

Zuoling Eco-Valley, Wuhan – a case study on attaining urban liveability through sustainable design at the master plan stage

Introduction

Welcome to Wuhan, the host city of the 2011 ISOCARP congress on urban liveability¹. Its history dating back more than 3500 years, Wuhan is now an important economical, financial, industrial and educational hub in central China. Important economic sectors are the automobile, steel and electronic and optical industries. This city of 9.2 million inhabitants has an ever-increasing population base². In order to accommodate this ongoing expansion large new urban areas like Zuoling Eco-Valley are being developed at a very fast pace.

Zuoling Eco-Valley

Zuoling is one of the many decentralized new urban areas that will be developed around Wuhan. Zuoling Eco-Valley covers 30 km² in the China Optics Valley (East Lake National Independent Innovation Demonstration Area) to the east of Wuhan. The project area stretches from the Yangtze River in the north to Gaoxin no 1 Road in the south and from the border with the adjacent city Ezhou in the east to Gehua West Road in the west. Two other Eco-Cities to the west of Zuoling Eco-Valley, Future-Tech City and Huashan, have been planned and are partially under construction.

Zuoling, on the Yangtze River, is a predominantly rural and agricultural area. At present the northern part of Zuoling is moderately urbanized and industrialized. It has a main town with almost 16,000 inhabitants and several industrial sites for chemical, electrical and metal vessel plants. Scattered throughout the southern part of the area, which is predominantly made up of farmland, are 12 villages that are home to another 20,000 people.



Zuoling Eco-Valley is located to the east of Wuhan (Grontmij, 2011)

The goal for the development of this area is to build a new city that can house at least 100,000 people, including all necessary transportation and commercial facilities as well as social services. Zuoling Eco-Valley should also offer numerous employment opportunities (40.000 jobs), especially in the 4th generation high tech optic-electric sector. Other preferred industries are research & design (R&D), information technologies (IT), biomedical, logistical, environmental and service industries that are to comply with certain standards of sustainability with regards to manufacturing processes, energy provision, mobility, waste and wastewater.

Content

This article describes the sustainable urban design in the conceptual master plan for Zuoling Eco-Valley that we feel should offer a sound basis for the further development of a sustainable and liveable new city.

First, we will describe our approach to sustainable urban design, including the layer approach and using BREEAM communities environmental assessment method at the master plan stage. We will then show the resulting layout for Zuoling Eco-Valley. We will describe how a sustainable urban green network based on the subsoil and existing landscape outlines Zuoling Eco-Valley. Sustainable measures in this green network are discussed per BREEAM category. The measures in the green network are namely to be found in the ecology, climate adaptation and resource (water e.g.) categories. The paragraph ends with the contribution of the green network towards urban liveability.

Subsequently, the urban network, or built environment, will be described. Sustainable measures and the contribution to urban liveability are also discussed. The measures in the built environment are in the transportation, buildings, business and place shaping categories.

Finally, we will discuss why we feel creating a sustainable urban design at the master plan stage is so important for sustainable urban development and could work well.

Our approach to sustainable urban design

In 2011 Grontmij Nederland B.V. was asked by to create a conceptual master plan for Zuoling Eco-Valley based on the “two model society” concept. According to the project developer, Wuhan Zuoling Eco-Valley Development and Investment Co. Ltd., Zuoling Eco-Valley is the first area to test the development of the “two model society”. This concept relates to (1) making Zuoling Eco-Valley environmentally friendly and (2) saving resources in the development of Zuoling Eco-Valley. Zuoling Eco-Valley should therefore be designed as a city that will allow residents to minimize their ecological footprint and to reduce their carbon dioxide emissions.

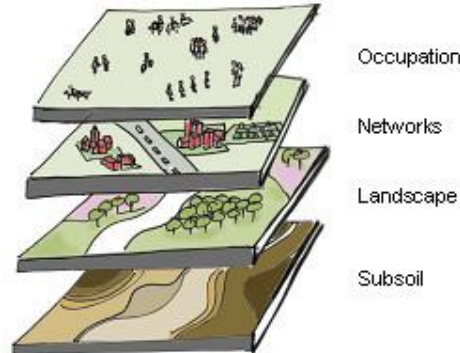
In terms of the holistic idea of sustainability (people, planet and profit) the two-model society concept is mainly about “planet”-aspects. Our idea is to also integrate the other two “P’s” (people and profit) in the sustainable conceptual master plan for Zuoling Eco-Valley. Environmental (planet), social (people) and economic (profit) interests all meet in the development of urban areas. By creating a sustainable urban design for Zuoling Eco-Valley in the conceptual master plan stage, we expect to offer a sound basis for the further development of a sustainable and liveable new city, i.e. a stage where people can lead healthier, ecologically based and economically more productive lives.

Eco-Valley, of course, plays off of the Eco-City concept. In China, the eco-cities are popping up around the country³. The eco-city concept is about making existing cities and new urban development more ecologically based and liveable (Kenworthy, 2006). Urban liveability can be further defined by the following aspects (Kuitert, 2010):

- Attractiveness: high spatial quality;
- A healthy living environment: environmental quality (air, noise, pollution, green) and the encouragement of physical activity
- Accessibility: areas that are usable to everyone regardless of age, ability, circumstance;
- Economical independence and emancipation;
- Identity: creating places with distinct characters;
- Flexibility: designs that can adapt to external changes;
- Safety: social security and road safety.

The layer approach

The basis for enhancing urban liveability through urban design we feel is to be found in the geographical characteristics of the area at hand. According to this approach the natural characteristics of the landscape are the starting point for urban development. The figure below depicts our preferred variation on the layer approach: the subsoil, natural landscape, the networks and the occupational layers (bron). It is based on the layer approach introduced by Sijmons (1998), including landscape, networks and built environment.

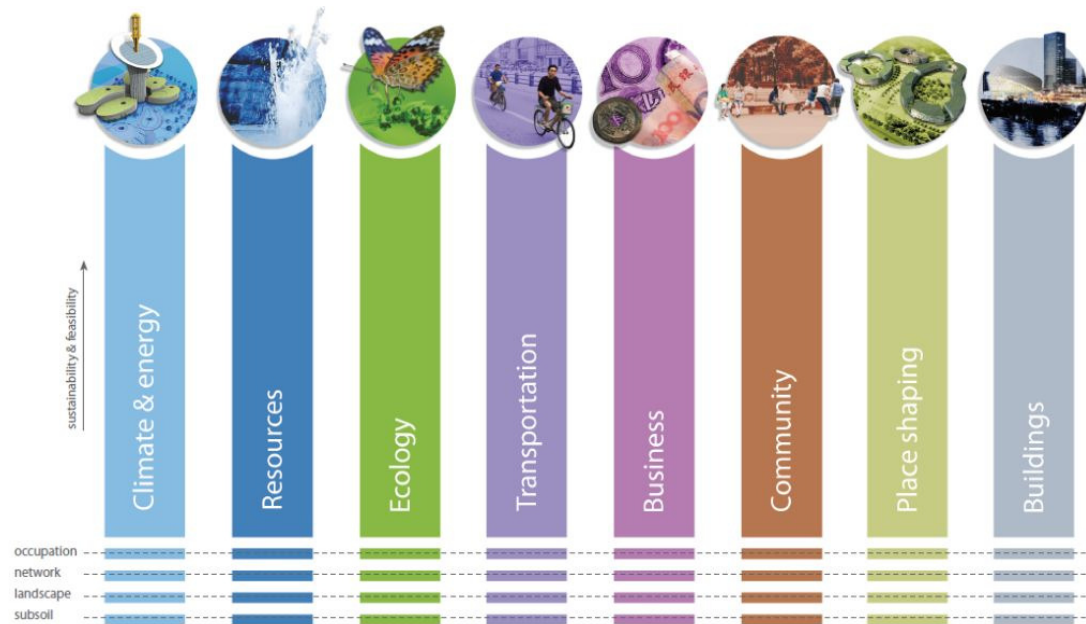


The layer approach to urban design (DLG/DOB, February 2009)

BREEAM communities

How then did we go about implementing the people, planet and profit aspects, in the different layers of the urban design? For an answer we turned to the “BREEAM communities” environmental assessment method (Waddelove, 2010). BREEAM is the leading and most widely used assessment method for measuring the sustainability level of buildings⁴ and cities⁵. By using the “BREEAM communities” assessment categories for cities at the master plan stage, sustainable measures can be explored from the start of the designing process instead of in retrospect. We feel this approach can lead to the more integrated and holistic sustainable development of (new) urban areas.

For the urban design of Zuoling Eco-Valley, sustainable measures were explored for the “BREEAM communities” categories below. The figure schematically depicts how these categories are implemented in the different layers.



Exploring sustainable solutions per BREEAM categorie in all layers (Grontmij, August 2011)

The Zuoling Eco-Valley layout

The layout for Zuoling Eco-Valley shown below, offers a solution to avoiding the problems high-density mega-cities have with regards to high emissions, which are the result the large movement volumes of people, goods, food and water. Changes in the way economic development is stimulated, i.e. that a greater economic growth can be achieved while preserving the eco-systems, also sets an example for urban development. This requires developing an urban area in harmony with natural surroundings, i.e. the existing landscape serves as the basis for the design. It is the source for giving the urban design its own identity that stands out from the identities of other urban areas. The creation of a strong green (20% of the surface area) and blue (another 17 %) structures for Zuoling Eco-Valley are essential components of this urban design as part of Wuhan's total metropolitan development.



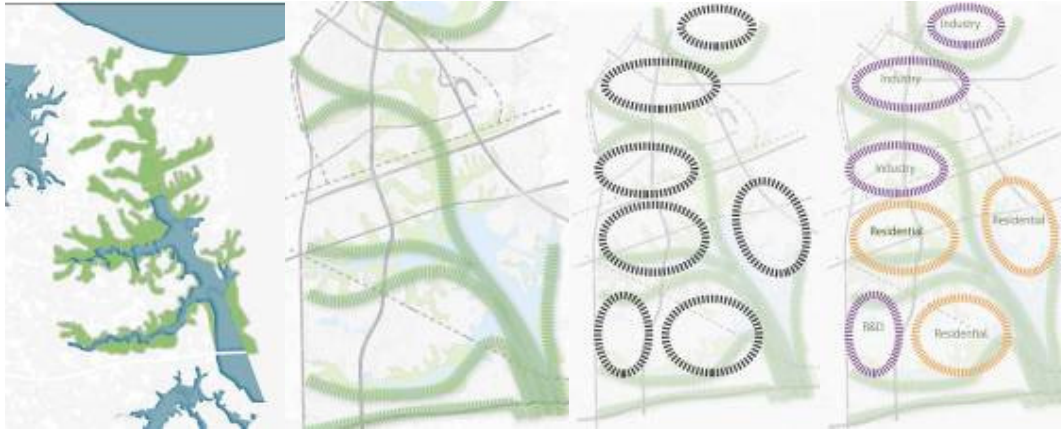
Birds eye view of Zuoling Eco-Valley layout (Grontmij, July 2011)

The green and blue network (subsoil & landscape layers)

Zuoling is located in a lake district and borders the Yangtze River in the north. The landscape in Zuoling is generally quite level with a maximum elevation of approximately 84 meter above sea level in the south western corner. The lower parts, where the lakes and other waterways are located, constitute the backbone of the urban design. Conserving these structures makes it easy to integrate natural and ecological corridors into the urban design.

The green and blue network is the guiding principle for the design of Zuoling Eco-Valley and gives this new part of the city its unique identity. Giving Zuoling Eco-Valley a natural, open and pleasant character, it is the natural framework for the various urban neighbourhoods. The interconnection of all these corridors creates a strong framework. All buildings are up to 400 meters away from the larger scaled green network. To get from a building to the green network of parks of Zuoling Eco-Valley, green routes have been designed with squares and parks along them at various levels and with various functions.

At a local level, everyone living, working or spending free time in Zuoling Eco-Valley will always be very close to an attractive green space. Green spaces come up to the doorstep of the residents of Zuoling Eco-Valley. Residential buildings will be built around car free, (semi) collective gardens, or courtyards.



The existing landscape as a basis for the layout of Zuoling Eco-Valley (Grontmij, July 2011)

Ecology



The green and blue network can support a broad range of habitats, promoting biodiversity both on land and in/under water. Maintaining biodiversity is important because it helps to prevent spreading of infestations and minimizes other health risks for the future residents. It could even support sustainable food production.

To ensure rich biodiversity within the network, fauna passages can be made where green and water corridors cross the main infrastructure (railways and highways) in the area. By incorporating these passages in the design, small mammals and amphibians can move around freely within the inner (green) part of the Wuhan metropolitan area.

Anticipating climate change



The master plan takes the foreseen extreme heat due to climate changes into account. There is a clear connection between green and blue network and the prevention of increased temperatures in cities. An extensive green network increases evaporation and reduces heating and the effect of urban “heat islands”. The design incorporates breezeways that allow the passage of a cooling breeze into the built environment. They are positioned in such a way that air that has cooled over the lakes and parks has a natural cooling effect on the rest of the city in the summer season. This prevents streets and squares from overheating and conserves energy that otherwise would have been required for cooling buildings. The green network will also result in a higher air-quality.

Water



The master plan offers a solution for handling of water surpluses due to climate change. In urban areas clean rainwater and wastewater (sewage) will be separated at the source at the building level. This separation ensures that rainwater will directly recharge groundwater and/or surface water systems in the green network, by way of green roofs, open surfaces, roads and wadi's. The rainwater will partly be collected in ponds that will naturally be kept at a sufficient water level. This allows the water to slowly move through the urban area and prevent flooding in doing so. Surface water also offers natural cooling, as mentioned above, and exciting playing areas for children.

It is the ambition that the lakes can be used for fishery, irrigation for agriculture, for recreation and as a source for drinking water. The city of Wuhan has started up a program aimed at improving water quality in lakes. One of the problems is that the excessive nutrient concentrations, usually of phosphorus, lead to the eutrophication of lakes. This, in turn, results in an abundance of algae, which eventually decay causing the oxygen levels to drop. High concentrations of algae also affect the quality of the (drinking) water and some types of algae are even toxic to animals and man. We encourage starting up a programme of

monitoring, assessment and action to improve the water quality of the whole Zuoling Eco-Valley area.

Contribution to urban liveability

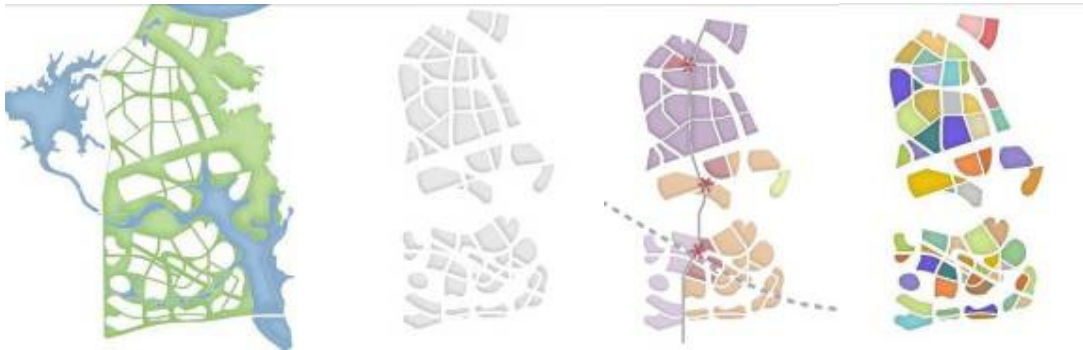


The green network of Zuoling Eco-Valley will offer many attractive areas for people to live, work and spend their free time in. The green and blue network will have a wide variety of characteristics, functions, forms and scales that give it distinct identities. The scale of the green network also provides enough space for new parks that can accommodate large numbers of people for major events and performances. Accessibility is another important issue with regards to liveability; no resident will live more than 400 meters from the green network. Moreover, the distances within Zuoling Eco-Valley are ideal for cycling and the cycling network will be designed accordingly. The green and blue network not only contributes to a better environmental quality (air quality, cooling), it also encourages physical activity: wellness centres, swimming pools and other sports facilities will be developed here. The extensive high-quality green and blue network in summary adds to the attractiveness, healthy living environment and accessibility of Zuoling Eco-Valley.

The built environment (network & occupation layers)

Using the existing landscape as the starting point for an urban design offers a very useful basis for designing the built environment, i.e. the network of housing, industry, city centres, infrastructure and public space.

Traditionally urban areas are built on higher ground as this location offers protection from flooding, for example. It is also cheaper and easier to build here because of the soil conditions and groundwater level. For instance, the costs for the foundations of buildings are lower. The natural elevation in the landscape also supports an extensive sustainable urban drainage system.



The green & blue network, built environment, functions & distinct neighbourhoods (Grontmij, July 2011)

Business areas



One of the main goals for Zuoling is the development of new business areas offering 40.000 people a job. Both an industrial area and a research and design (R&D) area have therefore been incorporated in urban design. These business areas will generate many jobs and employment opportunities for future residents. Based on the described existing functions and landscape structure, an industrial cluster will be located in the northern part of Zuoling Eco-Valley. The R&D industries are located in the south-west corner and will be related and linked with the R&D industries in the nearby Future-Tech City. The business areas offer space to industries that are to comply to certain standards of sustainability with regards to manufacturing processes, energy provision, mobility, waste and wastewater.

The existing agricultural businesses that now characterize the area are part of the urban design. At a large scale, agro-business parks have been designed. At a smaller scale the metropolitan agriculture concept can be unrolled by creating spaces for community gardens and green roofs.

Residential areas



The residential areas will mainly be in the southern part of Zuoling Eco-Valley. The existing Wuda Railroad line divides these areas from the business areas in the north.

Every neighbourhood in the city will have a specific identity. To make an urban area attractive and pleasant to live in, we feel it is important to divide the neighbourhoods in the city into smaller areas (groups of buildings), each with a distinct own style or character complementary to the overall identity of the neighbourhood. This can be attained by using different plot ratios and building heights, different types of architecture and designs of public spaces and different scales and styles of infrastructure.

The design of defensible spaces, where there is a clear distinction between the lively public fronts (i.e. with commercial facilities etc) and private backs of buildings, is encouraged. An appropriate urban design can reduce the opportunity for crime. They help create a vibrant community on the one hand and an urban area where people can feel safe and have less fear of crime on the other.

Architecture



In a next stage of the development the master plan will be translated into architectural designs. As mentioned above, every neighbourhood has a specific architectural identity. The groups of buildings within these neighbourhoods contribute to this identity. We also encourage the use of highly reflecting materials in order to help keep buildings cooler. The architectural designs of the buildings should also include overhangs that help shelter the homes from the sun in the summer and allow the sun to shine in in the winter.

Transportation system



The main guiding principle for Zuoling Eco-Valley's transportation system is called "modal diversity". Application of modal diversity can help balance urban economy and ecology. The proposed character and size of Zuoling Eco-Valley supports the incorporation of the model. The starting point of the model is that all residents have the freedom to choose for the best transportation option that fits their varying daily activities:

1. walking and cycling
2. public transport such as train, metro, bus
3. private car or motorcycle.

Application of modal diversity from the very start of the urban development process has proven to be the most consistent model for a sustainable urban development (Pettinga, A., A. Rouwette, et al. 2009). The success of the modal diversity concept is the high density of the network and the linking of the different networks of modalities. Incorporating nodes and hubs like multimodal stations in the design, make mixed land-use attractive and successful

Many short daily shopping and social trips of future residents will be within the city limits. Bicycles can become an important mode of transportation for Zuoling Eco-Valley, since the distances here are ideal for cycling. Cycling is also very environmentally friendly and healthy. It is an important part of the modal diversity philosophy. The roads are to be safe and the distance between work, residential areas, the facilities, city centres and the green network as short as possible (Pettinga, 1996). The bicycle network will be physically separated from motorized traffic in order to ensure safety and ease of movement.



Contribution to urban liveability

Like the green network, a sustainable built environment also contributes to the urban liveability of Zuoling Eco-Valley. As mentioned, each neighbourhood in the city will have a specific identity. A few sustainable iconic buildings (or landmarks) have been added to the urban design highlighting the sustainable quality of Zuoling Eco-Valley. The design of defensible spaces, where there is a clear distinction between the lively public fronts (i.e. with commercial facilities etc) and private backs of buildings, is encouraged.

Flexibility and being able to adapt to changes in climate, peoples needs or technologies, is important. The layout of Zuoling Eco-Valley offers flexibility at this abstract level. Functional areas, for example, can be interchanged if necessary.

Furthermore, the availability of diverse modalities in Zuoling Eco-Valley is very important for increasing the accessibility of the area. Multi-modal nodes and hubs play an important roll in interconnecting modalities. A high quality cycling network is an important part of the transportation system.

A sustainable well-designed built environment can, in summary, contribute to economical independence of its residents, a strong urban identity, flexibility, accessibility and safety.

Conclusion

Our goal for Zuoling Eco-Valley is to create a sustainable urban design at the master plan stage that will be a sound basis for the further development of a sustainable and liveable new Eco-Valley. The area should house at least 100.000 people, including all necessary transportation methods, commercial facilities and social services, and offer numerous employment opportunities, especially in the 4th generation high tech optic-electric sector.

The layout for Zuoling Eco-Valley is the result of our layer approach to sustainable urban design. Using the existing landscape as the starting point for an urban design offers a very useful basis for designing the built environment. The creation of a strong green and blue network for Zuoling Eco-Valley is an essential component of this approach. The green and blue network, covering approximately 37% of the total surface area will give this new part of Wuhan its own unique identity.

We explored sustainable measures for Zuoling Eco-Valley per BREEAM category. The measures in the green and blue network are namely to be found in the ecology, climate adaptation and resource (water e.g.) categories. The measures in the built environment are in the transportation, buildings, business and place shaping categories. All measures, we feel, can more or less contribute to the sustainable development of Zuoling Eco-Valley.

The green and blue network and the built environment, as now designed in the conceptual master plan, are both expected to contribute to different aspects of urban liveability. The extensive high-quality green network adds to the attractiveness, healthy living environment and accessibility of Zuoling Eco-Valley. A sustainable well-designed built environment can contribute to economical independence of its residents, a strong urban identity, flexibility, accessibility and safety.

In the end we feel that the chosen approach has worked well to create a sustainable urban design at the master plan stage. The holistic approach to sustainable urban design helped us tackle all relevant aspects for the conceptual master plan. We believe that by taking the sustainability measures into account in this early stage of the development process, it will have a much better chance of holding up and eventually leading to the construction of a sustainable and liveable Zuoling Eco-Valley.

The design process may be a bit more expensive because of this approach, but should lead to a cost and time efficiency in the next stages of the development (i.e. further detailing, engineering and construction stages). But, as this project is still in the master plan stage, it of

course still remains to be seen if the proposed measures for Zuoling Eco-Valley can be put into practice during these next stages (expected from 2012 onwards) and, in time, will have the effect on urban liveability that we now anticipate. For now, we feel the chosen approach has contributed to a well-balanced holistic sustainable urban design.

drs. Renske Dijkwel, Urban planning consultant, Grontmij Nederland B.V., The Netherlands
ir. Teske de Ruijter, Urban designer, Grontmij Nederland B.V., The Netherlands
ir. Pieter Krant, Senior landscape architect, Grontmij Hubei, China

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¹ 2011.isocarp.org

² ISOCARP Congress 2011 – preliminary congress brochure.

³ For example Tjianjin Eco-city in northern China and Dongtan Eco-city near Beijing.

⁴ Grontmij is the first assessor and advisor (2009) for existing real estate (BREEAM-in- Use) and is now able to execute assessments and advisory throughout Europe.

⁵ breeam.org