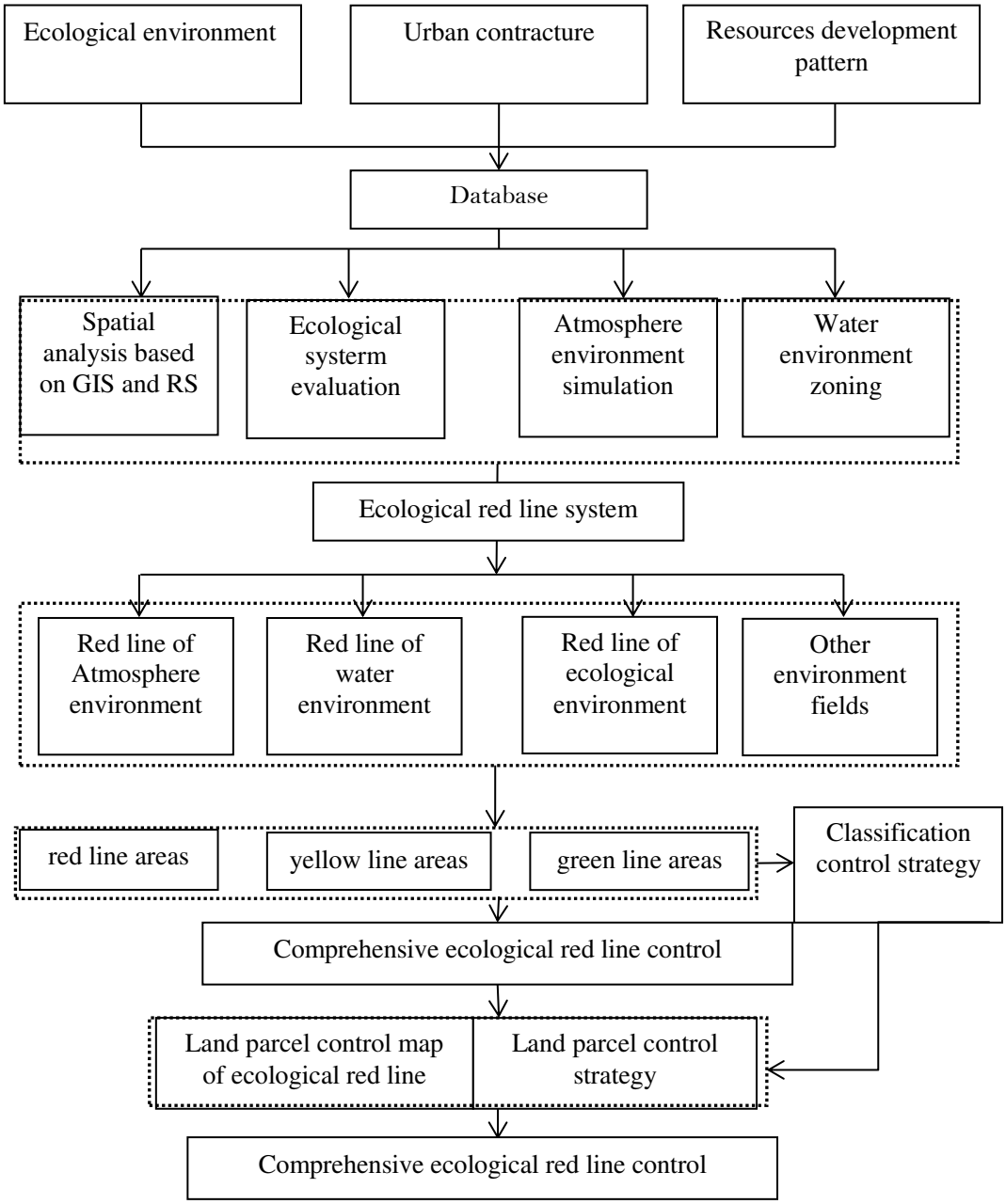

Figure. 3-22 Roadmap and Flow Chart of Environmental Space Control

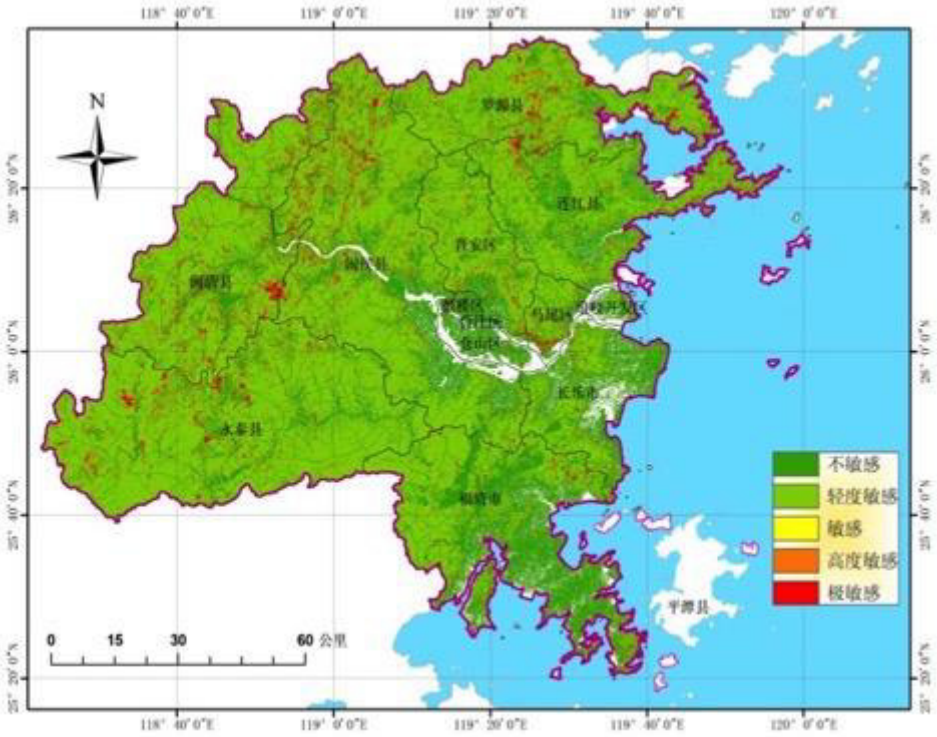

Figure. 3-23 Sensitivity evaluation of Water and soil loss in Fuzhou

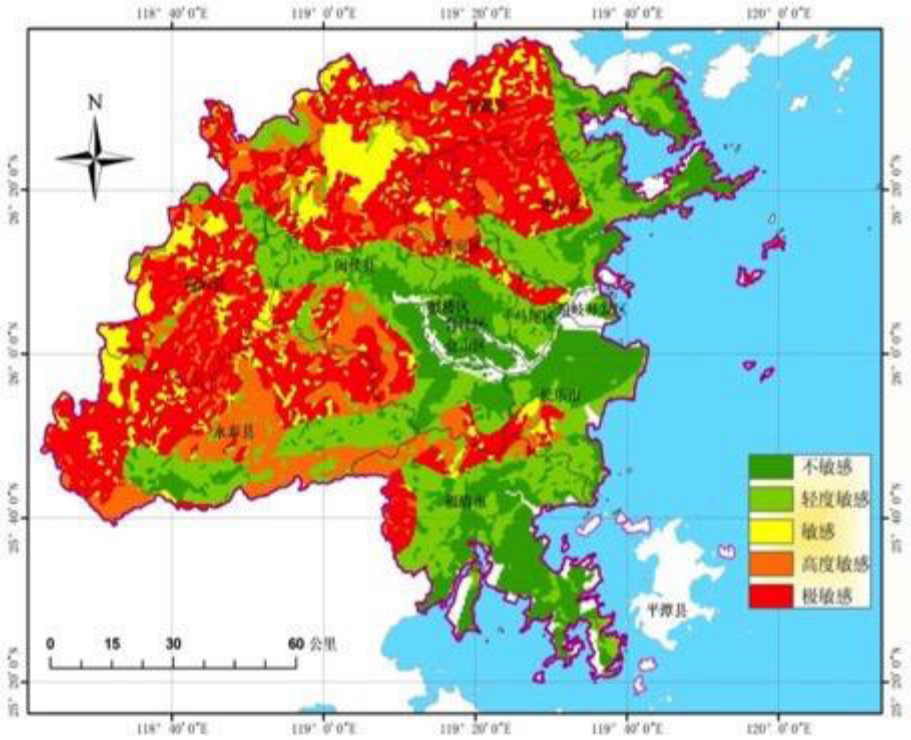

Figure. 3-24 Sensitivity evaluation of Acid rain in Fuzhou

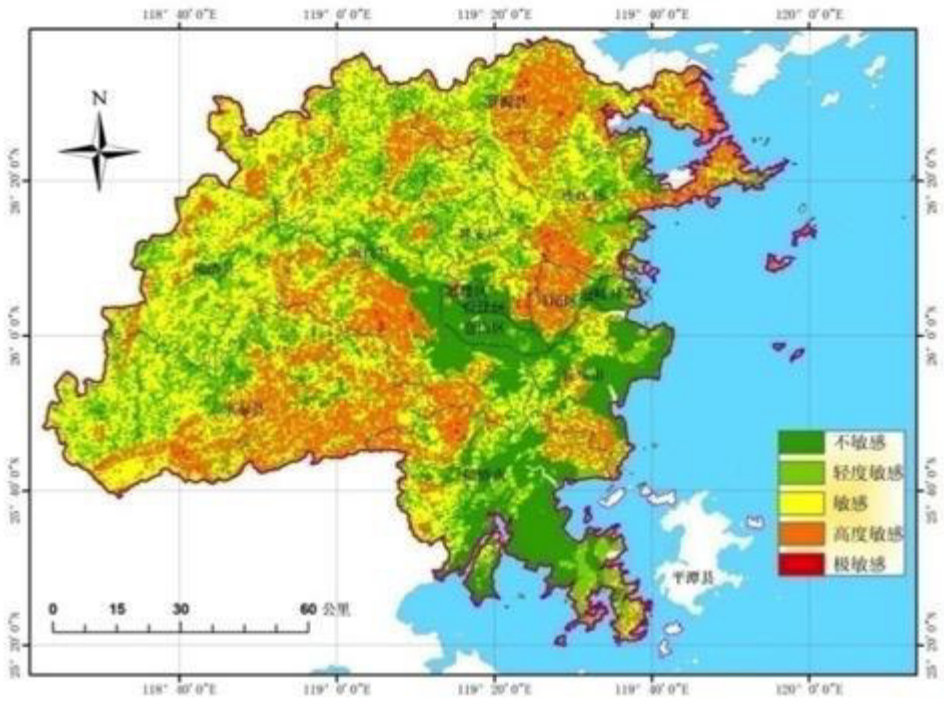

Figure. 3-25 Sensitivity evaluation of geological disasters in Fuzhou

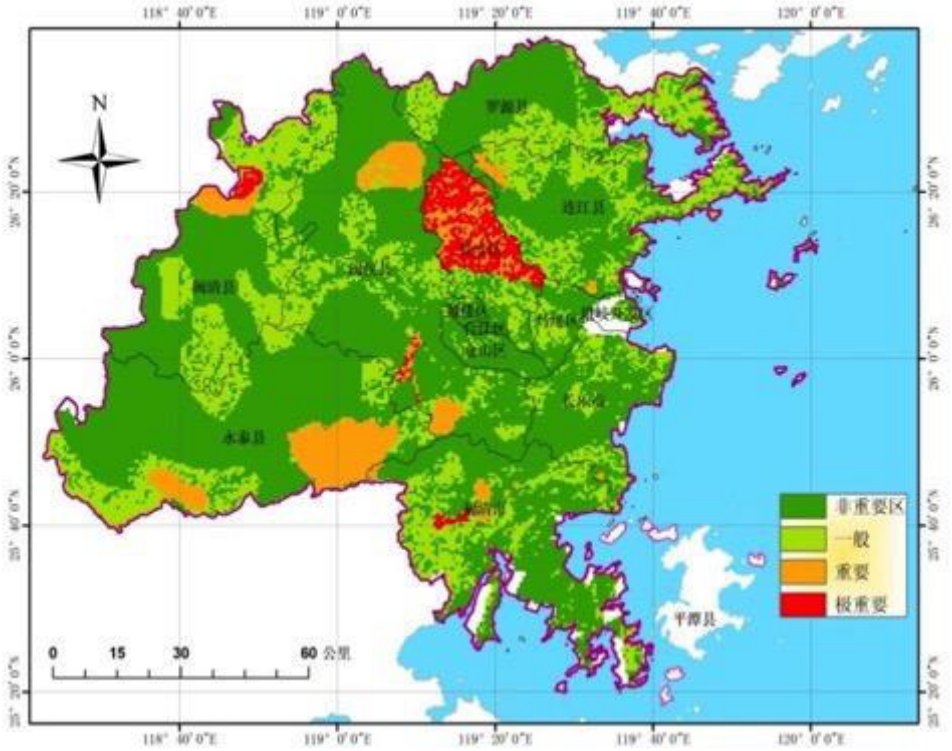

Figure. 3-26 Importance assessment of biodiversity in Fuzhou

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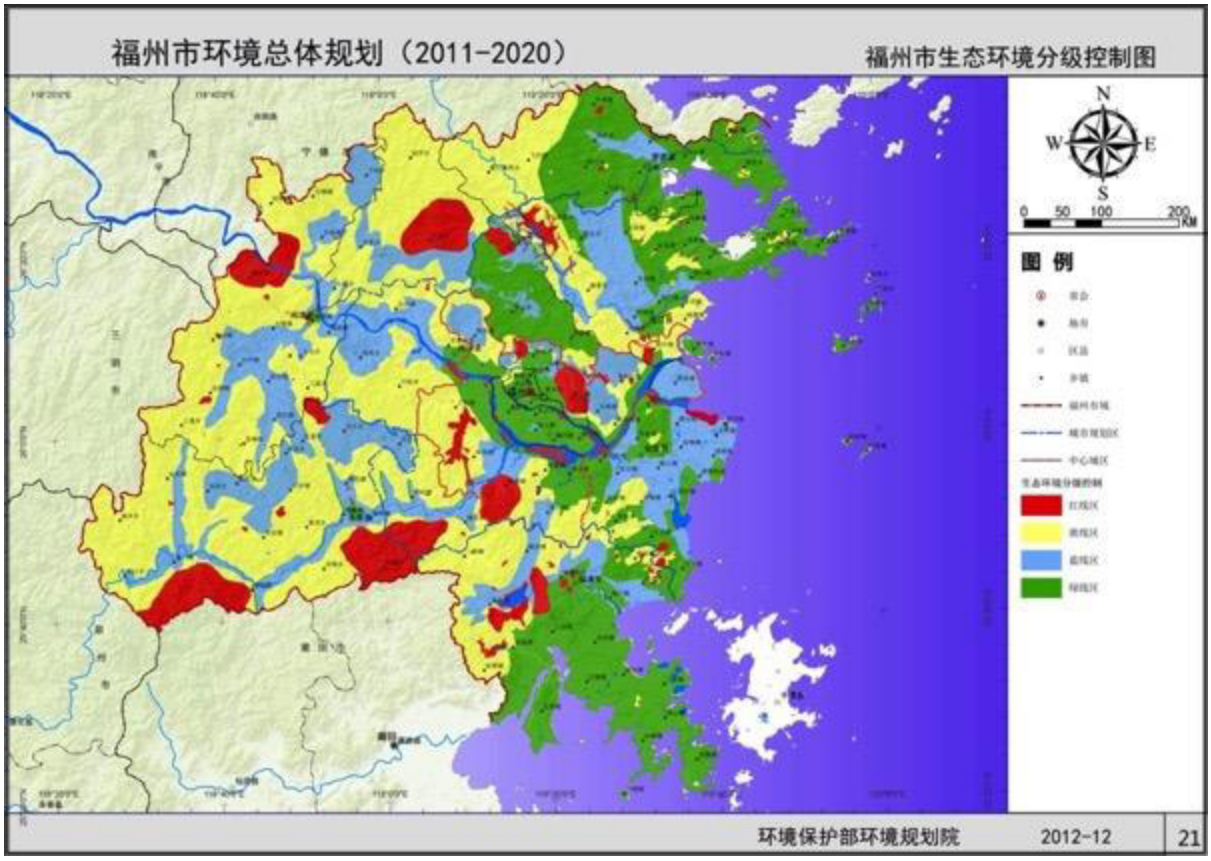

Figure. 3-27 Ecosystem environment hierarchy control map in Fuzhou

3.3 Guangzhou Pilot UREMP

3.3.1 Planning boundary

Guangzhou is the central city in China under the jurisdiction of the 11 districts. It is the provincial capital and also the political, economic, scientific, educational and cultural center of Guangdong Province. Guangzhou city has a population of more than 10 million, and the region's GDP was more than trillion, and covers an area of more than Shanghai and is a typical large city in China.

Guangzhou is rounded with mountain and facing the sea, across the low mountain and Guangdong Pearl River delta plain. It is located in the geometric center of the Pearl River Delta city group, to maintenance the great strategic significance of environmental function in Guangzhou city to the city group in Pearl River Delta, Guangdong Province and even in Southern China. At present, Guangzhou city environmental master planning has completed the initial outline text.

Figure. 3-28 The location map of Guangzhou in Guangdong province

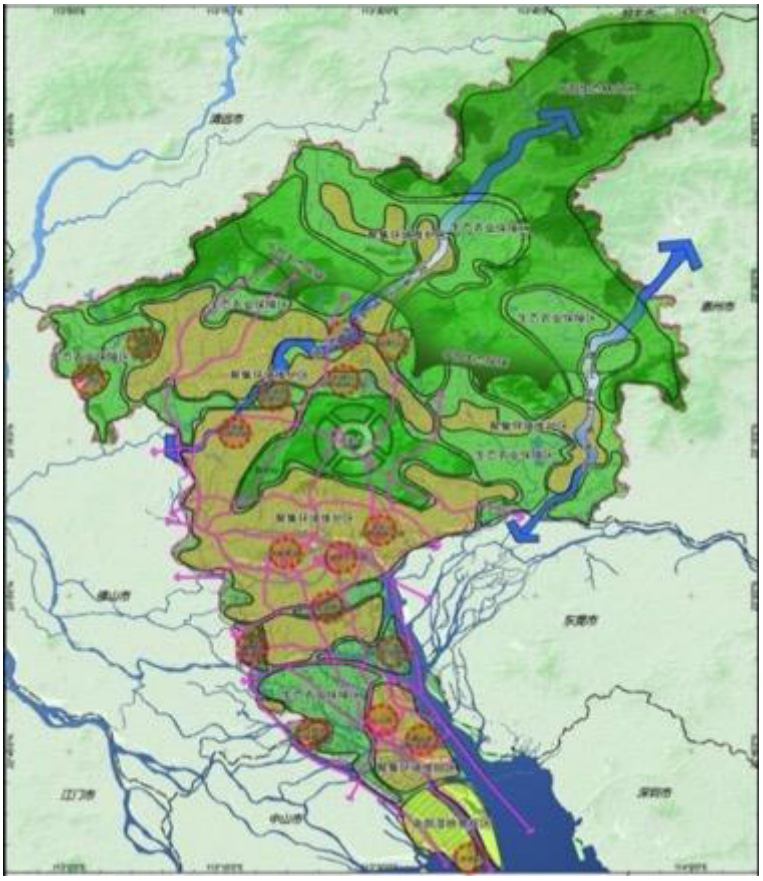

Figure. 3-29 The UREMP Planning boundary of Guangzhou

3.3.2 Indicative water quality protection zoning and mapping

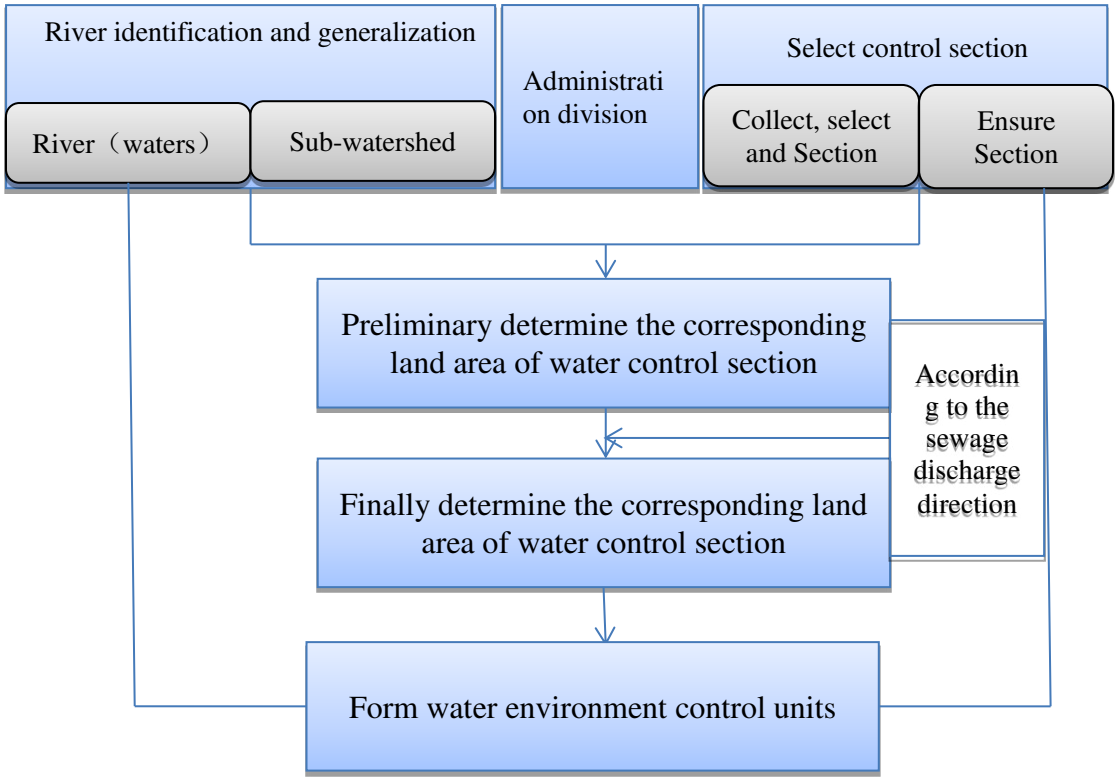

Figure.3-30 Flow Chart for Delimiting Control Unit of Water Environment

With this technical method, Guangzhou was divided into about 90 water environment control units, which can be seen in the following figure, and all the management strategies were designed based on these units.

Figure. 3-31 Map of the Water Environment Control Unit in Guangzhou

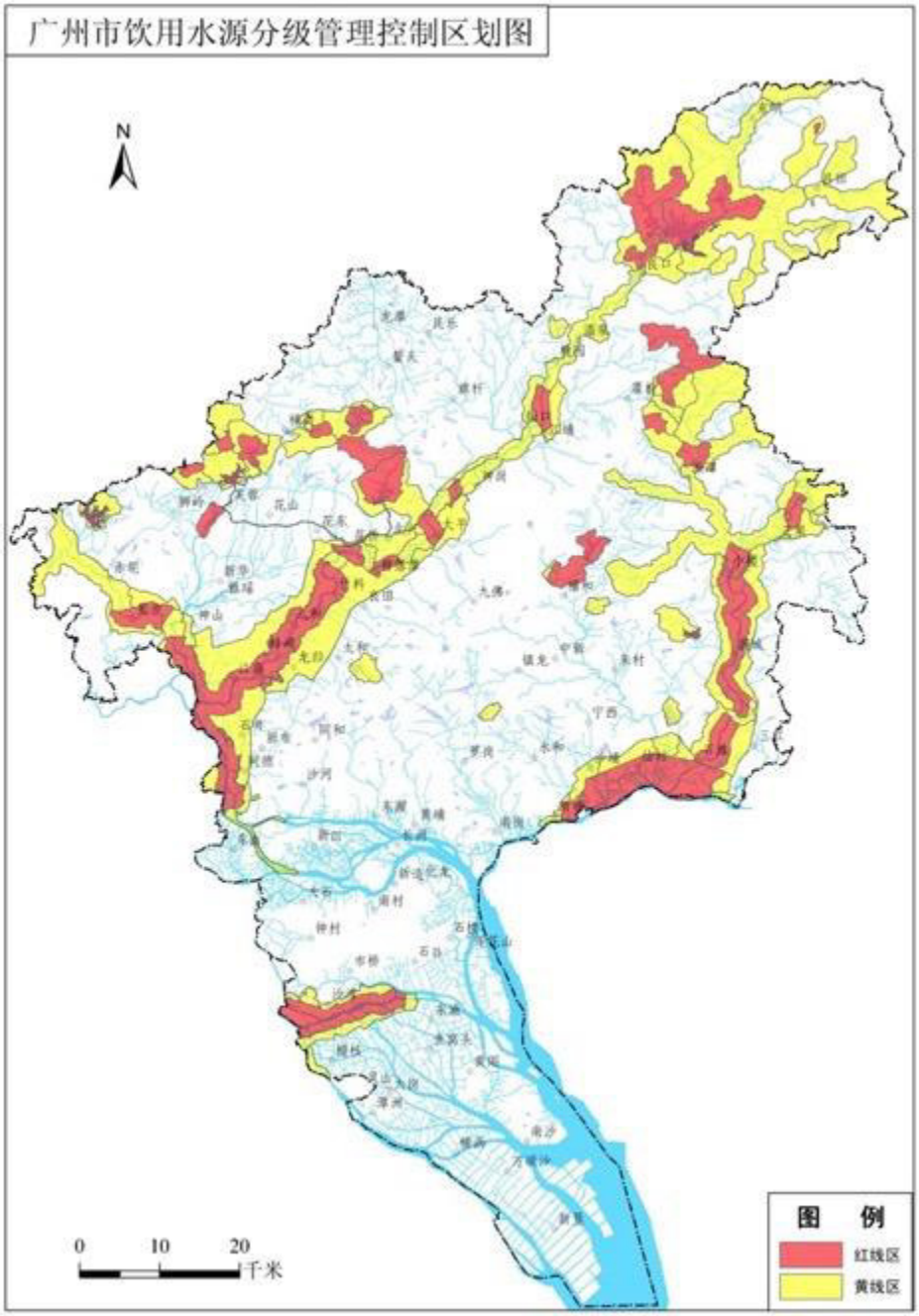

Figure. 3-32 Drink water protection zoning of Guangzhou

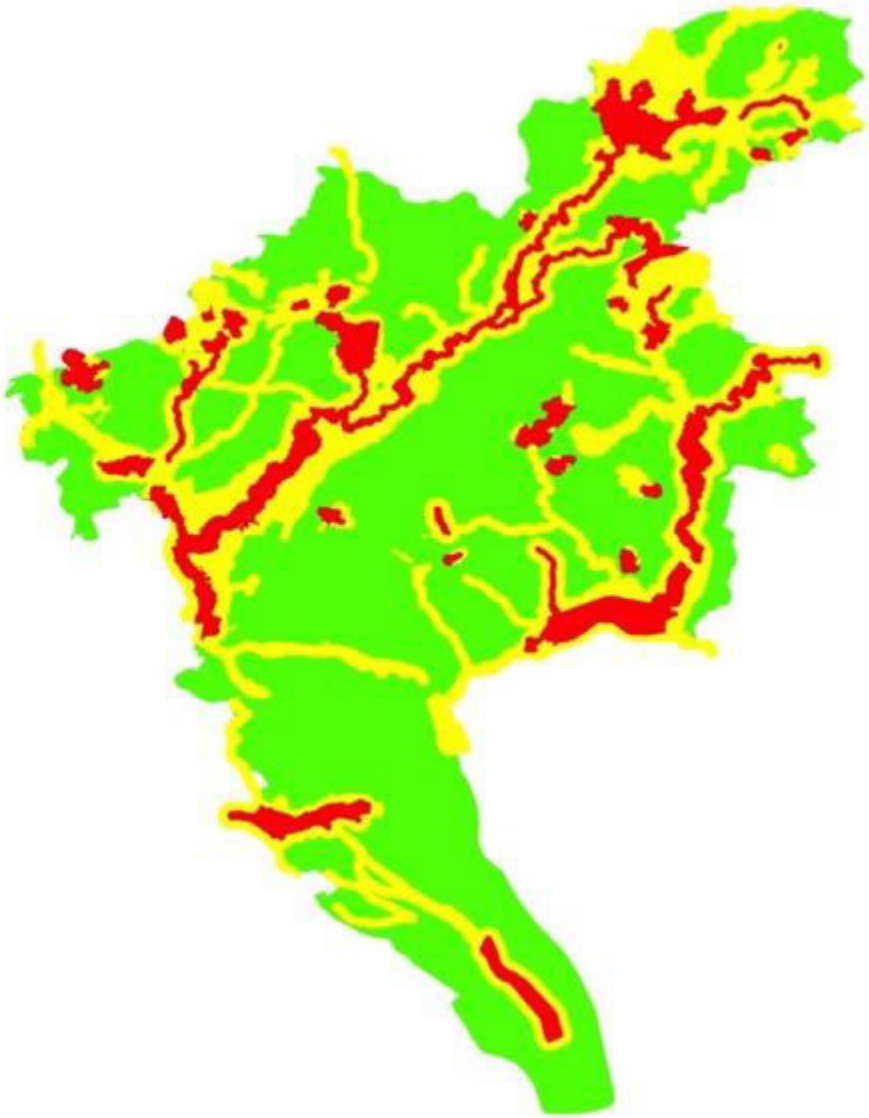

Figure. 3-33 Map of the hierarchy control of water environment in Guangzhou

3.3.3 Indicative atmospheric quality protection zoning and mapping

3.3.3.1 Develop a regional atmospheric flow model

Using CMAQ for analytical technology of atmospheric environment system. Resolution should be deepened from 3km*3km to 1km*1km; and analytical object should be expanded from sole SO2 to NOX and O3.

Table 3-10 Method for atmospheric System Analysis and Delineation of Spatial Control

	Guangzhou
Selection of air model	CMAQ
Evaluation method	Concentration vulnerability, layout sensitivity and receptor importance
Evaluation accuracy	Concentration vulnerability, (1 km * 1 km), layout sensitivity (3 km * 3 km)
Evaluation object	NO_X、$PM_{2.5}$、O_3

3.3.3.2 Develop a regional atmospheric absorptive model

The spatial pattern of environmental capacity of SO2, NOx and O3 of districts and counties have been calculated respectively. Based on the environmental capacity, current pollutant discharge and estimated pollutant discharge, the spatial pressure of atmospheric environment at different regions were determined. Based on three basic principles, such as: atmospheric environmental quality of all districts and counties should not be degraded, emissions in month with bad weather conditions should not be overloaded and the air environmental quality is continuously improving, the constraint goals for pollutant emission in atmospheric environment were determined.

3.3.3 Indicative air shed quality protection zoning and mapping

Based on the spatial difference on layout sensitivity, concentration vulnerability and importance of receptors of atmospheric environmental system, the whole administrative area of Guangzhou was divided into red line area, yellow line area and green line area of atmospheric environment quality to conduct space control of atmospheric environment.

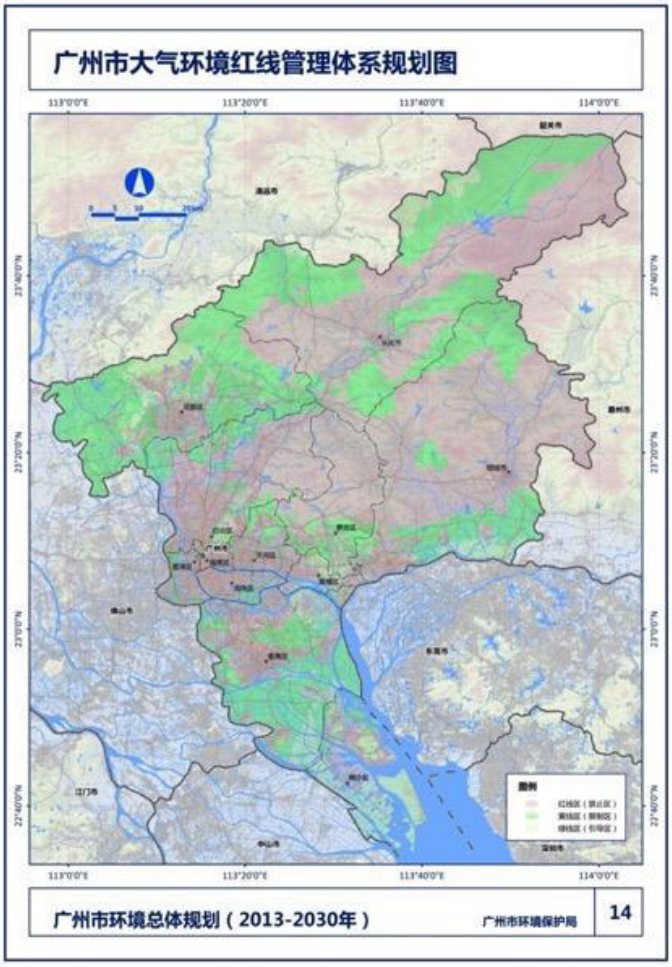

Figure.3-34 Map of Grade Control of Atmospheric Environmental Space

3.3.4 Indicative ecosystem protection zoning and mapping

RS and GIS technologies are adopted. Digital terrain, topography, climate, soil, vegetation coverage, land use and other basic data are utilized, characteristic assessment factors are selected for assessing sensitivity, vulnerability and importance of urban and rural ecosystem. Core area, buffer area, ecological corridor, radiation channel and ecological strategic node maintained by ecosystem are

recognized. Priority conservation scope is determined. They are divided into ecological environment red line area, yellow line area and green line area according to control requirements. Ecological environment control space can be designated for implementing management at different grades.

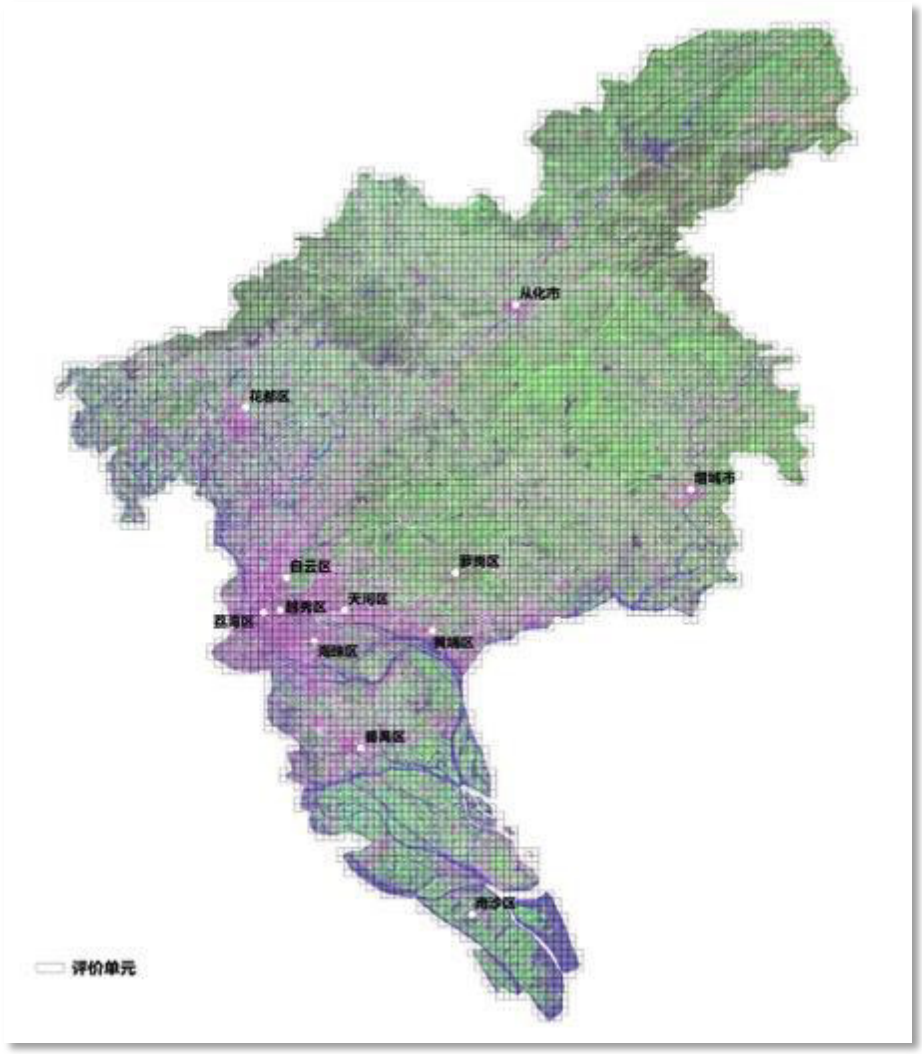

Figure.3-35 Grid of evaluation unit of Guangzhou

Ecosystem importance is assessed according to different ecological functions in water source conservation, water and soil conservation, biodiversity protection, nutrient maintenance, coastal belt protection, etc. Flood regulation and storage capabilities, wind prevention, sand-fixing and other factors also can be appropriately increased according to actual situation of the city. Importance of the ecosystem can be assessed, and the assessment methods also can be adjusted.

Where, 'National Ecological Protection Red Line-Ecological Function Red Line Delineation Technical Guide (Trial)' (Huan Fa [2014] No. 10) is adopted as reference aiming at assessment methods of water source conservation importance, soil and water conservation importance and biodiversity protection function importance.

Nutrient material conservation importance assessment regional nutrient material conservation importance is assessed from the perspective of point source pollution and eutrophication of lake wetlands. Eutrophication consequences and severity possibly caused by regional nitrogen and phosphorus loss are graded and classified according to rive grade, river location, impact objective importance and other factors. Coastal belt protection function importance assessment is mainly related to coastal anti-erosion area, storm tide resistance area, mangroves, coral reefs, other important

terrestrial and marine life distribution, breeding areas, and coastal belt, beach, coastal zone and other areas which are important for maintaining local ecological environmental safety.

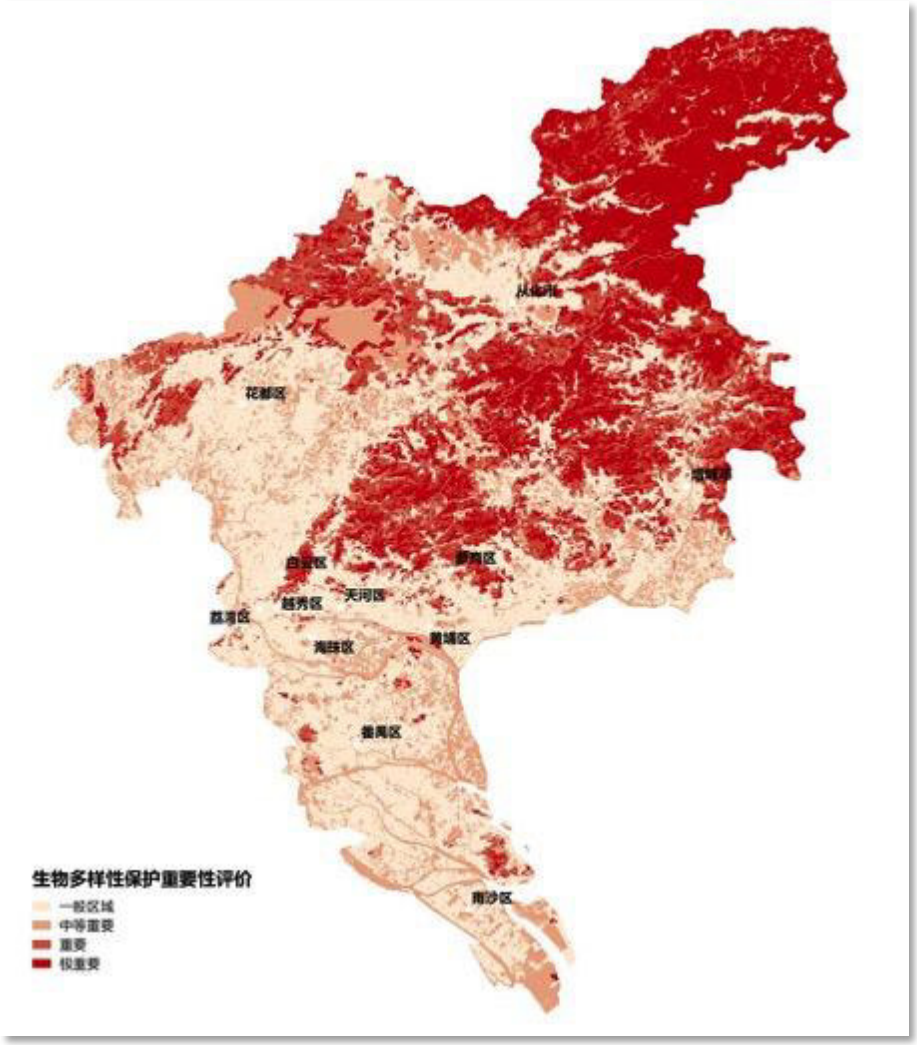

Figure.3-36 Importance evaluation of biodiversity in Guangzhou

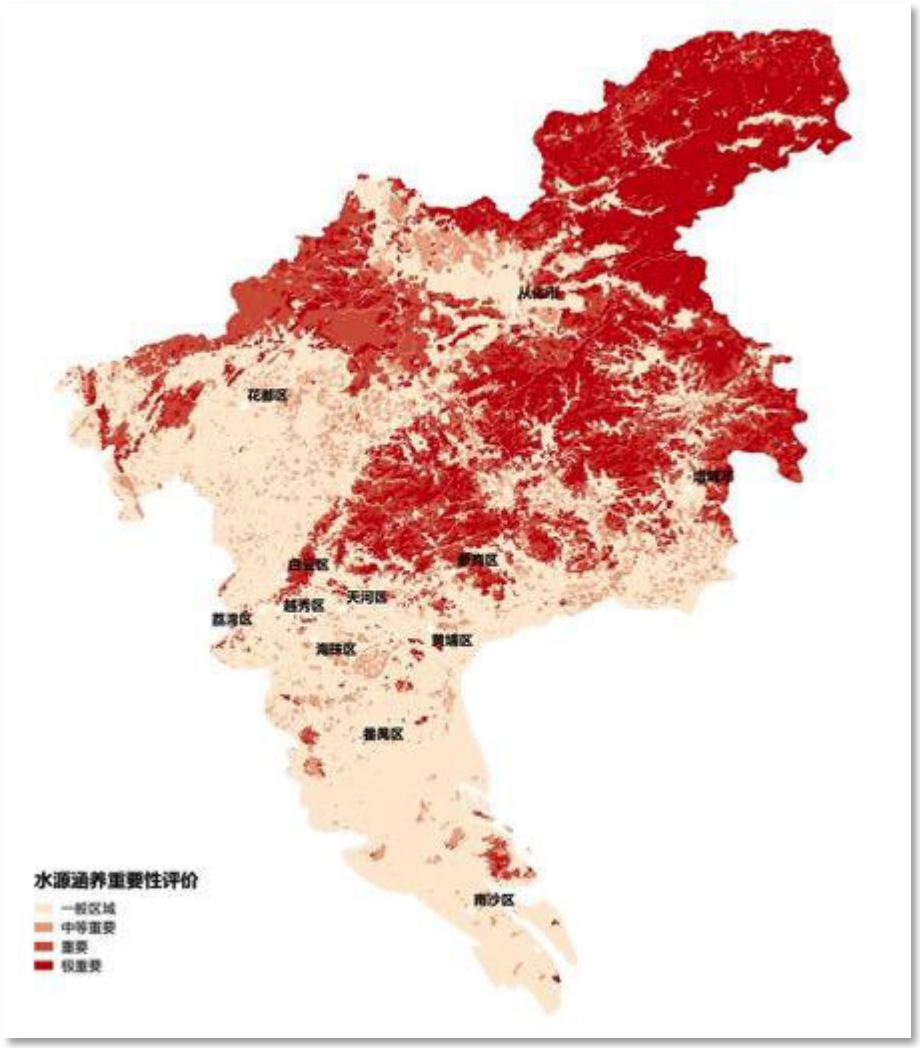

Figure.3-37 Importance evaluation of water reservation in Guangzhou

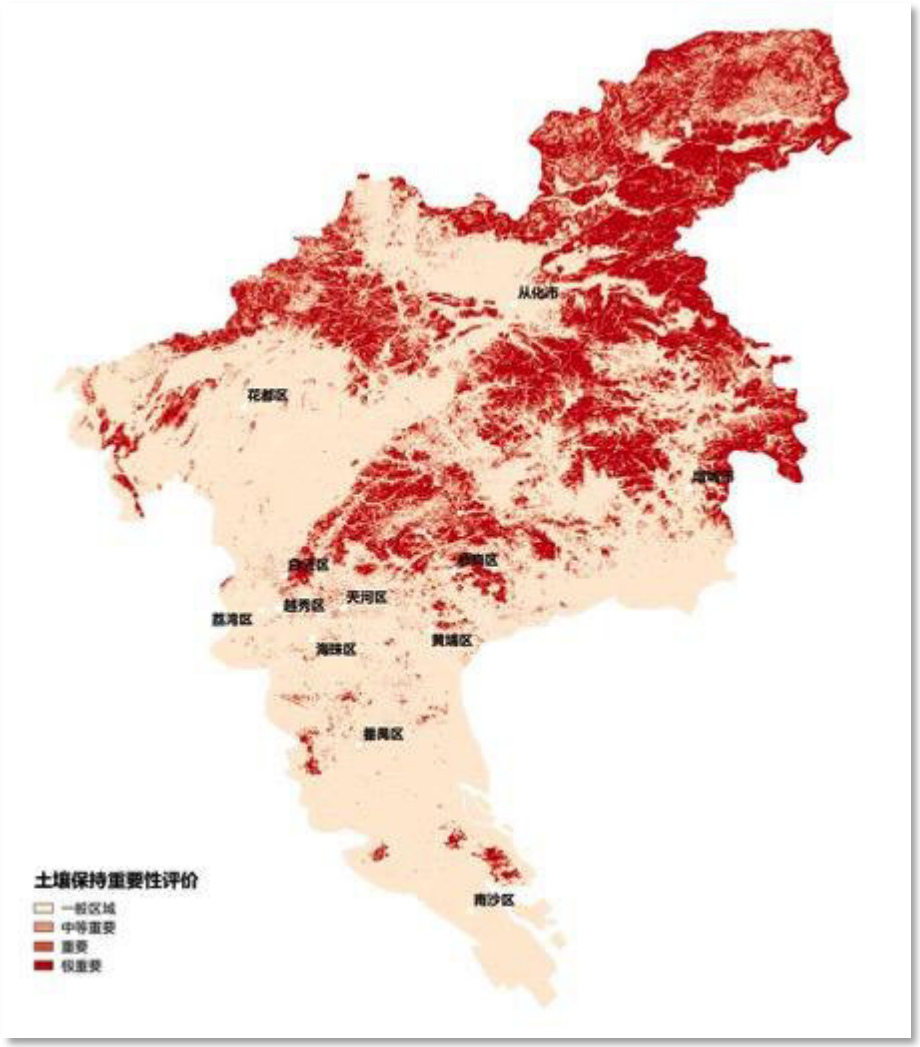

Figure.3-38 Importance evaluation of soil conservation in Guangzhou

Ecological sensitivity assessment is related to individual impact factor sensitivity assessment of water and soil erosion sensitivity, riverside belt sensitivity, soil erosion sensitivity, desertification sensitivity, stony desertification sensitivity, acid rain sensitivity, etc. Different impact factors can be selected for emphasized analysis according to different local natural and geographical conditions.

Qualitative and quantitative combination method is adopted for ecological environment sensitivity assessment. GIS technology is adopted for analyzing sensitivity of individual impact factors. The impact factors are overlaid and integrated according to certain rule, thereby obtaining integrated sensitivity distribution map. Sensitivity levels are assessed and zoned, and these areas can be divided into different levels.

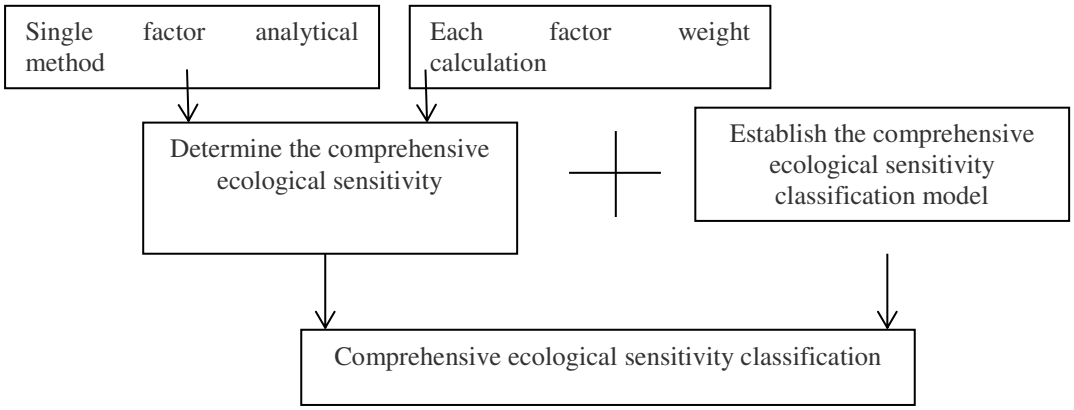

Figure.3-39 Technology Roadmap of Ecological Sensitivity Analysis

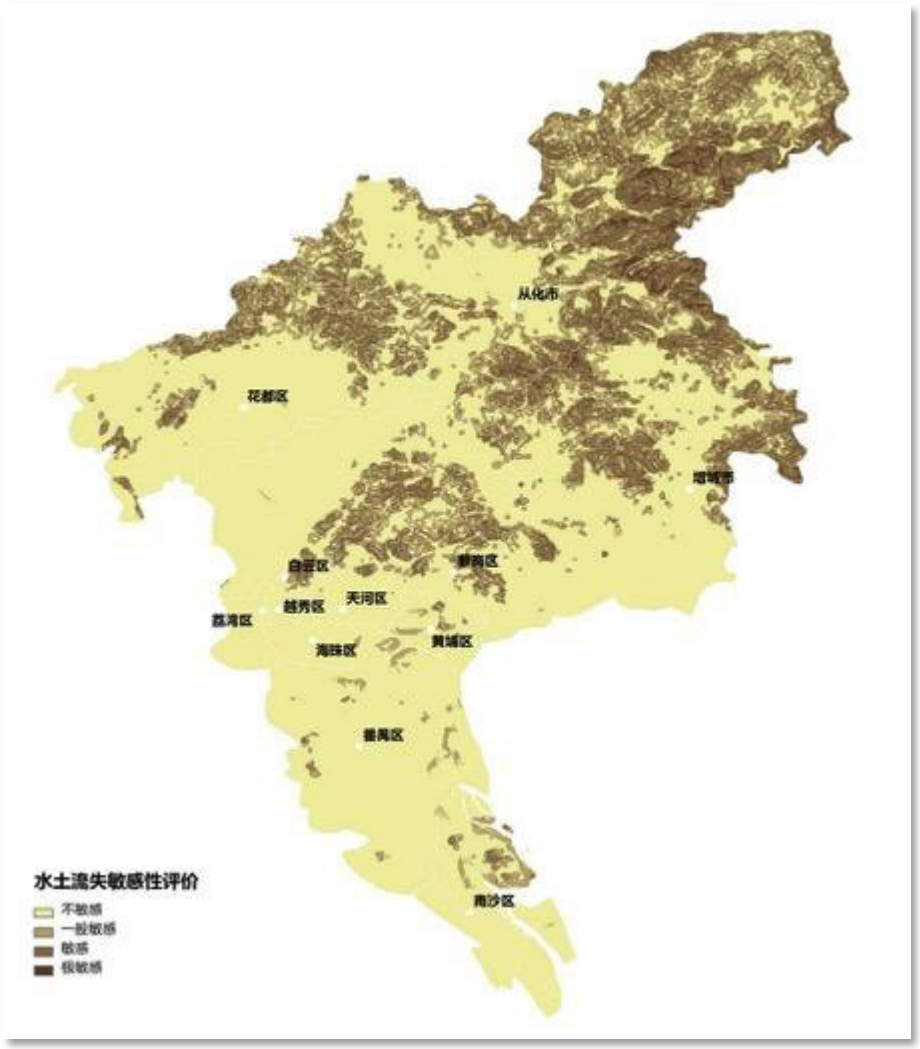

Figure.3-40 Sensitivity evaluation of water and soil loss

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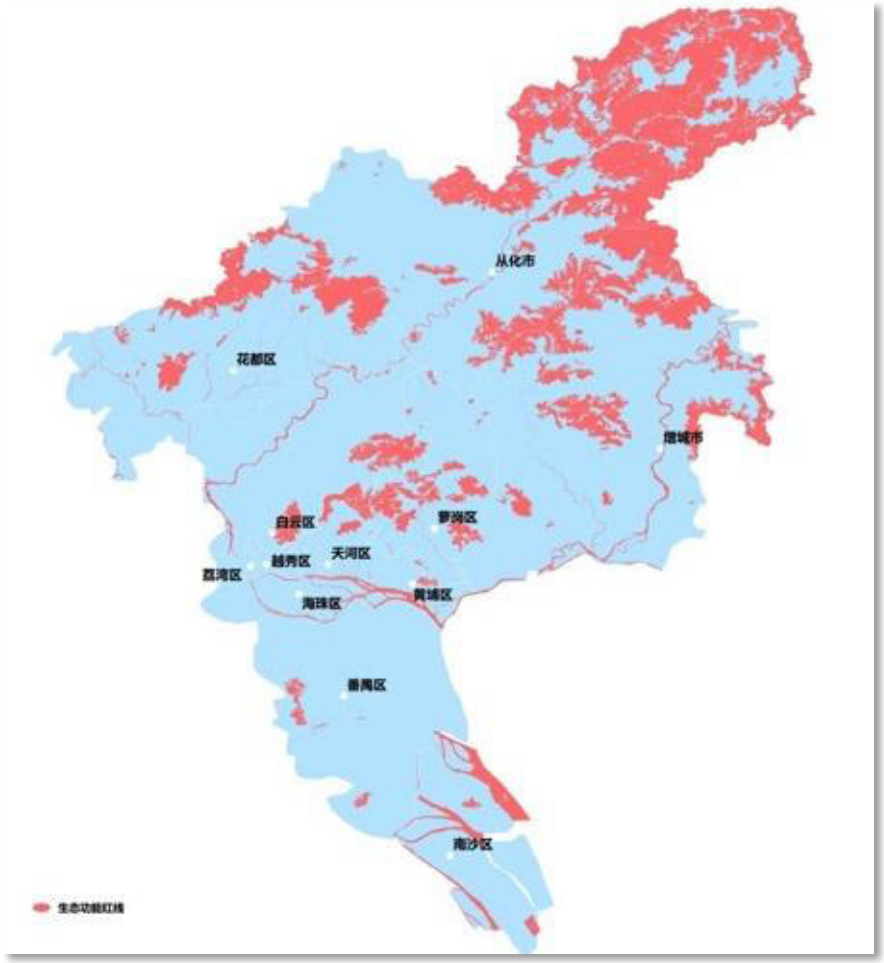


Figure.3-41 Ecosystem functional red-line of Guangzhou

Table 3-11 Control Measures of Ecological Function Red Line Area

Biology Classification	**Control Requirements**
Ecological function red line area,	Visit and tourism projects inconsistent with natural reserves, forest park and scenic area protection directions should not be constructed. Necessary construction projects in scenic spot should follow requirements in related laws and regulations. Construction land area and construction contents should not exceed related requirements. The built-up unrelated construction projects should be demolished or closed. Population is guided for relocation in order, thereby realizing 'zero emission' of pollutants and improving environmental quality.
Ecological function yellow line area,	Various development activities should be strictly controlled, construction projects damaging ecological environment should not be newly constructed or expanded. Pollution-type industrial projects should not be constructed. Biological environment should be comprehensively remedied in key areas with biological damage and water-soil erosion. Development content, mode and open strength control should be strengthened, various industrial enterprises should not be newly constructed, and area of existing industrial development should not be expanded in principle. More strict industry access environment standard should be implemented, project access should be strictly controlled, and biological restoration should be energetically implemented.
Ecological function green line area,	Biological protection should be focused in regional development and construction activities, development scope, mode and development degree should be strictly made clear. Biological restoration should be strengthened in biological environment vulnerable areas with serious water and soil erosion, etc. in the region, and the above activities should be orderly developed under the precondition of guaranteeing biological environmental health.

3.4 Weihai Pilot UREMP

3.4.1 Planning boundary

Weihai city is located in the eastern tip of Shandong Peninsula, is a node of eastern coastal city of Bohai economic circle, Shandong Peninsula Blue Economic Zone, and it covers 5797 km2. Weihai is a famous coastal tourist city in China with good environment, beautiful scenery, ecological and livable. At the same time, Weihai city is a note city in to maintenance strategic security and ecological balance of eastern Bohai state and Yellow Sea. It is atmospheric environment and ecological environmental quality model city in Shandong province, and also an ecological culture city with history, religion, humanity and all natural connotation. In August 8, 2014, Weihai environmental master planning outline was passed experts argumentation.

Figure.3-42 Planning boundary of UREMP in Weihai

3.4.2 Indicative water quality protection zoning and mapping

Importance, vulnerability and sensitivity of water environmental system are analyzed. Water system important area, sensitive area and vulnerable area in administrative regions of a city are recognized, and grade control requirements are formulated.

3.4.2.1 Water Ecological Sensitivity Assessment

Drinking water source protection area, fishery water area, industrial water area, landscape recreational water area, agricultural water area, transition area, mixing area and other environment functional areas are adopted as foundation for assessment according to sensitivity of functional areas (Table 3-12).

Table 3-12 Sensitivity Assessment Table of Water (Environment) Functional Areas

Functional Area	Sub-item	Execution	Extreme	Medium	General

Type		Standards	Sensitivity	Sensitivity	Sensitivity
Drinking water source protection zone			√		
Fishery water area	Precious fish protection zone	Type II	√		
	General fishery water area	Type III		√	
Industrial water area		Type IV			√
Landscape entertainment water area	Natural beach and swimming area with direct contact with human body	Type II	√		
	Landscape recreational water area with non-direct contact with human body	Type IV and Type V			√
Agriculture water area		Type V			√
Transition area and mixing area					√

Extremely sensitive control unit is designated as water environment red line area, including drinking water source protection area, precious fish protective area in fishery water area, natural beach, swimming area, etc. with direct contact with human body in landscape recreational water area. Moderately sensitive control units are designated as water environment yellow line area, including general fishery water area in fishery water area. General sensitive control unit is designated as water environment green line area; including industrial water area not belongs to extreme sensitivity and moderate sensitivity, landscape recreational water area with indirect contact with human body in landscape recreational water area, agricultural water area, transitional area, mixing area, etc.

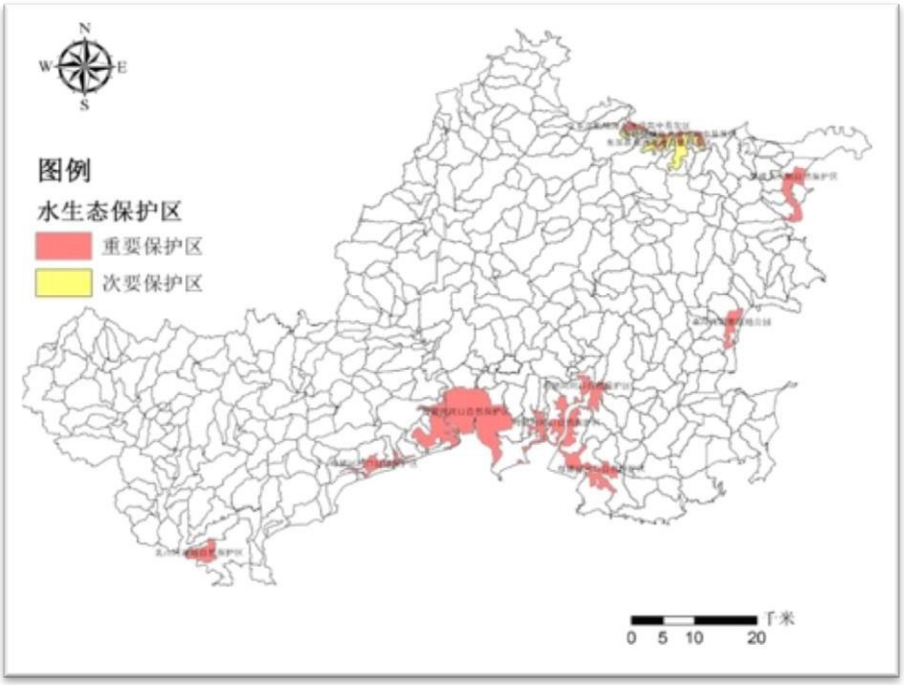


Figure.3-43 Water ecosystem conservation area

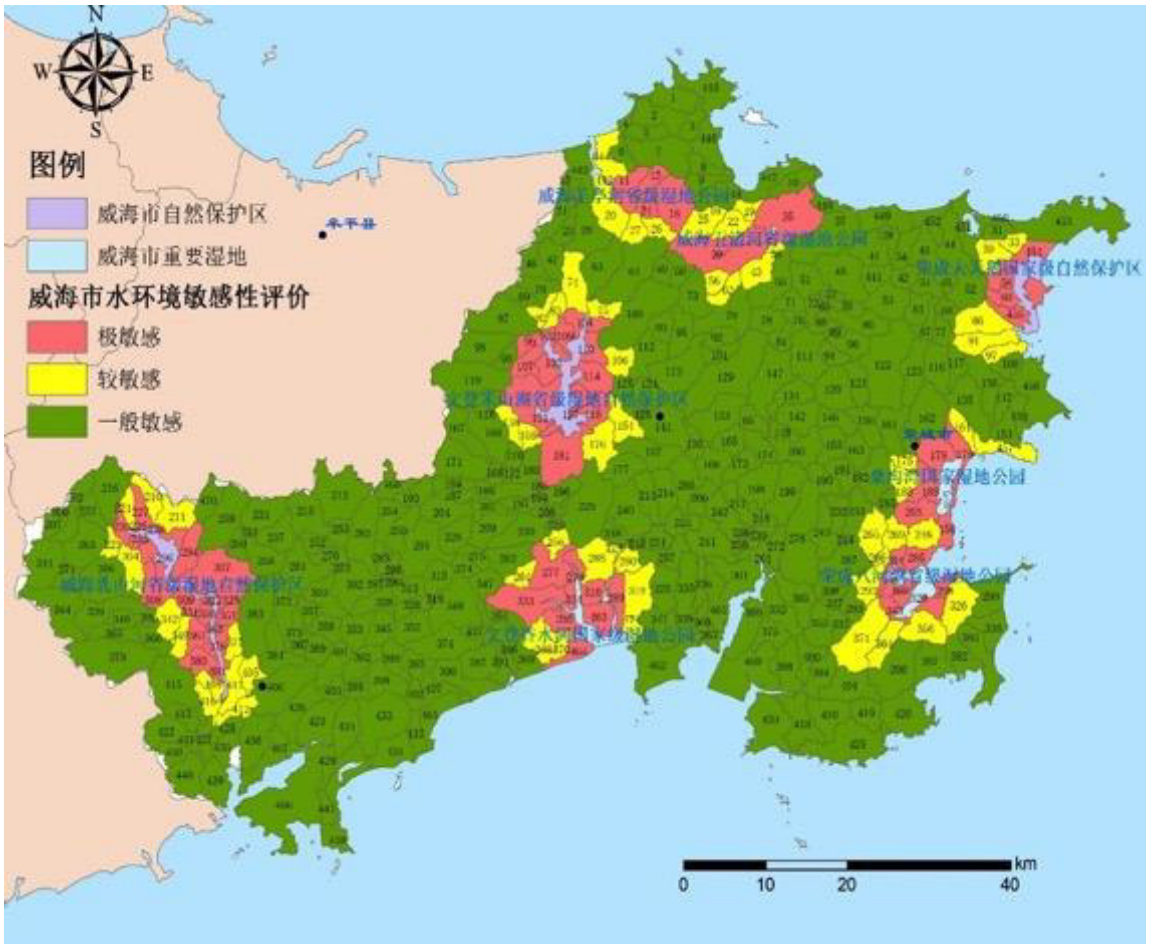


Figure.3-44 Sensitivity evaluation of water environment in Weihai

3.4.2.2 Water Environment Pollution Vulnerability Assessment

Qualitative and quantitative combined method is adopted for analyzing main factors affecting process vulnerability such as water hydrological characteristics, river conditions, water exchange conditions, etc. Impact of salt tide, morning and evening tides, etc. also should be considered for coastal city. Ares with difficult diffusion of pollutants, water flow exchange ability weakening and prominent reduction of water pollutant expansion speed and water environmental capacity due to significant flow capacity reduction, prominent flow speed lowering and sudden river narrowing are regarded as essentially vulnerable areas of water environment.

Water environment COD and ammonia nitrogen environmental capacity are regarded as indexes of vulnerability assessment, and they are divided into three assessment levels, namely extremely vulnerable, moderately vulnerable generally vulnerable levels. The part with unit waterway length natural COD capacity <1t/km•a and natural ammonia nitrogen capacity <0.1t/km is extremely vulnerable, which is designated as water environment red line area; the part with unit waterway length natural COD capacity 1-400t/km•a and natural ammonia nitrogen capacity 0.1-10t/km•a is moderately vulnerable, which is designated as water environment yellow line area, and the remaining water section control units are designated as water environment green line area.

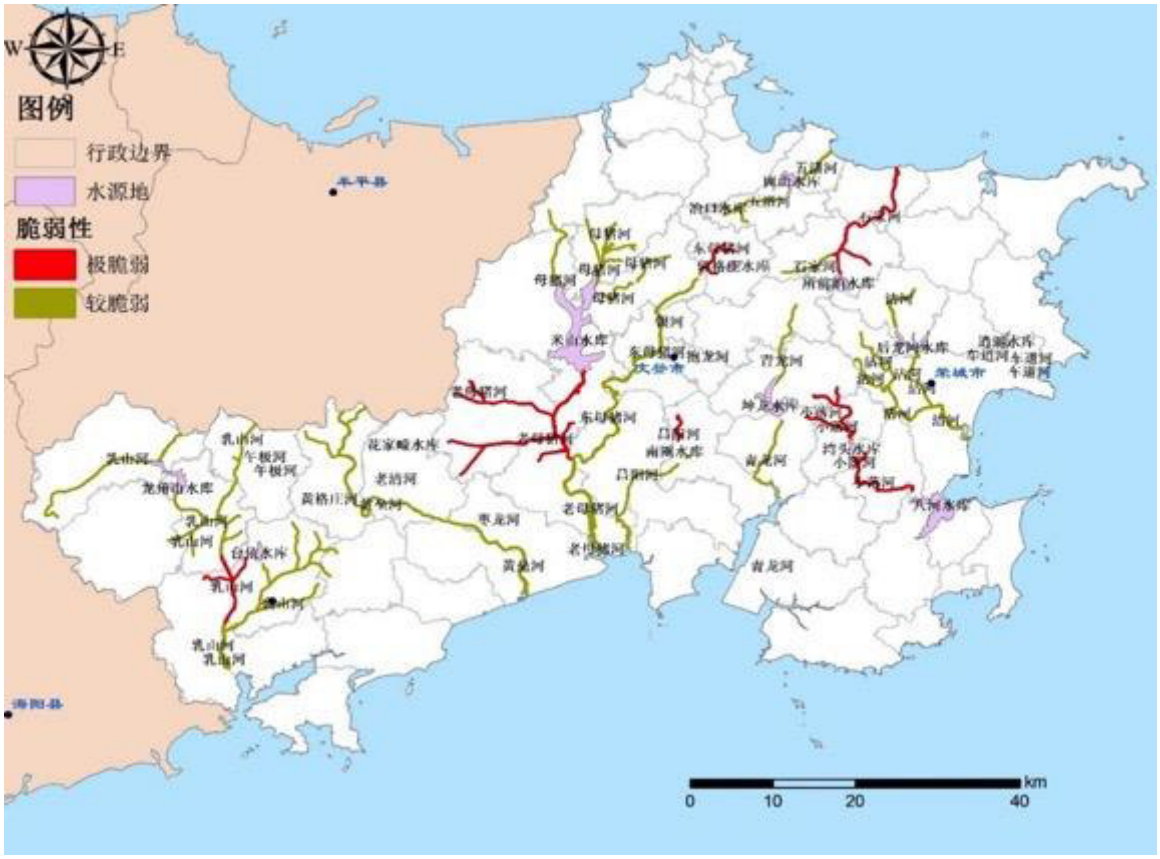


Figure.3-45 The vulnerability evaluation of water environment in Weihai

3.4.2.3 Assessment of Water Environmental Function Importance

Certain upstream area of water source has important function on water source conservation and protection, which is designated as extremely important area. River and lake with water quality maintaining at class II or class I has important significance on maintaining urban and rural water environmental quality, which are designated as very important areas. Areas with direct impact on habitat, breeding grounds and feeding grounds of rare, endangered and mainly protected aquatic species (mainly referring to scope 1km along the shores on the left and right of protected water body, and 10km on upstream part), which has important significance to aquatic biodiversity conservation, and is designated into water environment red line area.

Assessment units with water quality lower than targeted requirements of the function area due to anthropogenic pollution and difficultly guaranteed river ecological flow, general fishery water areas, catchment areas of other habitat, breeding grounds , feeding grounds for rare, endangered and mainly protected aquatic species are designated into water environment yellow line area.

Table 3-13 Water Environment Function Importance Assessment - Different Water Types

Water Type	**Extremely Important**	**Moderately Important**	**Generally Important**
Source water	√		
Water quality maintained at class II or class I	√		
Habitat, breeding grounds and feeding grounds of aquatic species	√		
It is more difficult to protect the ecological flow.		√	
General fishery water area		√	
Other water types			√

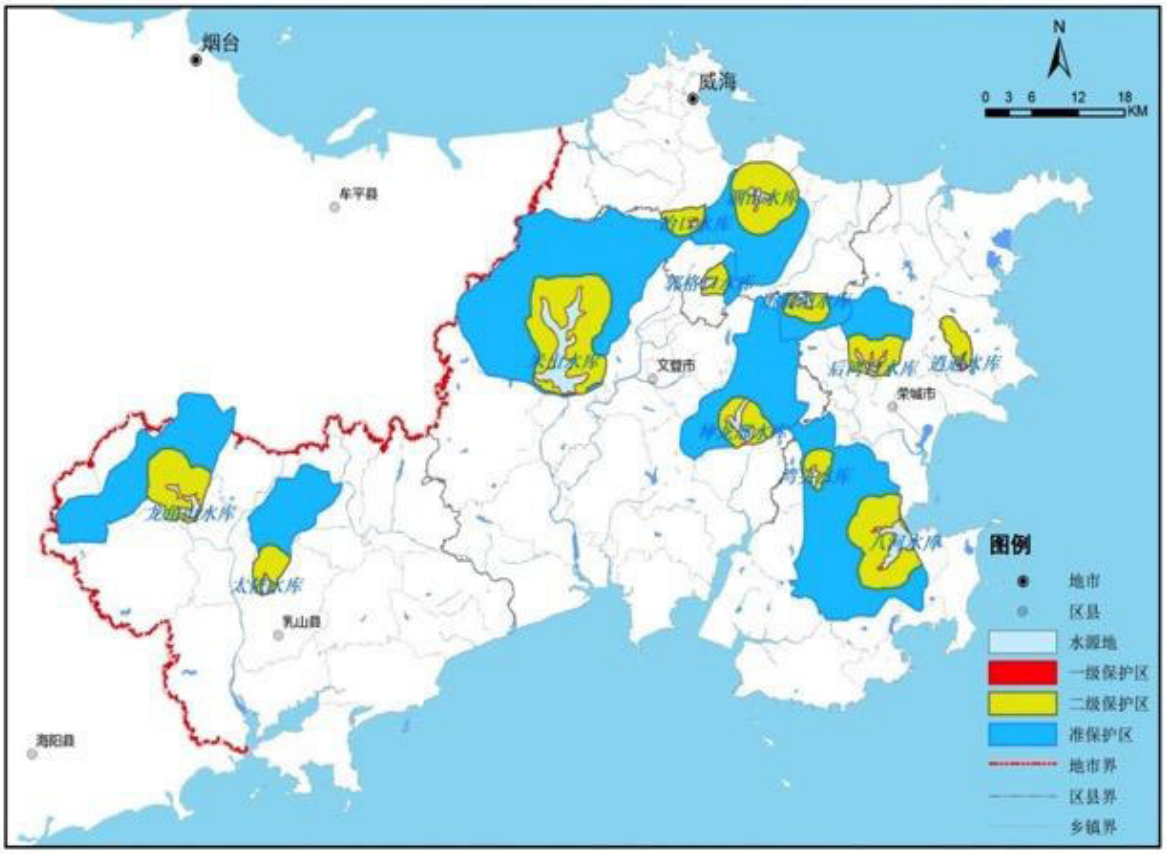


Figure.3-46 Location of Drink water conservation area

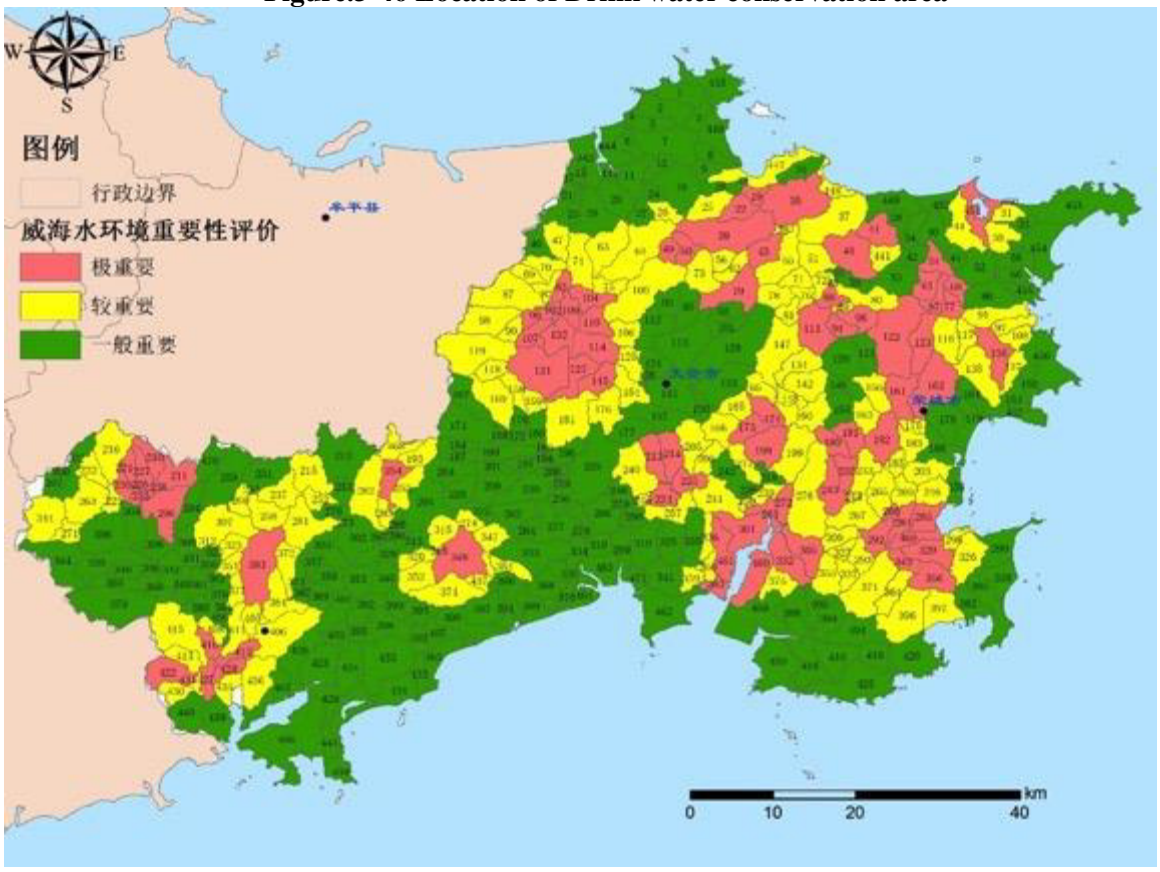


Figure.3-47 importance evaluation of water environment in Weihai

3.4.2.4 Water Environment Grading Methods and Control Measures

Water ecological sensitivity, water pollution absorptive degradation vulnerability, water environment functional importance and other factors are integrated for dividing urban and rural area into water environment red line area, water environment yellow line area and water environment green line area for management at different grades.

Water environment red line area should not be provided with sewage outfall. New construction, renovation and expansion of emission pollutant construction projects should be prohibited (completed projects should be removed or disabled). Construction project approval should be suspended, water environment pollution prevention and control should be strengthened, and industrial point-source pollution with larger impact on water environment should be gradually reduced.

Strict approval standards should be implemented in water environment yellow line area. Comprehensive and systematic water environment monitoring network is established for guaranteeing safety of water environment. Meanwhile, total control and total replacement measures are implemented. Emission of water environment pollutants should be gradually reduced.

Water environmental quality compliance should be actively promoted in water environment green line area in accordance with requirements of relevant economic and social development planning as well as environment protection planning.

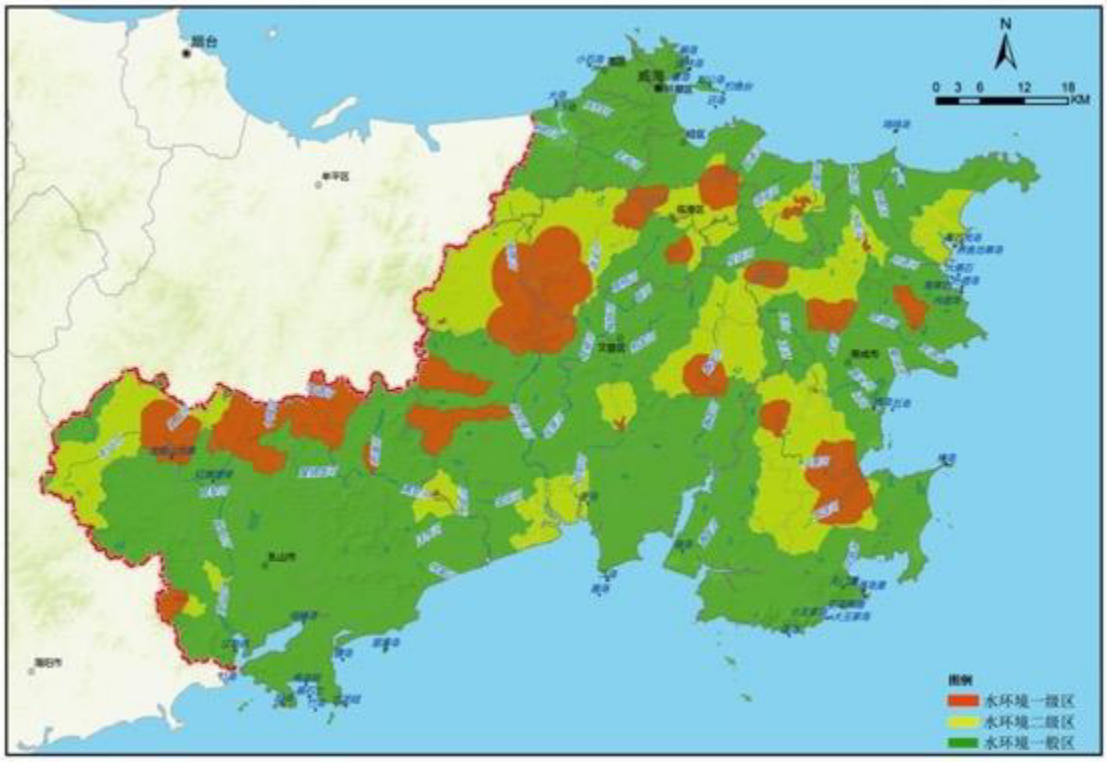


Figure.3-48 Grade control of water environment in Weihai

3.4.3 Indicative atmospheric quality protection zoning and mapping

3.4.3.1 Develop a regional atmospheric flow model

We have conducted practice and exploration on the above-mentioned ideas in pilot cities, and will continuously explore in selection of specific models and methods, selection of evaluation pollutant, determination of evaluation precision and grading parameters. We believe that, for selection of specific models and methods, selection of evaluation pollutant, determination of evaluation precision and grading parameters and other concrete content, they can be determined by comprehensively taking into consideration the factors such as availability of data, the precision of the data, urban scale and current air quality, etc. In general, it is recommended to combine the using of CALPUFF/CMAQ rather than single CALPUFF for analytical technology of atmospheric environment system; resolution should be deepened from 3km*3km to 1km*1km; and analytical object should be expanded from sole SO2 to NOX and PM2.5 and O3.

Table 3-14 Method for atmospheric System Analysis and Delineation of Spatial Control

	Weihai
Selection of air model	CALPUFF/CMAQ
Evaluation method	Concentration vulnerability, layout sensitivity and receptor importance
Evaluation accuracy	Concentration vulnerability, (1 km * 1 km), layout sensitivity (3 km * 3 km)
Evaluation object	SO_2

3.4.3.2 Develop a regional atmospheric absorptive model

The spatial pattern of environmental capacity of SO2, NOx and Primary Particulate Matter of districts and counties have been calculated respectively. Based on the environmental capacity, current pollutant discharge and estimated pollutant discharge, the spatial pressure of atmospheric environment at different regions were determined. Based on three basic principles, such as: atmospheric environmental quality of all districts and counties should not be degraded, emissions in month with bad weather conditions should not be overloaded and the air environmental quality is continuously improving, the constraint goals for pollutant emission in atmospheric environment were determined.

Taking annual average concentrations of the three pollutants reaching class I standard and Class II standard as constraint conditions, the 1km ventilation coefficient was calculated based on WRF-CALMET model; A-value method was adopted for calculating the maximum allowable emissions of SO2, NOx and primary particulate matter in 4 typical months of January, April, July, October and the whole year, with the spatial pattern of environmental capacity of the three air pollutants in districts and counties analyzed.

3.4.3.3 Indicative air shed quality protection zoning and mapping

1) 3D simulation of wind field in full region and analysis on airflow field

Wind field of Weihai was simulated at the resolution of 3 km; combining with the terrain data of Weihai, the features of atmospheric flow field in Weihai were simulated at the resolution of 1 km, with wind directions and wind speed emphasized.

2) Analysis on layout sensitivity

The CALPUFF model was used for quantitative simulation the sensitivity of spatial layout of pollution source, identifying the districts with higher affected scope and degree under equal pollution emission.

3) Analysis on concentration vulnerability

The CALPUFF model was used for quantitative simulation of the transmission and concentration characteristics of air pollutant and identifying the easily concentrated areas.

4) Analysis on importance of receptors

Functional zones of atmospheric environment, existing built-up area has relatively large influence to people's health.

5) Map of Grade Control of Atmospheric Environmental Space in Weihai

Through the above-mentioned processes, based on the spatial difference on layout sensitivity, concentration vulnerability and importance of receptors of atmospheric environmental system, the whole administrative area of Weihai was divided into red line area, yellow line area and green line area of atmospheric environment quality to conduct space control of atmospheric environment.

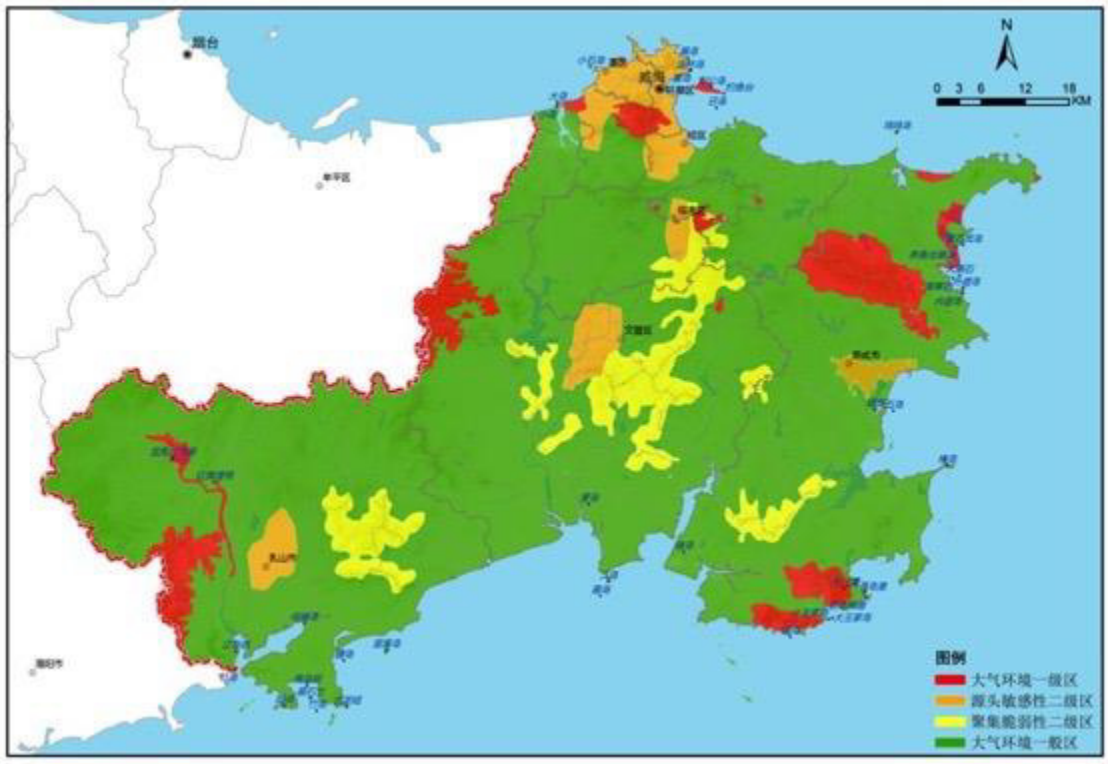


Figure.3-49 Map of Grade Control of Atmospheric Environmental Space in Weihai

3.4.4 Indicative ecosystem protection zoning and mapping

Ecosystem importance is assessed according to different ecological functions in water source conservation, water and soil conservation, biodiversity protection, nutrient maintenance, coastal belt protection, etc. Flood regulation and storage capabilities, wind prevention, sand-fixing and other factors also can be appropriately increased according to actual situation of the city. Importance of the ecosystem can be assessed, and the assessment methods also can be adjusted.

Where, 'National Ecological Protection Red Line-Ecological Function Red Line Delineation Technical Guide (Trial)' (Huan Fa [2014] No. 10) is adopted as reference aiming at assessment

methods of water source conservation importance, soil and water conservation importance and biodiversity protection function importance.

Nutrient material conservation importance assessment regional nutrient material conservation importance is assessed from the perspective of point source pollution and eutrophication of lake wetlands. Eutrophication consequences and severity possibly caused by regional nitrogen and phosphorus loss are graded and classified according to rive grade, river location, impact objective importance and other factors. Coastal belt protection function importance assessment is mainly related to coastal anti-erosion area, storm tide resistance area, mangroves, coral reefs, other important terrestrial and marine life distribution, breeding areas, and coastal belt, beach, coastal zone and other areas which are important for maintaining local ecological environmental safety.

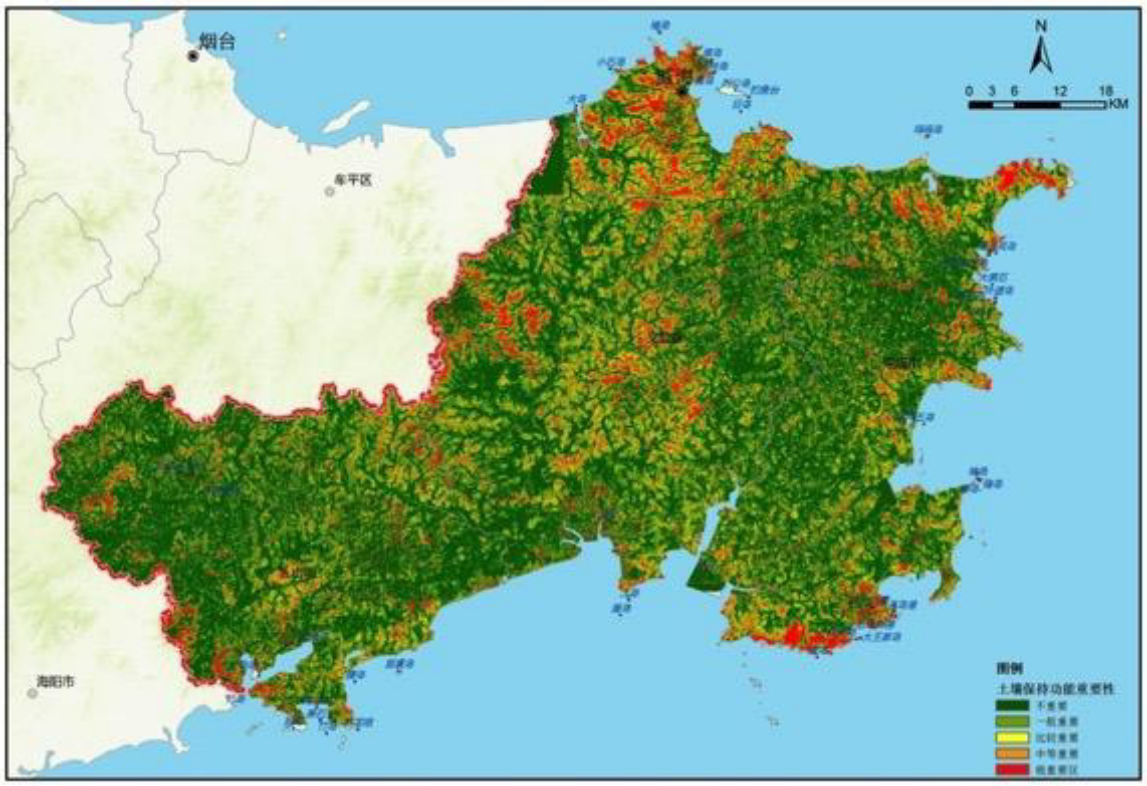


Figure.3-50: **Importance Evaluation of Ecosystem Service Function - Importance of Soil Conservation**

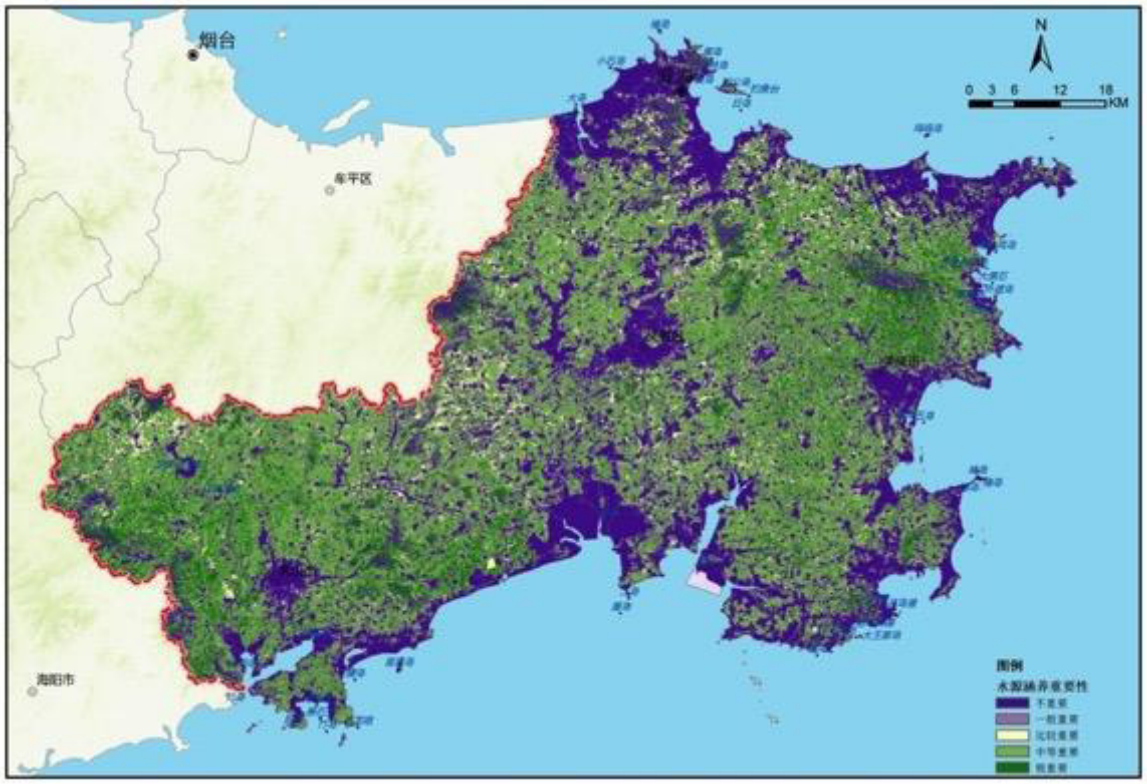


Figure.3-51: Evaluation of Water Conservation Function Importance

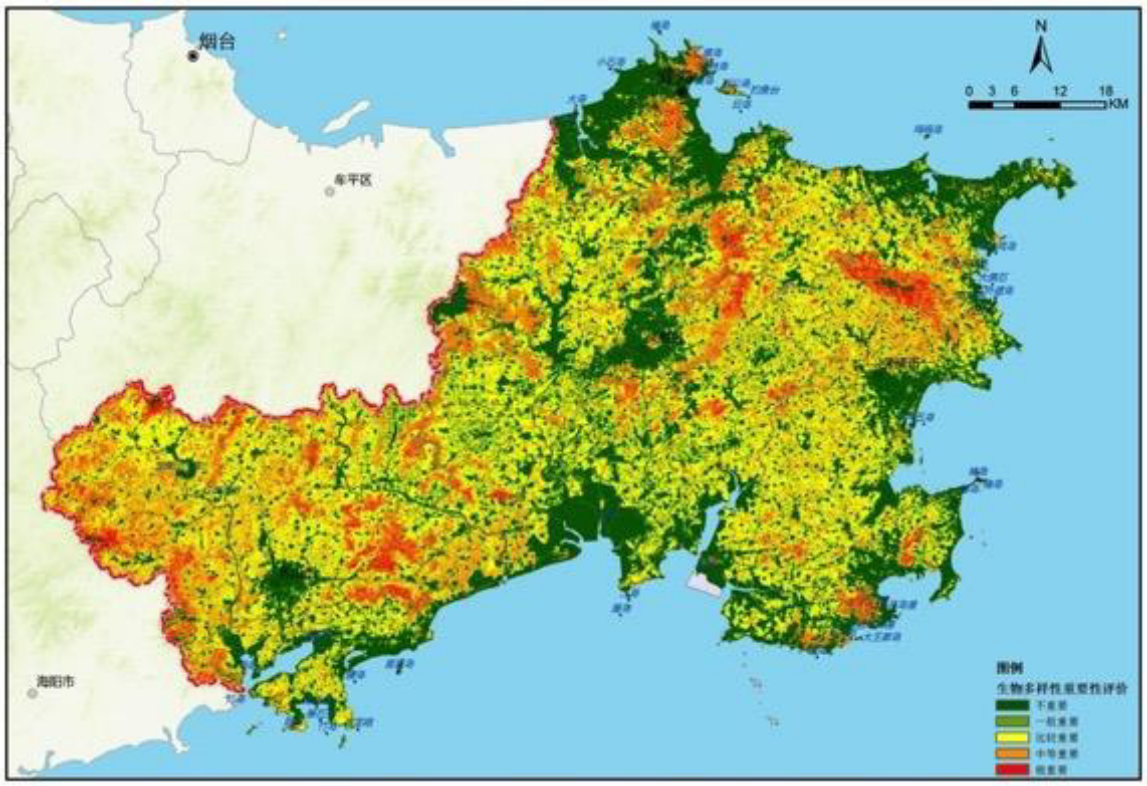


Figure.3-52

Ecological sensitivity assessment is related to individual impact factor sensitivity assessment of water and soil erosion sensitivity, riverside belt sensitivity, soil erosion sensitivity, desertification sensitivity, stony desertification sensitivity, acid rain sensitivity, etc. Different impact factors can be selected for emphasized analysis according to different local natural and geographical conditions.

Qualitative and quantitative combination method is adopted for ecological environment sensitivity assessment. GIS technology is adopted for analyzing sensitivity of individual impact factors. The impact factors are overlaid and integrated according to certain rule, thereby obtaining integrated sensitivity distribution map. Sensitivity levels are assessed and zoned, and these areas can be divided into different levels.

Soil erosion sensitivity analysis is based on Universal Soil Loss Equation (USLE). Rainfall erosivity R value, soil texture, terrain waviness and vegetation type are selected as main impact assessment factors for assessment.

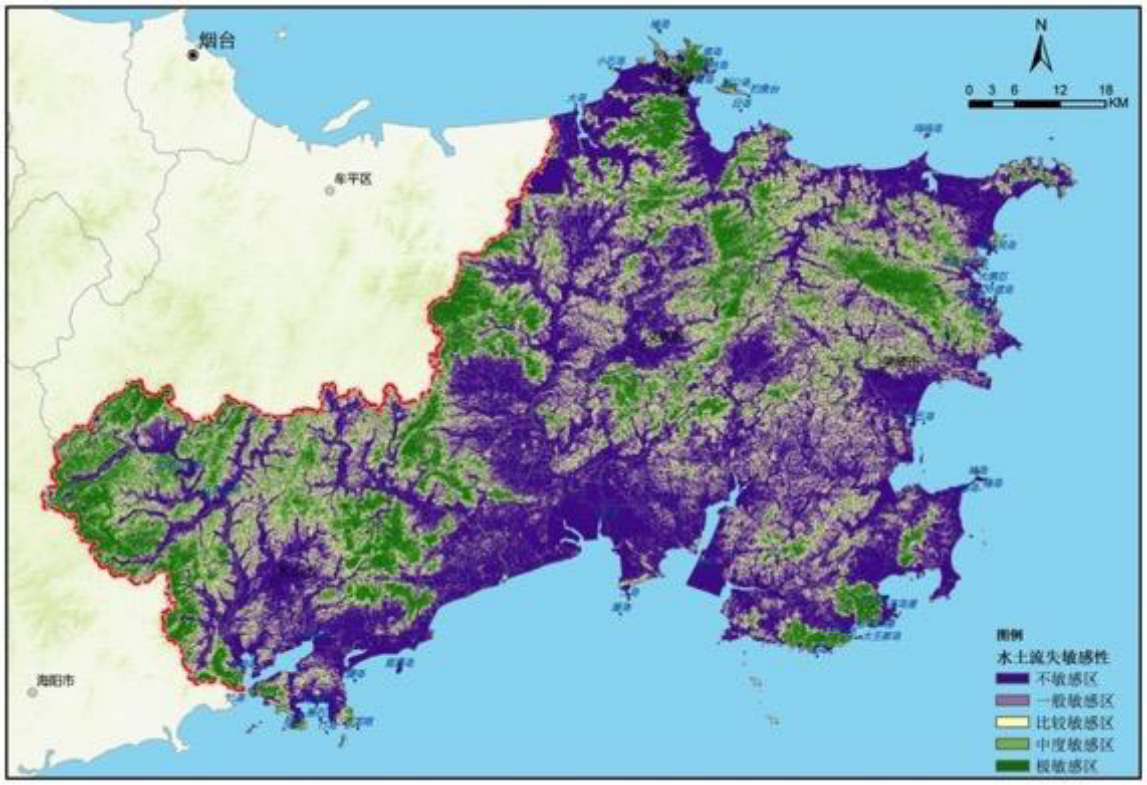


Figure.3-53 Soil erosion sensitivity analysis of Weihai

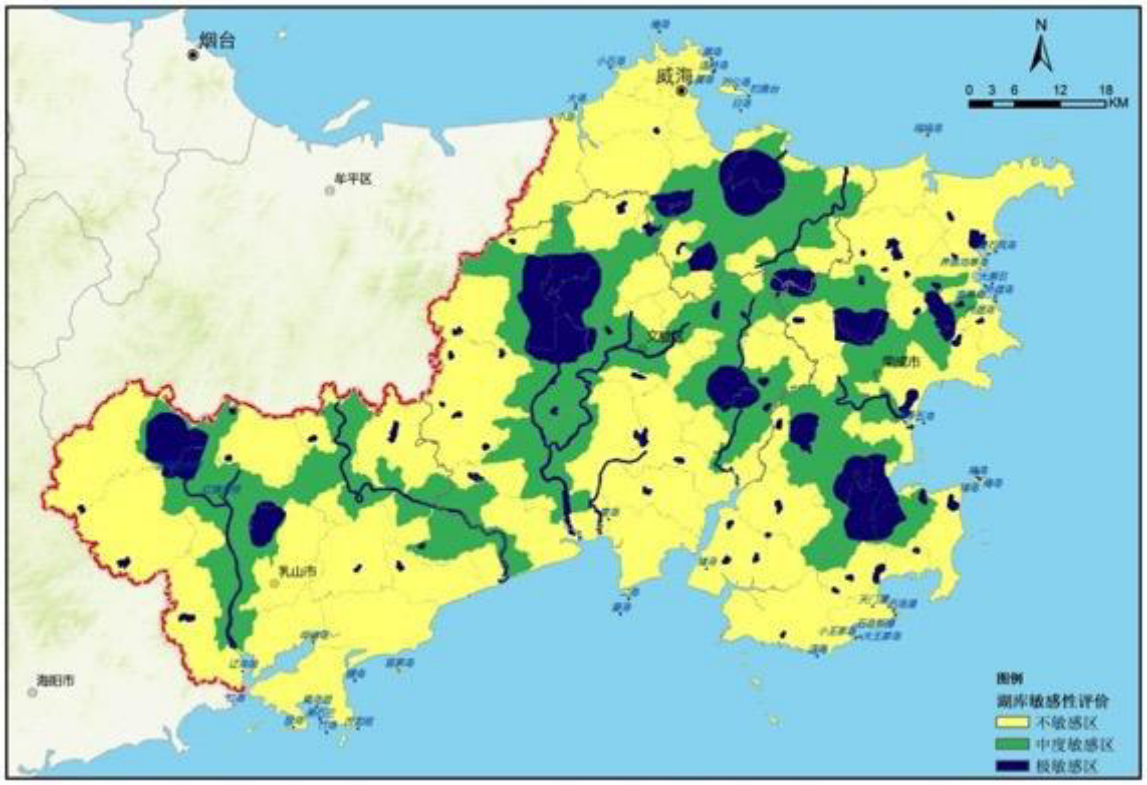


Figure.3-54 Sensitivity evaluation of lake and reservoirs

List method or assessment method is recommended for ecosystem vulnerability assessment.

List method: urban and rural regions, related to national eight major ecologically vulnerable areas, are included into list method according to 'National Ecologically Vulnerable Area Protection Program' (northeast tree and grass staggered ecologically vulnerable areas, north agriculture and animal husbandry staggered ecologically vulnerable areas, northwest desert and oasis connection ecologically vulnerable areas, southern red soil hill and mountain ecologically vulnerable area, southwest karst mountain stony desertification ecologically vulnerable areas, southwest karst mountain agriculture and animal husbandry staggered ecologically vulnerable areas,
Qinghai-Tibetan Plateau composite erosion ecologically vulnerable area and coastal water and land connection belt ecologically vulnerable area). In addition, urban and rural transitional area, riverside coastal areas, coastal shoreline resources, tidal wetland and other regions with staggered ecosystems also belong to ecosystem vulnerable areas. They can be selectively included into ecological environment red line area and yellow line area according to concrete city conditions.

Assessment method: Landscape diversity index, vegetation coverage, soil erosion, elevation, slope, exposure and other natural geographical factors, annual average rainfall, annual average temperature, annual average relative humidity and other weather factors, population and economic density, other economic and social factors are selected as assessment indexes on the basis of ecological sensitivity - ecological restoration force - ecological pressure degree (SRP) conceptual model. Spatial principal component analysis method and hierarchy analytic method are combined for assessing ecological environment vulnerability at different grades under GIS environment, which are respectively included into ecological environment red line area, yellow line area, and green line area.

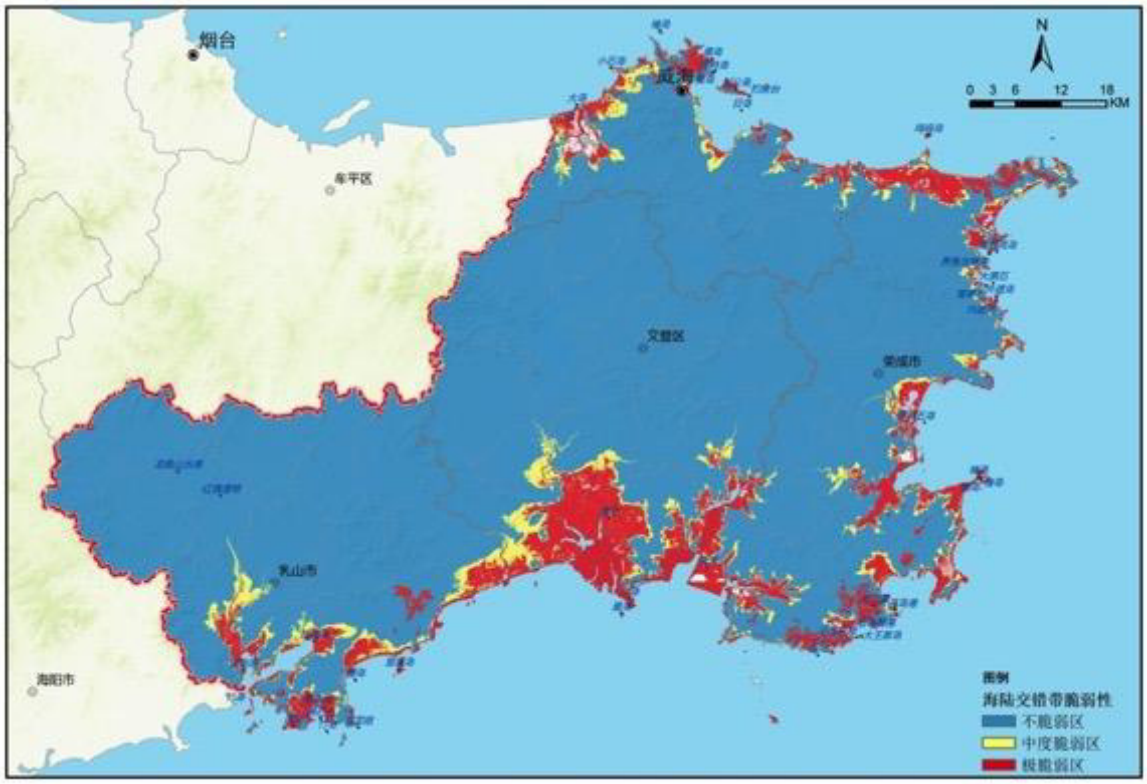


Figure.3-55 Ecological vulnerability assessment of land and sea eco-zone

Table 3-15 Propotional of the area of red-line, yellow-line and green-line area

	Area（km2）	Proportional
Red-line	1761.4	31.2%
Yellow-line	1138.8	20.2%
Green-line	2748.4	48.6%

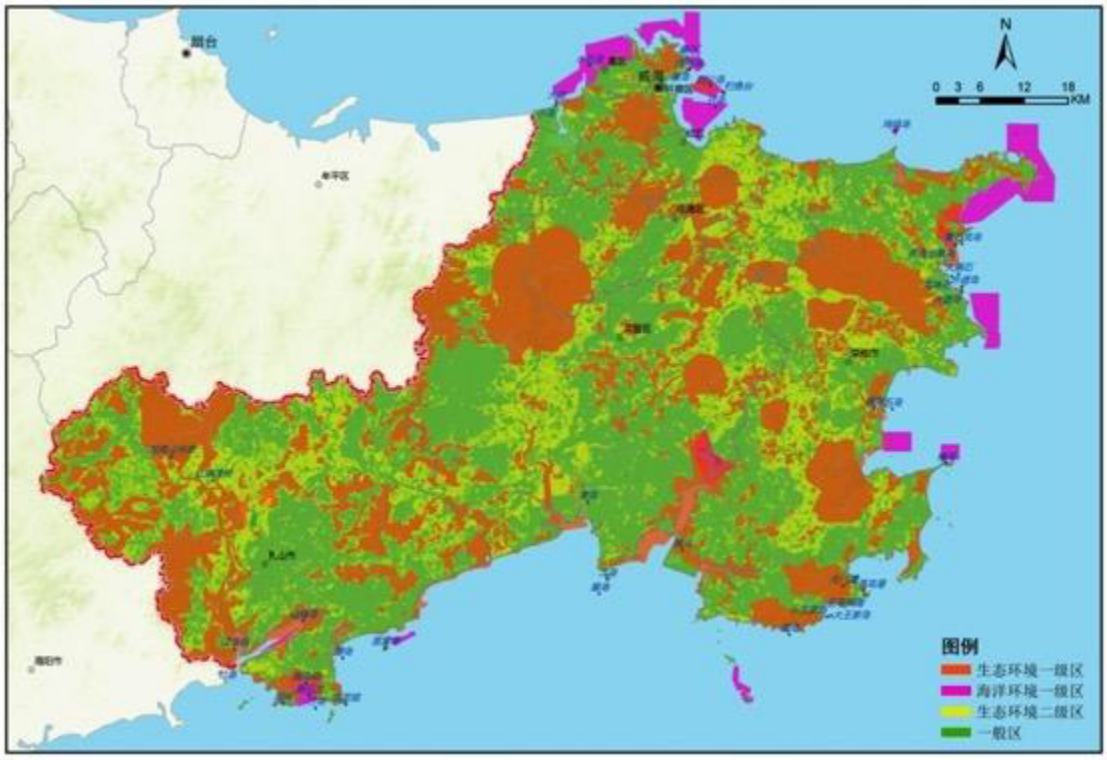


Figure.3-56 Map of Grade Control of Ecosystem Space in Weihai

Table 3-16 Control Measures of Ecological Function Red Line Area

Biology Classification	**Control Requirements**
Ecological function red line area,	Visit and tourism projects inconsistent with natural reserves, forest park and scenic area protection directions should not be constructed. Necessary construction projects in scenic spot should follow requirements in related laws and regulations. Construction land area and construction contents should not exceed related requirements. The built-up unrelated construction projects should be demolished or closed. Population is guided for relocation in order, thereby realizing 'zero emission' of pollutants and improving environmental quality.
Ecological function yellow line area,	Various development activities should be strictly controlled, construction projects damaging ecological environment should not be newly constructed or expanded. Pollution-type industrial projects should not be constructed. Biological environment should be comprehensively remedied in key areas with biological damage and water-soil erosion. Development content, mode and open strength control should be strengthened, various industrial enterprises should not be newly constructed, and area of existing industrial development should not be expanded in principle. More strict industry access environment standard should be implemented, project access should be strictly controlled, and biological restoration should be energetically implemented.
Ecological function green line area,	Biological protection should be focused in regional development and construction activities, development scope, mode and development degree should be strictly made clear. Biological restoration should be strengthened in biological environment vulnerable areas with serious water and soil erosion, etc. in the region, and the above activities should be orderly developed under the precondition of guaranteeing biological environmental health.

4 International Best Practice of UREMP

4.1 Atlas-Australia

Australia has a long history of environmental planning, and a complete environmental planning system 'from top to down' is formed now. Its local environmental plan is the key legal documents, which is used to determine the land use, use of local-level development controlling or land use districts, standards of development, and provisions of other planning.

Take Local environmental planning in 2013 of Coffs Harbour as an example, there are totally 12 categories of environmental planning maps, includes land use map, land zoning map, large-scale map, map of acid sulfate soils, scale map of area, map of heritage, map of building height, additional licensing map, map of land acquisition, urban area map, map of central business district, map of terrestrial biodiversity, water basin map, map of riparian land and waterways. This environmental planning does not involve maps of atmospheric environment, sound environment, solid waste, and electromagnetic radiation. From the point of planning system, the coverage of this planning is low, and it is close to land use master planning in our country.

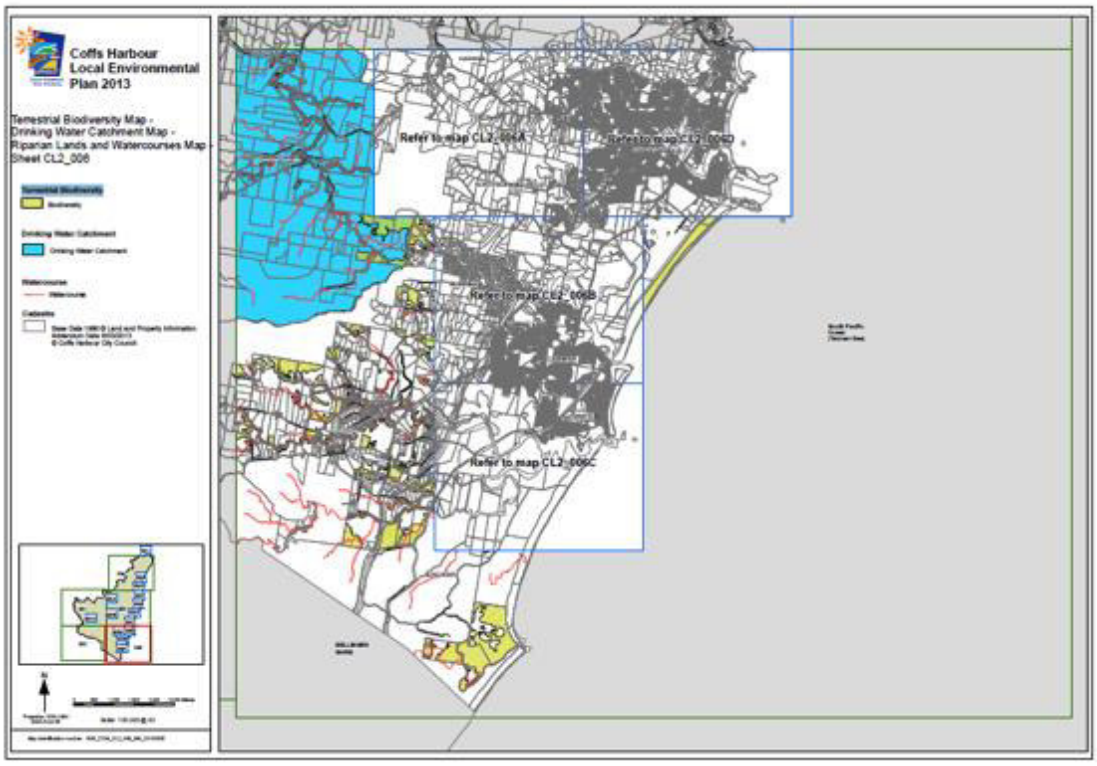


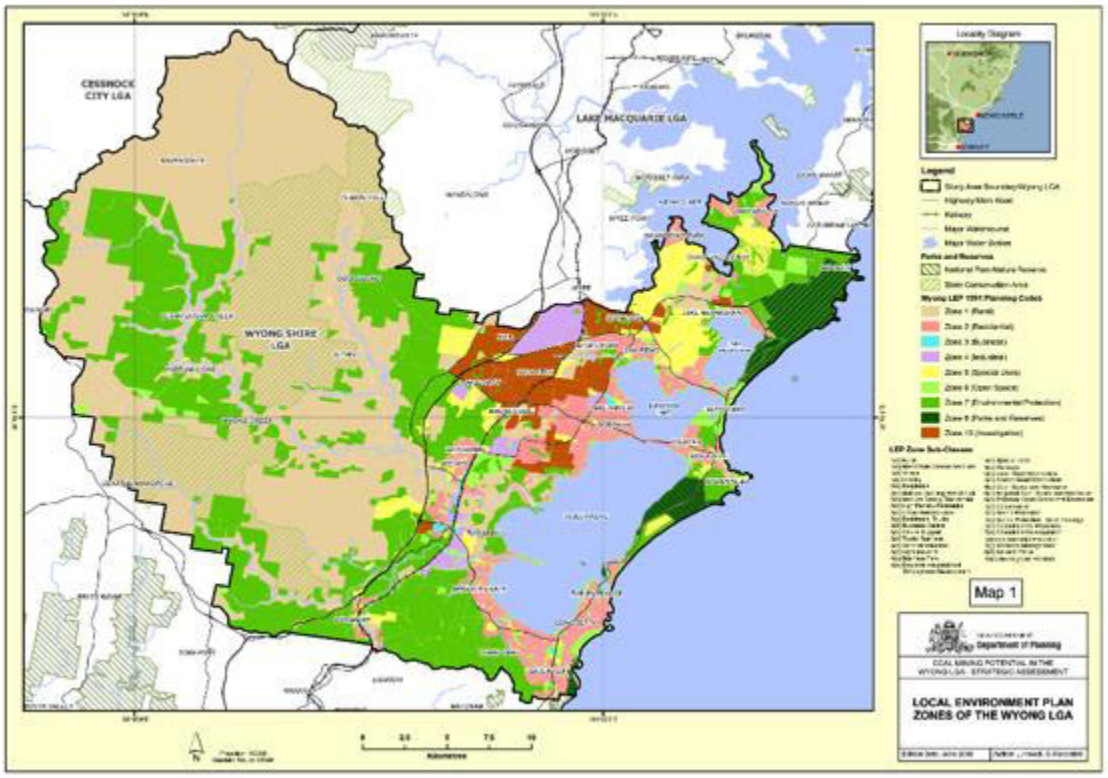
Figure. 4-1 Coffs Harb. CL2_006 1800_COM_CL2_006_080_20130326

The map standards of Australian environmental planning has strict and scientific requirements. As the example of No. CL2_0061800_COM_CL2_006_080_20130326 drawing, its figure number is rigorous and scientific. CL2 is the category, which means map of terrestrial biodiversity, water basin map, map of riparian land and waterways; No.006 represents that the drawing is in the sixth chapter, sub-chapter are added by final syllable ABCD etc.; No.080 represents the top map in this region, sub-chapter is No.020; No.20130326 is the date of map. The category is clear, which involves map title, map boundary and compass. And map scale is 0,100,200,300,600,1200,1800,2400,3000 meters, etc. Map scale expressed as 1:20000@A3，1:80000@A3, etc., according to the map size. Coordinate system adopts GDA1994 (Australia geocentric reference 1994).

As to environmental planning map, as an example of urban environmental planning in Australia NSW WYONG, the map elements are complete, such as figure captions, map boundary, compass, scale, proportion, legend, signature, icon, text description, map specification, drawing number, order of drawing number. Coordinate system adopts GDA1994 (Australia geocentric reference 1994). Legend consist of boundary, roads, river system and water. The natural and environmental elements in the maps are clear, which are represented rigorously and scientifically, and also has a strong reference value.

Figure.4-2 urban environmental planning map in Australia NSW WYONG

From the point of Australia environmental planning content, the elements are clear, but the natural elements are expressed incompletely, especially the biodiversity. There are many status maps,



but little planning map. And the regional environmental planning released does not include analysis map. Overall, content of Australia environmental planning is mostly expressed by words. The reference value of planning map is more significant than practical value, and the organization way of map code has strong reference significance.

4.2 Green Structure Planning in Europe

1. The European Union initiative 'COST Action C11' 2005[1] promotes the concept of 'Green Structure' as an umbrella term to include variously: green belts, open space, buffer zones and all the other labels which planning and environmental professionals apply to land adjoining urban development and transitioning to and integrated with agricultural land and rural landscapes. The term 'green structure' is used in these notes.

2. The COST project conceded that, within Europe, the traditional pattern of 'compact urban islands within a sea of green' has been reversed. These trends continue apace despite negative urban growth rates. The majority of the population now lives in landscapes where this pattern is turned upside down. Structural green space has always been a key element in the western tradition of development planning and the design of urban form; but, in reality, it is seldom considered in a 'holistic' or 'systemic' way which encompasses: intra urban space, extra urban space and inter-urban space as integrated ecological, social and economic assets.[2]

3. If a conceptually coherent, defensible green structure is difficult to achieve in the relatively 'manageable' operational conditions of Europe, what can China then learn from the Western experience? There are both methodological lessons and operational lessons and as is often the case there is 'nothing new under the sun'. So whatever approaches are proposed for the PRC via UREMP, there will be comparable experience elsewhere (including prior experience within China) which either supports or qualifies the final recommendations.

4. The main lesson, perhaps, is that while something approaching a professional consensus on the need for sustainable urban growth patterns may exist world-wide among urban and regional planners, this consensus does not generally extend across political and business interests. In this situation, every green space becomes a battle-ground and the establishment and defence of green structure at the urban and metro-city scales involves extensive and continuous justification.

5. Emerging patterns of incremental and organic growth are seldom apparent in the brief time-frame of political office. Thus a lack of strong commitment at policy level can result in increasingly chaotic patterns of sporadic urban growth and fragmented land use. Cities can become 'locked into' an unsustainable, high-carbon development path at a relatively early stage in the urbanization process, simply through inaction and delayed action.

6. It is pertinent to make some observations concerning the transferability of experience and models via case studies. The governance and strategy formation equation is ultimately context dependent. Although policy transfer is easier in situations of comparable context, even this is no guarantee of success. The main risk factors in policy transfer are: a) uninformed transfer – based upon insufficient information about the policy/institution and how it operates in the country from which it is transferred. b) incomplete transfer – not all the elements crucial to making the policy or institutional structure a success was transferred; and c) inappropriate transfer – when insufficient attention was paid to the differences between the economic, social, political and ideological contexts in the transferring and the borrowing country.3

7. In this instance, the third caveat is crucial. The use of case studies and examples from small, relatively easily managed (often over-managed) European or North American urban administrations with slow-growing populations and balanced economies can be of limited use. It is often argued that

[1] European Commission COST Action C11 Green Structure and Urban Planning, Final Report, 2005
[2] RISE: Region Integrated Strategies in Europe, Final Report 13 July 2012
[3] ESPON Targeted Analysis Based on User Demand , Identifying and exchanging best practice in developing Regional Integrated Strategies in Europe (RISE) 2010

case studies are relevant when the apposite time lag to relevance is applied, but this misses the characteristic ability of emergent economies to bridge intermediate technologies via non-linear pathways. This is particularly relevant in China which has long-since achieved 'developed status' via institutions and technologies which are uniquely Chinese. China can cherry-pick the best ideas but it demands its own solutions.[4]

4.3 The UK Green Belts

8. The greenbelt is both a policy and land-use designation. It is designed to retain areas of undeveloped land and protect the farmland which surrounds urban areas.

"The Government attaches great importance to Green Belts. The fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and their permanence."[5]

9. Historically, the UK government encouraged local authorities to include green belt land in their developmental plans. However, there is less cross-party support for the policy today and the policy has been challenged during periods of economic recession or Conservative administration. Nevertheless, green belt land now covers about 13% of total land area of England.

10. Green belts are not necessarily encircling 'belts' as the name suggests. Although the seminal London Green Belt takes this form, there are other instances where the legislation has been used to create green 'wedges' - axes of protected land which extend into the built-up area of a city, or so-called 'green lungs' – intra-urban zones entirely surrounded by development. Green belts have been criticized for causing sporadic and dissociated development, where new growth takes place in new locations in rural areas, while suburban greenbelt areas remain sacrosanct.

11. Green Belt boundaries are set down in local plans and are precise boundaries at this scale. According to the key UK Government 'Planning Policy Guidance NPPF' a green belt designation must be justified on the basis of its contribution to:

- check the unrestricted sprawl of large built-up areas;
- prevent neighboring towns merging into one another;
- assist in safeguarding the countryside from encroachment;
- preserve the setting and special character of historic towns; and
- assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

12. Green belts are conceived as a 'fixed' element within a generally flexible and adaptable spatial planning system. Green belt boundaries can only be altered in exceptional circumstances and generally transcend local plan updates and reviews.

13. Although the criteria for the establishment of the UK greenbelts (1955) were 'informed' by the embryo environmental movement (which may be linked to the US Dustbowl in 1935), planners only become adequately well-informed concerning the complexities of the symbiotic relationship between town and country over subsequent decades of implementation.

14. Thus, the there is no specific mention in the original UK legislation of, inter alia: sustainable development, ecological function and corridors, or climate change resilience. There is also no mention

[4] Initial Thoughts on the UREMP Project, the author
[5] UK Government, Planning practice guidance, February 2014. http://planningguidance.planningportal.gov.uk/blog/guidance/

of the complex and inter-related nature of green space functions that are now seen as critical. However, the Green belt legislation has now been 'repurposed' via NPPF[6] guidance. The traditional green belt has been harnessed to meet 21st Century environmental objectives.

15. The NPPF guidelines are explicit in setting urban and regional planning at centre of the economic, social and environmental dimensions of sustainable development, stating: *"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure."*

16. Local planning authorities are now required to adopt proactive strategies to mitigate and adapt to climate change. In vulnerable areas, risks must be managed through suitable adaptation measures, including integrated planning of green infrastructure. The guidelines mandate a need: to provide access and opportunities for outdoor sport and recreation; to retain and enhance landscapes, visual amenity and biodiversity; to improve damaged and derelict land; and to promote sustainable patterns of development. When defining boundaries, local planning authorities should: meet identified requirements for sustainable development; safeguard land between the urban area and the green belt to meet long-term development needs; and define boundaries clearly, using physical features that are readily recognisable and likely to be permanent.

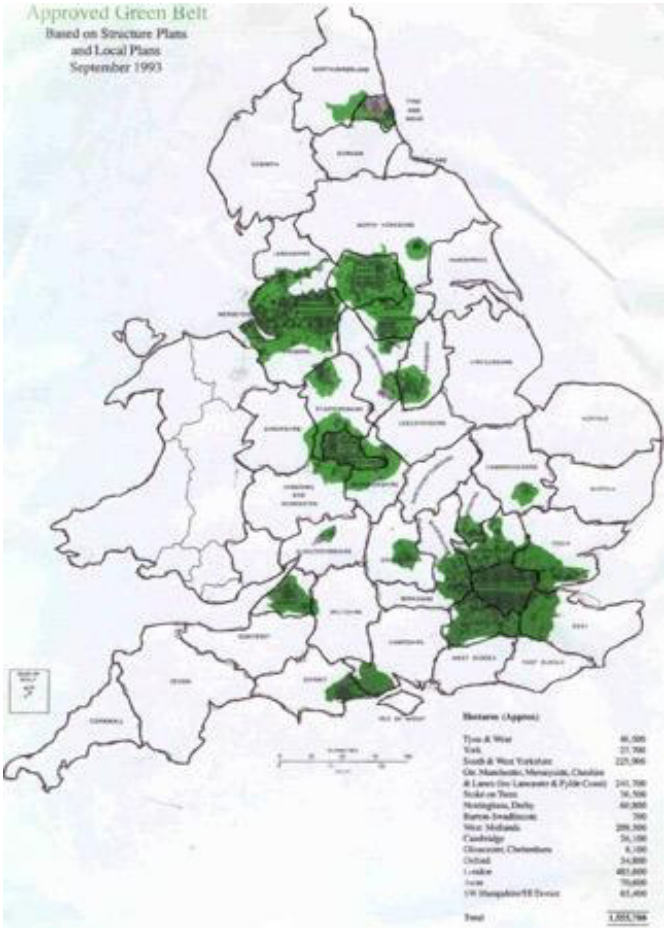
17. Planning and Environment are separate ministries in UK, unlike, say Netherlands. Coordination with the Environment Agency is mandated in the Town and Country Planning regulations. There is no requirement for an Environmental Master Plan; rather planning authorities are required to incorporate strategies to address environmental concerns.

18. The UK Government expresses very similar view to that set down in the PRC's new Environmental Protection Law. UK environmental planning policy is to:

"enhance the natural and local environment by: protecting and enhancing valued landscapes, geological conservation interests and soils; recognising the wider benefits of ecosystem services; minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures; local planning authorities should take into account the economic and other benefits of the best and most versatile agricultural land." Local planning authorities are also required to: *"planning positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure; and maintain the character of the undeveloped coast."*

19. There is also a directive to: *"plan for biodiversity at a landscape-scale across local authority boundaries; identify and map components of the local ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity".*

[6] Planning Policy Framework, Department for Communities and Local Government, March 2012



"As planners began to grapple with the messy realities of urban growth during the 20th Century, green belts gave them a tool to realise a normative geography that a city has natural limits, that urban and rural areas should be separated and that settlements should be balanced and evenly-spaced. Green belts were used as part of a project to construct a universal planning canon, being employed regardless of the contingencies that affect urban growth in different cities around the world. They also contributed to the construction of planning as a discipline, as the open space they preserved could be linked directly to famous UK planners such as Abercrombie and Unwin.

Planning has changed considerably since the early post-WWII period when practitioners attempted to physically realise the ideas of high modernism (Taylor, 1998). As planners seek to direct the growth of cities towards sustainable patterns of land-use, how likely is it that they will continue to see a green belt policy as a useful tool for managing urban growth? Planners are no longer the all-powerful experts that they once were, nor can they rely on a consensus politics that will support such bold measures. The impact that green belts have on market processes sits uncomfortably with the neo-liberal strategies to deregulate government invoked in many countries during the latter part of the twentieth century.

Furthermore, a number of well-known alternatives to a green belt exist, allowing planners to opt, for example for a green wedge, a greenway or a green-web. Despite these forces of change, green belts can be found next to fourteen cities in the UK, where they have remained a central plank of national planning policy for more than fifty years. Planners have successfully enforced green belts despite sustained periods of high development pressure particularly in the South-East of England. Green belts have garnered broad political support throughout successive changes of government. Yet, the UK's green belts are by no means sacrosanct and a debate currently rages on their future in relation to housing and the urban fringe."[7]

[7] Green Belts: A Twentieth-century Planning Experiment, Marco Amati, 2008

4.4 **The US Urban Growth Boundary**

20. Initiatives to address urban sprawl have been very limited in the USA. The National Capital Planning Commission (the authority responsible for Washington DC) published guidelines for urban expansion in the 1960s. These were well-received by planning professionals and environmental activists but failed to make any impact. Subsequently, the Senate introduced a series of land-use planning bills under the Nixon administration. These bills represented a shift in the role of land-use planning, away from urban design and towards environmental protection. Unfortunately, by 1974, this well-considered initiative had also collapsed under pressure from the business lobby. Even today, the Federal Government cannot readily progress environmental planning legislation.

21. The first example of an urban growth boundary (UGB) was in the State of Kentucky in 1958. Since the 1970s a number of state-wide programs have been created. Seven states have mandated Urban Growth Boundaries (UGBs) at the local level.[8] The Portland, Oregon metro-area UGB of 1973 is the most developed and best known.[9]

22. The Urban Growth Boundary creates a sharply defined transition between urban and rural areas. However, the UGB is a 'zoning' concept rather than a 'delineating' concept as the name might suggest. The boundary marks the transition between urban and rural population densities. It maintains a working rural landscape right up to the edge of the built-up urban area. However, within UGBs ecological and miscellaneous-use open space can also be designated; so, while it represents clear constraints on development on the 'rural side' of the line, on the 'urban side' it is not such a clear arbitrator of land use.

23. The current UGB of the Portland Metro area encompasses approximately 400 square miles of urban area and about 1.5 million people live within the boundary. UGBs are implemented through zoning laws (remaining subject to later modification) or land purchases and conservation easements[10] (which tend to be permanent). Oregon's land-use planning laws are administered through the Department of Land Conservation and Development. These laws require urban authorities to maintain a 20-year supply of residential, commercial, and industrial lands inside their UGBs. Five-year spatial plan updates therefore include modifications of the boundary to maintain the land supply requirement and safeguard employment creation.

24. "There are other harms of sprawl as well. It reduces the accountability of citizens to their fellow citizens. To avoid paying for social services to the needy, citizens can move away from the problems. Regional governance has been noted for its capacity to limit the efficiency of such relocation. By defining what is urban and rural, Oregon policy was able to better ensure that the citizens could not, in effect, shoplift the benefits of cities without having to pay for the costs of the city."[11]

25. Oregon's land-use regulation system of was enacted via a Senate Bill in 1973. The process works as follows: Local authorities submit their proposed UGBs to the Department of Land Conservation and Development for approval.12

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[8] Hawaii, Maine, Maryland, Minnesota, New Jersey, Oregon, Tennessee, and Washington.

[9] Urban Growth Boundaries, A Policy Brief for the Michigan Legislature, Michigan State University, Kolakowski, Machemer, Thomas, Hamlin, December 2000

[10] Outright land purchases and conservation easements can maintain de facto UGBs by protecting continuous greenbelts and corridors or maintaining rural reserves with lands of special agricultural, ecological, or cultural significance.

[11] Constitutional, Political, and Philosophical Struggle: Measure 37 and the Oregon urban growth boundary controversy, Benjamin P. O'Glasser, Journal of Constitutional Law, January 2007

[12] The Columbia Region Association of Governments, Metro's predecessor, engaged in a complete planning process and proposed an urban growth boundary for the region in 1977. When Metro was created by voters in 1979, it inherited the boundary planning effort. A year later, the Land Conservation and Development Commission approved the boundary as consistent with state-wide planning goals. Oregon metro website

26. UGB proposals are assessed against State-wide Planning Goals concerning:

- citizen involvement
- land use planning
- agricultural lands
- forest lands
- air, water and land resources quality
- areas subject to natural hazards
- recreational needs
- economic development
- housing
- public facilities and services
- transportation
- urbanization
- river greenway
- estuarine resources
- coastal shore-lands
- beaches and dunes
- ocean resources

27. The intension is to promote the preservation of good-quality agricultural land, forests and open space. At the same time such, the criteria encourage 'urbanity' in built-up areas with densities that support urban facilities and services, particularly public transit options, and allows for affordable housing close to jobs. However, despite overall environmental gains, there is no real evidence that the UGB has met key transport planning objectives concerning journey to work and public transit.[13]

28. The Metro authority state:

"The location of the Metro urban growth boundary involved more than simply drawing a line on a map. The plans and growth projections of Washington, Multnomah and Clackamas counties, along with 25 cities and more than 60 special service districts had to be accommodated. The initial urban growth boundary was based on a projection of the need for urban land as well as the land development plans of individual property owners."

Expanding the urban growth boundary[14]

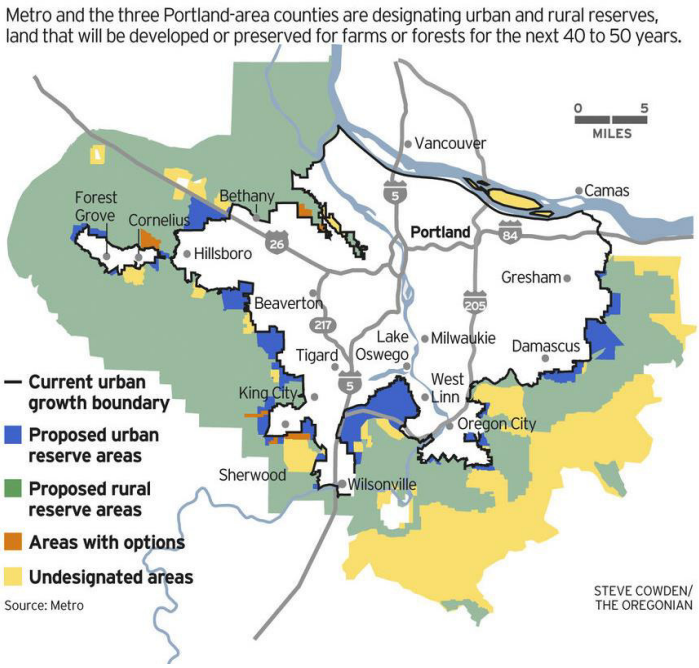
Since the late 1970s, the boundary has been moved as necessary. Most of those moves were 20 acres or less. Metro Council has also approved larger additions:

- 1998, about 3,500 acres were added to make room for approximately 23,000 housing units and 14,000 jobs.
- 1999, another 380 acres were added based on the concept of "sub-regional need." An example of "sub-regional need" would occur when a community needed land to balance the number of homes with the number of jobs available in that area.
- 2002, an unprecedented 18,867 acres were added to the urban growth boundary to provide 38,657 housing units and 2,671 acres for additional jobs. This action also created important regional policies to support neighborhoods, protect industrial areas and enhance regional and town centers. These expansions represented an increase of only about 9%, even though our population has increased by about 17% since 1990.
- 2004, 1,956 acres were added to the boundary to address the need for industrial lands identified as part of the 2002 planning process.
- 2005, the Metro Council added 345 acres of land for industrial purposes which will complete the 2002 planning process.
- 2011, the Metro Council added 1,985 acres to the boundary to help address the anticipated 20-year need for new housing and jobs.

[13] The Effects of Portland's Urban Growth Boundary on Urban Development Patterns and Commuting, Urban Studies, Vol. 41, No. 7, 1333–1348, June 2004, Myung-Jin Jun, October 2003

[14] Source Oregon-Metro Website

29. However, there are undoubtedly unintended impacts on development trends and patterns. Within the UGB, the urban core is growing comparatively slowly, even when demographics are considered. The central city of Portland, accounted for about 8% of the total population growth of cities within the UGB from 2000 to 2004; the inner ring, including cities bordering on Portland, accounted for more than 40%; and the outer suburban cities more than 50%.



30. Thus while core densification is occurring, overall growth is decentralizing despite the constraints of the UGB. Meanwhile, planning constraints on development land and local resistance to densification have escalated land prices and hence housing costs. This has impacted most on the provision of low-cost housing which developers only provide reluctantly and then often in remote, disassociated locations.

31. In the United States, there is strong opposition to what some consider 'social engineering'. The urban growth boundary is seen as impinging on the Fifth Amendment[15] - individual freedom, property rights and the free-market economy. Free-market critics see the UGB as a form of 'social engineering' where society derives benefits through the depreciation of individual property rights. Although local governments in Oregon are required to demonstrate that regional plans provide sufficient buildable lands within the UGB, this was rejected as irrelevant to the argument. Consequently, the famous 'Measure 37' (2006) was launched to 'reclaim' property and development rights outside the UGB. Subsequently, however, 'Measure 49' (2007) more or less reclaimed the UGB status quo.

32. The acrimonious debate surrounding these measures was necessary to test and enforce the concept of green structure in the challenging political environment of the United States. The outcome has proved that in perhaps the least hospitable place for a 'hard' land use policy the population value the environmental benefits over their much vaunted defence of individual freedom.

[15] "....nor be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation." cited from the Fifth Amendment to the United States Constitution

A review of research and housing data across the 24 cities and 3 counties of the Portland UGB found: [16]

- Portland now ranks among the 10% least affordable housing markets in the USA;
- The average housing density has increased from 5 dwellings per acre to 8 dwellings per acre while multi-occupancy housing units makeup about half of all new building permits;
- Even with these increases in density, the Portland area is expected to have a housing deficit of almost 9,000 housing units by 2040;
- High rates of infill and redevelopment were associated with low overall levels of housing production; and
- More than 80,000 single-family homes became "unaffordable" to Portland residents as a result of housing-price inflation.

Lessons were learned from Napa County and Portland's experience with growth boundaries:

- Growth boundaries contribute to higher housing costs, although the magnitude is uncertain. Metro, Portland's regional-planning agency, could alleviate housing costs by releasing more low-cost vacant land for development but chooses not to;
- Growth boundaries encourage families to buy larger homes with les open-space such as gardens and hard-standing (higher plot ratio and plot coverage in areas of height restriction);
- Growth boundaries create new special-interest groups that will oppose growth-boundary expansion, including high-income hobby farmers who want to protect their rural lifestyle;
- Recalls of local officials and the defeat of new funding for the regional-rail system suggests that public support for urban-growth boundaries in Portland may be weakening; and
- Higher housing prices are contributing to concerns by low- and middle-income households that the growth boundary works against their interests, weakening overall support for regional-growth management.

[16] Urban-Growth Boundaries and Housing Affordability: Lessons from Portland, Samuel R. Staley and Gerard C.S. Mildner, October 1999

4.4 The Randstad

33. There is no clear-cut urban and regional planning hierarchy in the Netherlands. Local governments are left to interpret and develop centrally conceived plans and policies.[17] Urban planning is an elaborate and exhaustive process of consultation, negotiation and collaboration that could only exist in a well-managed professional bureaucracy governing a small and relatively stable society. The civic-minded population is closely involved in the decision-making process.[18] This comprehensive and integrated approach to 'governance' means that relationships between the three governmental levels and across the spatial plan framework are in continual flux.[19]

34. The original idea of the Randstad dates from 1958.[20] It was seen as a collection of discrete but interrelated urban regions, sited around the rim of a large central open area and clearly separated by green buffer zones (the 'Groene Hart' or Green Heart). The Randstad consists of an urbanized ring about 60 kilometers across, comprising Amsterdam, Rotterdam, The Hague and Utrecht. There are few long-established small towns and numerous villages within the green heart. Nevertheless, it is largely a rural area, characterized by livestock and arable farming, market gardening and leisure pursuits. The 'hollow centre' gives the Randstad a totally different character from most multi-nuclear metro-cities and city clusters, e.g, London or Paris.[21]

35. The Randstad consists of a ring of cities with a population of about 6 million, and a central core with 670,000 inhabitants. Population density in the outer, urbanized 'ring' is approximately 1,680 per km^2, and in the Green Heart 470 per km^2 (slightly higher than for the Netherlands as a whole). The main part of the Green Heart is located in the province of South Holland, with smaller segments in North Holland and Utrecht. The Green Heart contains 43 municipalities in their entirety and parts of 27 others.

36. Randstad functions as a collection of largely self-sufficient urban regions; when viewing it as a network of cities, Amsterdam is the dominant node, with the rest of the Randstad as a functional hinterland.[22] The Green Heart is thus not entirely rural, nor are the constituent cities entirely urban.

37. Current commuting patterns within the Randstad city network generally support energy conservation and sustainable city objectives. Data on daily commutes suggests significant travel across urban borders. However, roughly three quarters of the working population in the Randstad works within their local urban system, making this the dominant level of scale for the job market.[23]

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[17] RISE Regional Integrated Strategies in Europe, Annex 3 Randstad Case Study, Targeted Analysis, Marjolein Spaans, Bas Waterhout, Wil Zonneveld ESPON and University of Birmingham, 2012.

[18] Population growth 0.4% annual increase from all sources vrs 0.7% USA, 0.6% UK and 0.5% PRC. Economic growth: -0.8% (negative) vrs 2.4% USA, 1.9% UK and 7.5% PRC

[19] *Governance* is from the Greek words *kybenan* and *kybernetes*, meaning 'to steer' and 'pilot' or 'helmsman'. It is the process whereby 'an organization or a society steers itself, and the dynamics of communication and control are central to the process'. *Government* describes a more rigid and narrower set of activities among a narrower set of participants (usually civil servants, elected politicians and some influential or privileged interests).Source: UK Open University website.

[20] Albert Plesman introduced the term 'Randstad Holland' (Rim City Holland) in the 1930s. The term became popular in Dutch spatial policy in the 1950s.

[21] Six Green Heart municipalities may be regarded as largely urban, i.e. Gouda, Alphen aan de Rijn (each of which have a 70,000 inhabitants), Woerden, Waddinxveen, Boskoop and De Ronde Venen (which includes Mijdrecht). Population growth in the Green Heart's rural municipalities has been slightly lower than the national average since the late 1980s, the populations of the urban municipalities have been growing twice as rapidly as those in the rest of the country.

[22] Is The Randstad a City Network? Evidence From Commuting Patterns, Jan Ritsema Van Eck and Danielle Snellen, Ruimtelijk Planbureau (Netherlands Institute for Spatial Research)

[23] This may change as the city networks concept advances. Commuting patterns within the Randstad are characterized by slightly longer distances than in the rest of the country, although the internal rate of increase is slower. The increase over the years has been stronger outside the Randstad. Commuting and the Definition of Functional Urban Regions, The Ranstad, Institute of Community Studies, 2005.

38. Randstad is the best-known planning doctrine associated with Netherlands and advanced by Dutch planners and policy-makers. There is also an extended concept of the larger Central Netherlands Urban Ring, covering large parts of Gelderland and North Brabant. This extended 'ring' seeks to address demand for housing land and to service much-needed economic growth by relieving pressure on Ranstad. However, Netherlands is not immune to the world-wide trend where population and economic activity gravitates towards the capital region. Hence debate continues about how the Randstad should develop further and about how it should be governed, summarized in the government's vision paper 'Randstad Strategic Agenda 2040.[24]

39. The 'Deltametropolis Association' was founded in 1998. The four largest cities combined with another eight municipalities and four regional chambers of commerce in the Randstad to form a pressure group for change.[25] The weight of consensus now is to develop the Randstad region into a metropolitan entity called the 'Deltametropolis'. This move was successful as the Fifth Policy Document of the Netherlands Government 2001 advocated city networks. It included the 'Deltametropolis' as the largest of six urban networks in the Netherlands.

40. Thus National, regional and local stakeholders have formed a broad and growing coalition for change motivated by ambitions to improve the international, inter-regional and inter-urban competitiveness of the Randstad as an investment location. Despite protestations and extensive academic papers arguing the merits of this revisionist policy, there are fears that economic growth priorities now effectively threaten the whole 'ring-city - green heart' concept and turns it on its head. In effect, this 180 degree turn-around could transform a discrete highly urbanized region into a thinly populated metropolitan model more akin to Los Angeles that the traditional pattern of discrete and compact European cities.

41. The current Dutch government policy allows for the larger cities on the edge of the city region to expand within a program of managed growth which attempts to maintain the essence of a green heart.[26] However, all the evidence suggests that the green heart is shrinking and becoming less green.[27]

The Randstad will get more than its share of the extra 0.9-1.9 million homes and 0.74-2.2 million jobs that planners envisage nationally by 2030, workplaces. However, house-builders and industrialists are cautious about emerging trends and the environmental lobby. Central and local government too is aware of implications of change.

The Ministry of Housing, Spatial Planning and the Environment, the Ministry of Agriculture, Nature Management and Fisheries and the Ministry of Transport, Public Works and Water Management have undertaken to work together to enhance the "green" quality of the area. Eleven projects, involving a substantial investment over the next 25 years will be launched in an effort to create and link nature conservation areas, develop both a waterway network for pleasure boats and a sign-posted cycle path network, plan the transitional areas between the cities and the Green Heart, and create new woodlands and recreational areas. The upcoming plan for the development of the former Groene Hart includes four areas: [28]

[24] Randstad Holland towards 2040 - perspectives from national government, Arjen J. van der Burg and Bart L. Vink – Randstad Holland 2040 – 44th ISOCARP Congress, 2008

[25] Global city-region ambitions in the Netherlands: from Randstad to Deltametropolis, Bart Lambregts, 2003

[26] Like many agricultural areas in China, especially in the North, agricultural land in Netherlands may be extensively 'industrialised' via greenhouses and poly-tunnels. Within the green heart there are measures to limit greenhouses and other types of commercial buildings to maintain the rural character and a green-fields landscape overall.

[27] It also shrank because certain regions were no longer regarded as being part of it. These include the 'Little Ring' between The Hague, Delft, Rotterdam and Zoetermeer, a major part of the Haarlemmermeerpolder (where Schiphol Airport is located) and the area around the villages of Vleuten and De Meern to the west of Utrecht.: Explorative modelling of future land use for the Randstad region of the Netherlands, Peter H. Verburg and Jan-Peter Lesschen, Wageningen University, the Netherlands, undated

[28] Randstad Holland towards 2040 - perspectives from national government, Arjen J. van der Burg and Bart L.

- Around the outside of the Groene Hart is the Randstad ring of cities. This is an urban area that almost completely surrounds the Groene Hart. Between these urban areas lie green environs that connect to other green sections of the Netherlands.
- Connected to the Randstad Ring is an extended area with lots of water and forests. This is used for recreation and as a buffer against urban sprawl.
- There will be four core areas for nature and water sports. There will be extended areas of bogs, marshes, and other types of wet forests. These four areas - De Venen, de Krimpenerwaard, Vechtplassen and Hollandse Plassen - will be connected to each other with structural green space.
- Between the core areas and the outer areas will be pastures for nature, recreation, and agriculture.

42. The Ranstadt received extensive international attention in the mid-1960s.[29] Since then, it has been put forward in many quarters as a sustainable urban development model. However, the 'green heart' is perhaps a less coherent concept than its international reputation may suggest. The major cities are as separate and distinct from each other as most adjacent urban areas. Moreover, the original Green Heart was a vague planning concept and its successor, the Deltametropolis, is also a 'descriptive' not a 'prescriptive' term. Randstad remains an area with a de facto structure but no clear boundaries and no clear policies.

43. Nevertheless, the ecological corridors that extend from the Green Heart and run between the cities, known as Rijksbufferzones, have kept the Randstad cities separate, after the fashion of the UK Green Belts. Although this residual green structure was not established to address specific environmental concerns or to further the concept of a sustainable city region it has become a crucial part of the legacy.[30]

Note: Amsterdam on the Northern Wing; The Hague, Rotterdam and its harbour located on the South Wing
Source: Zuidvleugeloverleg (2003)

Vink – Randstad Holland 2040, 44th ISOCARP Congress, 2008

[29] Gerald Burke published a book entitled 'Greenheart Metropolis' in 1966. In the same year, 'World Cities' by Peter Hall extolled the green heart concept.

[30] Green Heart Attack: An Environmentalist's Eulogy for the Randstad, Dutch Grand Planning, and the Compact City, Kate Keleher, 2012

4.5 Emscher Regional Park

44. Emscher has become a model for environmental rehabilitation and economic recovery with relevance to many obsolete heavy industrial areas throughout the World. North Rhine-Westphalia administration created the Emscher Park in 1989. It comprises the inter-riverine region between the Ruhr in the south and Lippe in the north and with the Emscher in the centre covering around 457 km^2 across 20 municipalities. The Landscape Park was established as the central component of an integrated development strategy for the former industrial region. About two million people live in the region. In relation to urban management: at the state level, the State Chancellery is responsible for spatial planning of the North Rhine-Westphalia federal state. It also coordinates the involvement of other relevant ministries.

45. Emcher in the Ruhr Valley was one of the most degraded and depressed post-industrial landscapes in Europe. It was once the country's industrial heartland where coal mines and iron and steel mills served the military–industrial complex during two enormously destructive world wars. This same region was the engine for the German 'economic miracle' during the 1950s and 1960s following catalyst investment via the post-war Marshall Plan.

46. However, by the 1970s as elsewhere in Western Europe this economic model had surrendered to more competitive low cost production centers in Asia. Emscher suffered from the environmental legacy of mining and heavy industry with degraded land affected by subsidence risk and heavy metals pollution. Within the region, large-scale industrial closures had led to a vast inventory of marginally economic brown-field sites. In terms of urban structure, this left a fragmented landscape and a loss of differentiation between urban and rural areas. There was severe ecological damage and untold geological problems. The River Emscher was excessively polluted.

47. There was a long-standing tradition of regional planning with provisions for green corridors and public green linked to environmental concerns for air quality and water supply in the Rhur Region. This dated from the 1950s but could not survive industrial decline.[31] These factors make it difficult and often uneconomic to build new underground infrastructure and reuse contaminated brown-field sites.[32]

48. The Emscher Masterplan established development strategies and identified growth areas and priorities for urban projects, green structure, parkways, water projects and open space as the platform for the development of the regional park system. The Emscher Landscape Park is now conceived as the 'green heart' of a Ruhr Metropolis. It covers about 450 km^2 and includes more than 200 individual regeneration projects following the establishment of the IBA in 1989. On-going operation and maintenance is the responsibility of the Ruhr Regional Association (RVR).

49. The five objectives for the Emscher Landscape Park are:

- preserving the remaining leftover landscape;
- linking up the isolated, separate areas in the agglomeration;
- re-zoning separate areas as parkland;
- reaching agreements both regionally and locally on individual projects with a long-term
- perspective; and
- maintaining and managing the new open spaces in a permanent regional park association.

[31] Hybrid Parks, Parks and Gardens in Spatial Development Policies North Rhine-Westphalia – A best practice case study, 2010

[32] The pre Eshner environment has much in common with Liaoning Province in China where much of the derelict industrial land is not feasible to redevelop according to most cost-benefit models. Nevertheless China has invested in many such areas.

50. The stated intensions are to:

- stabilize and foster the area by starting a transition process which creates opportunities and future perspectives for the people and companies in the area;
- develop an industrial region with a new spatial economic identity;
- attract new economic activities, companies and investments;
- stop and reverse the depopulation;
- create an ecological and socio-economical process of renewal for the Emscher Region and the northern part of the River Ruhr; and
- protect and conserve the old industrial monuments through adaptive reuse as landmarks.

The strategy was established on the back of 2.5 billion Euros of investment commitments from national, EU and private sector sources. It involves: setting up a collaborative process based on a strong spatial concept of green space; combining hundreds of individual project proposals under a single unifying planning context; and networking communities, private investors, individual citizens, local companies and special interest groups

51. As a first step, the extensive inventory of brown-field sites in public ownership was used to generate project ideas. Strategic 'flagship' projects were designed to catalyze environmental transformation. The region's industrial heritage and culture were reinterpreted as assets to create a cohesive regional identity. The master-plan was structured in terms of sub-units each managed by a different steering group. As an essential precursor to attracting outside investment in economic regeneration, low-cost dwelling units were developed via rehabilitation and new-build programs.[33]

52. Emscher is innovative in a number of ways: It uses 'ecology' as the central organizing focus for the regeneration of the region's economy as well as its environment; industrial wastelands are transformed into a network of open space, recreation, and cultural resources at a regional scale; and as the largest derelict area regeneration project in Europe, it confronts brown-field restoration on a regional, rather than site-specific, basis.

53. "*Today, the parks and gardens in the IBA zone (and the larger Ruhr area) are more than just important open spaces for the population of the region. They are also of major relevance for the identity and image and for regional development strategies which do not deny periods of prosperity and crisis, but actively use all these as unique assets. With their high aesthetic quality they are a sign*

[33] Eshmer Park, Transformation by IBA and Masterplan

of a dynamic and forward-looking mood and a request for others, including private investors, to follow this example and to implement high quality development." [34]

4.6 Summary and Inspiration

The spatial planning is the development orientation of urban, economic and resource planning, as well as the core content of integration of several plans and adhering to a plan to the end. For the core characteristics of environmental system such as spatial difference, regional impacts and spatial coupling, the UREMP must break the mindset of traditional tasks and indicators based environmental planning, create a set of technical systems for analysis, assessment, decision making and planning of spatial system, so as to implement the space related policies of environmental planning and achieve an effective connection with urban planning, land planning and economic planning in space. The philosophy of ecology priority and the principle of coordinated development between social economy and environment should be respected and reflected in the space first. The related systems and policies on environment protection should also implement a differentiated management on the basis of a scientific analysis of the spatial characteristics of environmental system.

This was a highly complex initiative involving the creation of an entirely new administrative structure after the fashion of the time-limited development corporations and enterprise zone authorities in the UK – but on a much larger scale. Innovation was fostered through a free exchange of ideas in conferences and seminars, canvassing external expert opinion. Emscher Park has transformed its image as an investment location and has lifted the aspirations of a dispirited population through the simple concept of green structure as a transformative element in the urban environment.

Table 4-1 the summary of international experience for 'green' land

Case Study	Key Characteristics	Current Status	Applicability to China
United Kingdom 'Green Belt' (London and nation-wide)	National-scale zoning and land-use policy instrument, repurposed to address the contemporary concerns of environmental protection, the drive for sustainable cities and the increasingly important climate-change agenda.	Under some threat concerning its impact on cost of housing land in the capital city and impinging on the laissez-faire principles of the free-market economy during periods of economic recession. However, the green belt commands such wide popular support it is likely to weather most short-term political pressures.	Applicable in the China context, but there is a mismatch between the China situation: a) zoning on environmental criteria as supported by the forthcoming environmental law; and the UK situation: b) an instrument based on spatial organization and planning criteria which can be designated without any specific ecological or landscape criteria being met.
United States 'Urban Growth Boundary' (Portland)	Limited location specific initiative which has been continually modified under development pressure, but remains valuable in relation to reducing urban scatter and sporadic development in those	Under threat concerning impact on cost of housing land in Portland and impinging on the laissez-faire principles of the free-market economy enshrined in the 5th Amendment.	Applicable to China, but essentially adds nothing new in terms of the philosophy and tools available to address environmental issues associated with rapid urbanization.

[34] Emscher Park, Germany — expanding the definition of a "park", Judith M. Labelle, 2001

	locations where it is applied.		
The Netherlands 'Randstad' ('Groene Hart' / 'Deltametropolis')	More a description of an evolved urban pattern than a planned or implemented concept. Nevertheless, the urban structure and urban environmental qualities thus created have been influential in the planning profession and have demonstrated the values inherent in specific urban rural land use mixes.	Has not been sufficiently robust to resist the pressures of suburbanization. However, the new development 'concept' for the area is also a possible model for replication with low density suburbs and integral 'green lungs'. The more explicit integration of water elements in delta planning is timely.	The current system is not especially compatible with the objectives of the forthcoming environmental master planning law. Thus there may be limited application to China, except to demonstrate the value of identifying 'desirable' evolved patterns and protecting them to the extent possible to develop a robust green structure.
Germany 'Regional Park' (Emscher)	Location specific initiative to address widespread post industrial dereliction.	Growing in importance as a model for the integrated redevelopment of obsolete urban economies and urban patterns	Applicable to China where comparable initiatives are in progress to support urban regeneration and industrial restructuring in the urbanized 'rust belt' of the north east.