HOW CAN MULTISCALE MAPPING GENERATE A MULTIFUNCTIONAL URBAN PUBLIC RIVERFRONT?

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Dedication

to my parents
and grand aunt
Acknowledgments

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Chapter One

INTRODUCTION
ABSTRACT

Given the increased complexity and uncertainty of the landscape milieux, mapping as a liberating, enabling, creative activity plays a pivotal role in the design process and affects how we understand and act upon the world. This project employed multiscale mapping to not only interpret, speculate on and explore the performance of an urban public riverfront (Tui Glen Reserve within Henderson Creek Corridor), but also to generate a responsive site design incorporating various landscape performance requirements revealed by the multiscale mapping process. Although the information that emerged from the multiscale maps was inevitably influenced by my mapping protocol and agenda, the project shows that multiscale mapping offers a potentially powerful framework for an improved understanding of the landscape, which in turn, may generate a design capable of responding to different conditions at different scales.

THEORETICAL BACKGROUND

Contemporary landscape architecture has experienced a shift of emphasis from the design of enclosed objects to the design and manipulation of larger natural and social processes, territories, programmes and events. This shift indicates an interest in the performance of landscape rather than the representation, stylization, or even cultural meaning of the landscape (Wall 1999, Corner 1999, Reed 2007). There is a move to more holistic thinking and new design strategies and techniques that allow the negotiation, interpretation and creation of a contemporary landscape. Mapping is a traditional instrument to help people make sense of the world. However, it has been said that mapping also “plays an important role in stimulating the human imagination to reach for the very meaning of life on earth” (Wilford 1987, p.4).

Mapping is an increasingly vital activity that underpins diverse disciplines and links the tangible world with the intangible. Mapping technologies today are as diverse as the agendas driving them: social networks are mapped with dynamic digital interfaces; buildings are mapped with lasers; cities and regions are mapped by satellite. Mapping is a fundamental design process that increasingly shapes the physical and conceptual dimensions of the contemporary world. It is a core aspect of what designers do. But as Corner (1999) advised, there is a need to develop various procedures and techniques of mapping which are better correlated with inquiry, research and criticism; critical experimentation with new and alternative forms of mapping remains largely under-developed or under-practiced.
A BRIEF HISTORY OF MAPPING

Mapping as a visual representation of projected elements has existed for centuries. The earliest extant world map, a clay tablet, was made by Babylonians and dates from 6,000 BC (Fig. 1). The Babylonians mapped their property lines and city walls with some accuracy. However, outside those boundaries, what they didn't know they either ignored or invented - a habit which lasted at least until the 20th century (Wilford 1981). In this sense, the cartographic procedures of selection, omission and invention “make the map already a project in the making” (Corner 1999, p. 216).

Ancient maps show that mapping conventions were established very early. A 2300 BC Nuzi clay tablet map from Northern Iraq is oriented: it shows three cardinal points, east (top), west and north (Wilford 1981, p.8). Maps found in Hunan Province, China, dating from the 2nd Century BC, showed well-advanced cartography and were surprisingly accurate and detailed for their time (Fig. 2). These 1:170,000 and 1:190,000 maps depict much of the topography of what is now Hunan Province as far as the South China Sea. Some parts of these maps may have employed on-the-spot surveys. Another advanced feature of these maps is their use of standardised symbols and legends, for example, the names of provinces are in squares, and cities and villages in circles (Wilford 1981, p.8). Augustus Caesar put his son-in-law Agrippa (63-12 B.C.) in charge of a mapping project which resulted in the “Peutinger table”. The Peutinger table was similar to today’s London Underground map in that it concentrated on that information useful to the medieval traveller and omitted information considered unnecessary. For example, major roads were drawn as straight lines, with no scale or attempt to show...
their true course but with the distances between places written in (Wilford 1981, p.48). Over centuries cartographers have developed a range of conventions to effectively communicate spatial information. These conventions have now become so accepted that we are at risk of failing to see them.

If a map refers to a completed artefact of what has been projected, mapping can be understood as an ongoing, indeterminate, and mutable process. As Brian Harley states in *The History of Cartography*: “There has probably always been a mapping impulse in human consciousness, and the mapping experience - involving the cognitive mapping of space - undoubtedly existed long before the physical artefacts we now call maps”. (Harley 1987, p.1)

Mapping as a powerful interdisciplinary strategy, one that links people and places, data and organizations, physical and virtual environments, is gaining new currency as a means of “making the complex accessible, the hidden visible, the unmappable mappable” (Janet Abrams & Peter Hall 2006, p.2). In the words of landscape architect James Corner, mapping is a “collective enabling enterprise” (Corner 1999, p.213), a creative act that describes and constructs the space we live in.

**MAPPING IN THE LANDSCAPE DISCIPLINE**

In order to develop critical thinking about how mapping works, I will look at mapping in the landscape discipline. The role mapping plays in creative design has been explored by James Corner, one of the most influential contemporary landscape architects. Corner distinguishes “tracing” (what is) and “mapping” (equal to what is and what is not yet) in his essay *The Agency of Mapping: Speculation, Critique and Invention* (in Cosgrove 1999, p.214). As I understand it, the former is more about the representation or description of what already exists, while the latter involves interpretation, speculation and the creative process. Corner is focused on the optimistic revision of mapping practices; he is concerned with how mapping can “reveal and realize hidden potential” (Corner 1999, p.213). In this essay, Corner is more cautious about mapping as a productive and liberating instrument, a world-enriching agent rather than a means of projecting power-knowledge. For Corner, mapping has the potential to make visible
existing complexities or contradictions and to develop new strategies for using this potential. His main concern with mapping is in the designer’s ability to develop strategies, gain understanding, and act upon it. He sees mapping as a highly creative activity, in fact, the most creative part of the design process. In my opinion, it is the intrinsic relationship between maps and their maker’s mapping protocols and predilections that makes mapping an integral part of design.

Corner writes about four types of mapping, ‘drift’, ‘layering’, ‘game-board’ and ‘rhizome’, and gives detailed explanations of these approaches before explaining how they are implemented. His goal is to “suggest ways in which mapping acts may emancipate potentials, enrich experiences and diversify worlds” (Corner 1999, p.213). As Connolly contends, giving explicit attention to life on the ground is core to Corner’s ambitious project, “connecting to life on the ground might allow him to employ the instrumentality of mapping and the landscape whilst avoiding the instrumentalism normally associated with maps and synoptic overviews” (Connolly 2004, p.202). Corner believed that his large scale mapping both reveals life and brings life to his project. From my perspective, these big maps certainly contain some information that is invisible at smaller scales, but, since landscapes exist in a wide range of scales it is clear that one scale does not fit all. We need to employ a variety of scales to better represent the landscape and investigate its various performance requirements.

Deleuze and Guattari characterize mapping in A Thousand Plateaus as “entirely oriented towards experimentation in contact with the real which fosters connections between fields” (Deleuze and Guattari 2002, p.12-13). Designers can use maps to interpret the existing and to speculate on changes that they will insert, how this insertion will affect its surroundings and how it will, in turn, be affected. Mapping creates an understanding of the world and illustrates the relationship between places, people and events. Mapping is about opening our eyes and creating a consciousness about the world we dwell in.
MAPPING IN CONTEMPORARY LANDSCAPE PRACTICE

Ian L. McHarg pioneered the concept of ecological planning in his famous book *Design with Nature* published in 1969. He created a systematic inventory centred on suitability to conduct comprehensive mapping (Fig. 3). These maps were used not only to understand how a place came to be, but also to identify problems and opportunities.

The end product would be a map of present and prospective land uses, in communities of compatibilities, with dominants, co-dominants and subordinates derived from an understanding of nature as a process responsive to laws, having limiting factors, constituting a value system, and exhibiting opportunities and constraints to human use (McHarg 2002, p.39).

McHarg’s approach focused on mapping both natural and human-made attributes of the study area in order to gain an ecological perspective of a site. He linked suitability analysis with theory and provided a theoretical basis for overlaying information (maps). McHarg was the first to advocate the use of the overlay technique to gain an ecological understanding of a place (Steiner 2000).

McHarg contends that by following his method of landscape analysis, an idealized land-use pattern could be obtained. McHarg’s method assumes a linear process; it is based on the premise that, if we follow his methodology, and make the data as accurate as we can, the end result will be an optimum plan and design. From our current perspective, McHarg did not ground his own assumptions and mapping protocols sufficiently in his project. In other words, the idealized land-use patterns he revealed were based partly on his own value criteria. In addition, McHarg falls short of describing a complete, cyclical ecology, and focuses mostly

Fig 3: Layered analysis plans, Ian McHarg
on patterns of land use and the morphology of human settlements. This deficiency is, in part, a reflection of the book’s era; suburban sprawl was seen as the principal threat to the natural environment in the late 1960's. In my opinion, it is at least arguable that there is an over-emphasis on the scientific and analytical aspects of mapping that fails to embrace nonlinear natural and social changes. Today’s landscape demands new strategies and logic, which may generate unexpected new design outcomes and develop new critical linkages with the real world. Consequently, these new strategies should be integral components of the planning and design intended to produce a responsive landscape. Some contemporary landscape professionals have recently undertaken this kind of exploration.

Rem Koolhaas was among the first to develop mapping and layering strategies in site design and planning. His proposals for the Parc de la Villette in Paris (1983) continue to be regarded as a benchmark in landscape architectural literature. In this project, his maps are not about the existing site or context, but rather the intended programmes for the site which are conceived as independent layers. Thus the result is a heterogeneous and ‘thickened’ matrix (Fig. 4). As James Corner comments “such richness and complexity gained from mapping are beyond the limited scope of the single master-plan or the zoning plan” (Corner 1999, p. 235). He states that the resultant design “might be less about the construction of finished and complete works, and more about the design of ‘process,’ ‘strategies,’ ‘agencies,’ and ‘scaffolding’-catalytic frameworks that might enable a diversity of relationships to create, emerge, network, interconnect, and differentiate” (Corner 1997, p. 231).

Corner has spent the last seven years planning Fresh Kills Park, one of the world’s largest (2,200 acres) sanitary waste landfills, but now finding new life as a park. No amount of planning
or design could completely encompass a project of this scale and complexity. Corner uses mapping as a design approach; employing maps to analyse natural and social systems and the interactions between them. Maps are then used to illustrate the proposed transformation processes. Circulation, program, structure, art and culture are mapped across the site. Further he tries mapping the process of habitat diversification, landfill mound restoration and the growth of the park over time. Typical of this work are detailed mappings of phasing, animal habitats, succession planting, and hydrological systems, as well as programmatic and planning regimes which are standard fare for projects of this type (Fig. 5). From my point of view, on the one hand, maps provide only a snapshot of projected elements - process can never be depicted by any map. On the other hand, natural and social processes are all nonlinear - no one can precisely predict the future. Therefore, I doubt that Corner’s mapping has the ability to predict the indeterminate future; it will always be a personal subjective speculation. However, the maps developed by Corner do construct a robust and flexible landscape framework for the park and employ a very clear logic to interpret the landscape transformation process. He shows that

Fig 5: Fresh kills, field operation
mapping definitely provides new perspectives and a new design language in landscape architecture.

Other landscape architects have explored new area of contemporary landscape architecture through mapping. Alan Berger used mapping (aerial photography, maps, charts and graphs) to map waste land in ten American cities, coining the term 'drosscapes' for the resultant maps (Berger 2007). By highlighting an aspect of urban environments that had usually been ignored, this approach changed the way these environments were perceived and identified urban waste land as a design challenge for new theory and practice.

Stoss LU, one of the most promising urban landscape design groups in North America, is dedicated to the search for new agendas, new working methodologies and approaches that better engage with contemporary urban conditions (Reed 2007). Mapping is an important tool in their wide array of projects. Either as an analytical instrument to address ecological, economic, social issues, or as phasing prospects, mapping has demonstrated its creative agency in the design process.

**MAPPING IN CHINESE LANDSCAPE ARCHITECTURE**

In ancient China, every city had its own local records, including maps that recorded its geology, topography, hydrology and climate. These maps have been regarded as advanced for their time; “Chinese cartography in ancient times was more advanced than that in contemporary cultures elsewhere in the world” (Wilford 1981, p.8).

*Yuanye*, the first Chinese monograph about landscape design, published in the 17th century, provides theoretical frameworks and paradigms relevant to today’s landscape architectural profession (Jiaji, Zhang 2002). The first part of this book talks about site investigation: the general principle expressed is that design should be based on thorough investigation and understanding of the site. This indicates that site mapping had already gained recognition in traditional Chinese landscape design.

Although it appears that there were strong traditions and advanced techniques of map-making in Chinese history, there remains a gap between map-
making and mapping as a creative instrument to generate design within contemporary Chinese landscape practice. However, new developments in mapping are apparent in contemporary Chinese landscape architecture. CAD (Computer-Aided Design), GIS (Geographical Information System), and other new technologies and software are powerful instruments for landscape architects and more and more Chinese landscape architects are using these tools. Mapping in China mostly focus on scientific analysis and site evaluation and the majority of maps are at the regional or catchment scale and are usually created at the planning stage (Fig. 6). The agency of mapping as a productive research instrument and the mapping process are still, to a large extent, overlooked by many contemporary Chinese landscape architects.

As a Chinese landscape practitioner, I have a responsibility to explore different ways of landscape design. I have a particular interest in how multiscale mapping can be used as a means of interpretation, speculation and exploration to contribute to the creative landscape design process. In this project I will attempt to avoid a synoptic overview of the landscape by investigating it at multiple scales.

Fig 6: Master Plan for Waterway, Hangzhou, Turenscape
MY PROJECT FROM LOCATION TO PRACTICE

The maps developed for, or used in, landscape design are often large scale (e.g. Corner, Reed) or single scale (e.g. McHarg). Although such maps can provide a design framework, used in isolation they fail to reflect what really happens on the ground. If we don’t map the landscape at a detailed enough scale, or at multiple scales, we risk missing important features of the site.

Whereas multiple scale mapping has been used in some ecosystem or landscape planning projects, it has rarely been used to generate designs for smaller scale projects.

In this project, I employed multiscale mapping to observe how the landscape performs at different scales and generate a responsive design at the site scale. I have attempted to explore how mapping at different scales (including spatial and temporal) can provide an in-depth understanding of the landscape and effective information (including non-visual data) which derived from my interpretation and techniques. I cannot transfer all information such as non-spatial data into maps. For example, the human appropriation frequency information is not physical, so I used a gradient map to identify the different frequency of human occupation. In this way, the unmappable information can be incorporated into the design process. I mapped and prioritized each map to identify which site has the most interactions between natural and urban systems. Obviously interactions are far more complex to map, so I made the assumption that layering would reveal the intensity and the number of interactions supported in each site.

I assume that mapping, as an open-ended, bottom-up communicating strategy, is capable of providing effective information and opportunities for landscape architects to intervene in the design process. I believe that mapping is an increasingly vital activity in the landscape design process. With this in mind, I have attempted to use the creative potential of mapping, its performative potential and a critical cartographic consciousness, to interpret and represent the living landscape around us.
PROJECT AIMS

- To produce a design strategy that will transform an urban riparian public space into a multifunctional landscape which is adaptive over time and capable of accommodating a variety of ecological and social functions.
- To develop some landscape design techniques that will be useful in my own career and beneficial to others.

OBJECTIVES

- Rejuvenate Henderson Creek and its public riverfront. Improve its capacity to support diverse activities over time, including those that cannot be determined in advance.
- Provide a sense of place, history and belonging. Highlight a nature-related sense of place identity and encourage citizens to appreciate the natural processes of Henderson Creek and to participate in the transformation process.
- Emphasize the inherent qualities of the site while revealing hidden ones.

METHODOLOGY

This project is intended to explore the agency of mapping in landscape architectural practice and show how multiscale mapping can assist in designing an adaptive multifunctional landscape.

- I began with a brief review of the theoretical background to touch base with the history of mapping, contemporary landscape mapping practices and mapping in Chinese landscape design. Also I attempted to locate my project in contemporary landscape practice.
- Then, I used mapping to identify the key elements operating in Henderson Creek and mapped a variety of issues (refer to maps in chapter...
two) related to these key elements addressing natural and urban systems at regional and catchment scales.

- Next, I prioritised each map and overlaid maps to analyse the importance of different parts of Henderson Creek within the Twin Stream catchment. From this, I found that it is at the confluence of the twin streams in the city area that most natural systems and urban systems interact. Then in the same way, I identified Tui Glen, a semi-abandoned riverfront park, which has the most overlap of high priority maps at the city-scale, as the project site.

- Subsequently, I investigated the project site through different scales and between different map sets, using mapping to unfold the site and to understand how different natural and urban systems operate on and across the site at multiple scales, to further inform the design. This was followed with processing and manipulation of the information from the previous stage to develop a site design.

- Finally, I critiqued my approach and made suggestions for future research.
THE IMPORTANCE OF MULTISCALE

Pollak (2001) states that scale is an inherent issue in all landscape design but is rarely addressed in either theory or practice. Scale can articulate differences in the spatial or temporal dimensions of an object or process. A site exists at an unlimited number of scales, from the smallest detail of each landscape composition to large ecological and social systems.

“Landscape may no longer be viewed as a segment of the geographical world but rather as a situated image or system at the interface of different scales” (Terkenli 2005, p.165). Hence we should ascertain the appropriate geographical scale to conduct the analysis and subsequently relate and connect the analysis or intervention to other relevant scales.

If we only look at one scale, we run the risk of oversimplifying the site. Different phenomena are relevant or observable at different scales and responses to them are therefore best accomplished at an appropriate scale. We should therefore be sensitive to scale and ask the appropriate questions at appropriate points in the design process. For example, some landscape patterns, such as connectedness, may not be readily apparent at a small scale and other aspects of the landscape, such as the abundance of native vegetation, may be overlooked if the geographic perspective is too narrowly focused. This often requires simultaneous consideration of multiple natural and social issues from site to catchment to larger scales. Sometimes issues and scales will be compatible; other times they will require compromises.

Moving between multiple scales can provide new insights into the study area. One of the main conclusions of Robinson and Petchenik (1976) is that by the manipulation of scale, objects can be transformed from a state of ‘separateness’ to one of ‘proximity’. This suggests that multiscale maps can reveal previously hidden, or unconscious, relationships between objects. Enlarging and reducing the boundary of the milieu will alter the given elements’ form, significance, and their relationships with other phenomena. Scalar manipulation may clarify relations among selected phenomena and reveal patterns and harmonies invisible without such process. Corner (1999) reminds us that scale selection and manipulation is a powerful imaginative and generative act which records and sets in train chains of meaning and association in the active process of knowing.
MULTIFUNCTIONAL LANDSCAPE

As Brandt (2002) states, since the mid-eighties there has been a shift from monofunctional landscapes to the development of multifunctional landscapes in order to meet the challenges of the growing ecological, economic and social conflicts.

To create a multifunctional landscape we need a dynamic systems way of thinking. Urban landscapes should be conceived as tangible, mixed natural and urban systems interacting with each other and capable of adapting to change. Although we cannot predict change by extrapolating from the past and present into the uncertain future, we can, however, speculate and prepare different scenarios on the basis of historical and current conditions. Then we can prescribe what, in our opinion, should be done to give the best chance of realising desirable outcomes.

In this report, multifunctional landscape refers to the different natural and social processes that take place simultaneously and interact within the landscape. I regard urban landscapes as a hybrid of natural and urban systems which function in multiple domains (e.g. environmental, social and economic) and can respond to future change. For instance, the event lawn is a hybridized plaza - green. It accommodates a variety of events and programs for people to socialize – outdoor concerts, sports, games and art festivals. The space also can provide economic benefits – weekend markets and car shows. In the case of the water garden, an under-utilised place is reprogrammed to accommodate multiple use scenarios - stormwater treatment, wildlife habitat, and human recreation.
DEFINITION OF SCALES

Scales are defined as follows:

- Regional-scale: includes Waitakere City and Auckland City (map0-1)
- Catchment-scale: Twin Streams Catchment (map0-2)
- City-scale: Henderson Creek within Henderson Township (map0-3)

The following scales were defined after site identification

- Site-scale: Tui Glen Reserve (map0-4)
- Riverfront-scale: Henderson Creek riverfront within Tui Glen Reserve (map0-5)

In order to study the significant relationships between Henderson Creek and its different scale contexts, my scales are not calibrated numerically but selected according to spatial relationships. Since these scales are commonly used and understood, using them makes my project transparent to other projects. Of course, scales are infinitely variable. However, for the purposes of this project I chose several easily perceived scales to demonstrate how multiscale mappings can be conducted.
SITE IDENTIFICATION

As my design interest lies in the use of multiscale mapping to generate adaptive multifunctional landscapes, I chose an urban riverfront area, Henderson Creek, as my research site. Rivers serve many functions and are effective agents in linking landscape elements both in space and in scale. Riparian areas act as the interface between land and water and provide various opportunities for landscape transformation. Henderson creek played a defining role in the location and subsequent development of Henderson Township (now Waitakere City) and had comprehensive relationships with the city and the people living there. However, the creek is now neglected by people and the river corridor is at risk of degradation. I intend to design landscape conditions that will attract more people to the creek, which hopefully will foster greater appreciation of it in the community, which, in turn, may lead to popular demands on local government to improve the creek’s condition.

In order to identify key elements operating on the site, I developed a series of transects from Henderson Creek to three key locations: the Waitakere Ranges(map0-A), Waitemata Harbour(map0-B) and Britomart(map0-C), representing hills, sea and city respectively. Through these transects,
vegetation, water and transportation emerged as the three recurrent elements that link Henderson Creek with larger natural and urban systems. As an urban landscape, it is obvious that human activity and fauna play important roles in the ecology of the creek. Thus, I identified four ‘key players’ in the life of the riverscape: human activity, water, vegetation, and fauna. I then chose key data sets related to these four ‘key players’ to conduct the mapping. Next I prioritised each map to identify and evaluate its importance among the same scale map set. I regard urban riverscapes as human-dominated landscapes, hence human activities and human-related social systems should be at the top of the priority hierarchy followed by water, vegetation and fauna. Even within each category, sub-ranking of information at the same scale is required. For example, in urban systems at the city-scale, the hierarchy of importance from high to low is as follows: human activity and people movement; green space and reserve; cycleway and transportation, access and view; stormwater; land-use and history. This order is based on the intensity of each element currently influencing the site. The general principle is that current human activity is more important than historical or indirect human influence. Finally, I overlaid different information (maps), and chose the site with the most overlap of high priority information as the design site - Tui Glen.

MAPPING AT FIVE SCALES

The following section shows detailed mapping at five scales.

- Regional-scale: includes Waitakere City and Auckland City
- Catchment-scale: Twin Streams Catchment
- City-scale: Henderson Creek within Henderson Township
- Site-scale: Tui Glen Reserve
- Riverfront-scale: Henderson Creek riverfront within Tui Glen Reserve
I used regional-scale mapping to get a broader understanding of how different ecological and social systems work and investigate linkages between Henderson Creek and the whole region. This indicated that the design shouldn’t be limited by the physical boundaries of the site but also provide opportunities to connect the site back to its wider context.

From catchment-scale mapping I identified the confluence of the Twin Streams area in Waitakere City as having the most interactions between natural and urban systems. I then mapped various issues of these systems within this area at the city scale. I assigned a priority to each map and analysed the importance of each site according to set criteria. From this I obtained a hierarchy of important sites. Tui Glen Reserve had the highest rating and provided the most opportunities as my project site.

Next, I conducted a series of mapping related to the four ‘key players’ to reveal how they perform at the site and riverfront scales.
Map 1-1: Shows where people settled in this region. Tui Glen was bounded by the residential area which is an integral part of the regional human settlement. Thus the design should enable potentials to bring more people from both Waitakere City and Auckland City. Consequently, I designed more cycle tracks and walkways to actualise this potential.
Map 1-2: Registers the urban housing process in Henderson. The east bank of Henderson Creek developed earlier than the west bank. I inferred that the creek is a natural boundary which constrains the housing development. Hence I intended to enhance connections between both banks, such as the design of stepping stones and a new footbridge.
Map 1-3: Shows Tui Glen as a public riverfront is integrated to the whole open space system which is an important arena for people to socialise. Therefore, I have attempted to set up new conditions in Tui Glen to accommodate more social events, for instance, the design of the event lawn.
Map 1-4: Illustrates that the cycle/walkway has integrated Waitakere City with the Auckland Region. It indicates that the design of cycle/walkway would be one way to integrate Tui Glen to the region.
Map 1-5: Records the water routes from Auckland to Henderson Creek. Tui Glen is the terminal of the routes. Hence I amplified its role in the water route which can be seen in the design of river trails and ramps.
Map1-6: Shows Henderson Creek is an integral part of the whole regional water system. This informs me that any hydrological intervention should make reference to its larger context and consider its effect at large scale. The water garden design attempted to make the site participate in the large hydrological process.
Map1-7: Records the distribution of native vegetation. Incorporated with the native fauna habitat map (map1-9), it indicates that the design of new plantings may support more wildlife in Tui Glen.
Map 1-8: Shows recorded wetlands which are highly related to estuaries. It generated the water garden design which purifies the stormwater before discharging into Henderson Creek.
Map1-9: Shows native fauna habitat has high correlation with native vegetation. It indicates that in order to attract more native wildlife to Tui Glen, the planting strategy should select suitable native vegetation.
Map1-10: Interprets the regional scale maps. The region comprises overlapping systems and processes which are part of larger systems and processes. Tui Glen as a node of this web should always find entryways to enhance or re-link to its larger milieux.
Map2-1: Illustrates the waterways pattern within the catchment. It is a useful distributive pattern when designing with water on the site.

Map2-2: Reveals the stormwater pattern. Stormwater moves across Tui Glen and discharges into the creek; it is a crucial issue of the site.
Map 2-3: Shows native vegetation distribution. Tui Glen is within the fragmented native vegetation patches. It indicates that planting more native vegetation probably can improve its role within the native vegetation system.

Map 2-4: Reveals most native fauna habitats present in the native vegetation areas. Tui Glen is out of the scope, but it still potentially provides important habitats for urban wildlife. So the design should take urban wildlife into account.
Map2-5: Shows historical human settlement concentrated in the confluence of rivers. Tui Glen is one of the archaeological sites, so the design should make connection to its history. In the case of the design of the circular pond, its shape is drawn from the fact that Maori dug holes at the top of hill to preserve food.

Map2-6: Records diverse land-use which I used to identify what kinds of human activities occur around the site. The proposed programs made reference to this context.
Map 2-7: Shows Tui Glen is one of the biggest open spaces near Henderson Township and surrounded by several other open spaces. The design of river trails and cycle tracks were intended to enhance links between these open spaces.

Map 2-8: Identifies Tui Glen as part of the ecological linkage from Waitakere Ranges to Waitemata Harbour. Thus improving its ecological performance is an issue in future design.
Map2-9: Illustrates urban area has a high density transportation system. It indicates people need more transportation to support everyday life. This is why I enhanced the circulation system within Tui Glen.

Map2-10: Indicates people need more pedestrian circulation. It contributes to the design of the cycle/walkway.
Map2-11: Shows the different landforms within the catchment. Tui Glen is situated in a lowland area. Considering the previous maps (map2-5,6,7,9,10), I identified many human-related activities occur in this lowland, urban area.

Map2-12: Interprets the catchment-scale maps. Henderson Creek flows through native forest, agricultural land, and the urban fields to the sea. The changing contexts give different character to the creek – it is a natural, also an urban, social and historical entity.
CITY-SCALE
Map3-1: Reveals Tui Glen is at the interface of fresh water and tidal water. It shows that the design of river trails can probably bring more people through water routes.

Map3-2: Shows stormwater causes pollution of the creek but also provides the potential to link urban systems with the creek. Thus I integrated stormwater in the design of Tui Glen.
Map 3-3: Identifies Tui Glen is a relatively large green space in the city which has the potential to support both human and wildlife. The designed wetland not only creates wildlife habitat, but also provides a recreation place.

Map 3-4: Shows Tui Glen is part of the reserves within Henderson Creek corridor. The design of circulation attempted to link these reserves as a whole.
Map3-5: Illustrates there is only one footbridge linking Tui Glen with the west bank of the creek. Accordingly, I designed stepping stones and a new footbridge to enhance the connection.

Map3-6: Depicts the existing cycleway across and around the site. My designed cycle tracks have networked to the cycleway system.
Map3-7: Records diverse land-use which I used to identify what kinds of human activities occur around the site. The proposed programs can make reference to this context.

Map3-8: Identified Tui Glen once was a busy waterway for transporting timber from Waitakere Ranges. This contributed to the materiality of the platforms design.
Map3-9: Records how people walk through the site. The design of the river trails and the cycle/walkway referred to the existing path.

Map3-10: Records how people run through the site. The design of the river trails and the cycle/walkway referred to the existing path.
Map3-11: Records how people walk dogs through the site. The design of the river trails and the cycle/walkway referred to the existing path.

Map3-12: Records people fishing points and picnic area. The river trails should be widened near fishing points.
Map 3-13: Shows three access points to the creek are disconnected to Tui Glen by the creek. Therefore I designed stepping stones and a new bridge to link both sides of the creek.

Map 3-14: Illustrates different views from the creek. The design of stone walls enhanced the visual linkage between Tui Glen to surrounding area.
Map 3.15: Records the ethnicity, occupation, population and age of Henderson Ward. The proposed programs took this information into account by creating different landscape conditions. In the case of the platforms design, I designed these platforms to be different sizes and levels to provide diverse opportunities for people to use them in different weather conditions.
Map3-16: Reveals how people disperse to different places in different numbers. The aquatic centre attracts the most people as it provides more recreation options. Hence I intended to create more activity opportunities in Tui Glen to bring more people back to this area.

Map3-17: Represents spatial changes in the urbanization process over 68 years. It shows the creek has been part of the urban fabric. The proposed activities are intended to enhance linkages between site and its urban environment.
Map 4-1: Records human appropriation frequency at the site. This information is very important and contributes to many design decisions, such as the design of the event lawn and the access to the cycleway being located near the popular spots within Tui Glen.

Map 4-2: Illustrates the view corridor and focal area. The analysis from this map was used to arrange the direction of the stone walls.
Map 4-3: Records tree type and reveals the deciduous tree distribution pattern (along the creek and road). I followed this pattern in the planting strategy to create a favourable habitat for aquatic life.

Map 4-4: Identifies tree values. The designed circulation system preserves high value trees.
Map 4-5: Identifies different conditions of ground cover. The designed paving and the circular pond is located in the areas where the existing ground cover is absent.

Map 4-6: Illustrates different degrees of bank erosion. It reveals that the severe bank erosion area is either near stormwater outlets or where there is a lack of appropriate ground cover. So the riparian planting should consider ground cover.
Map 4-7: Investigates noon sun angle and shade in different seasons. When designing the platforms and the sitting terrace, the above maps were used to make use of the shade in summer time.

Map 4-8: Investigates how the sun and the tree provide favourable habitats for birds and insects. This information contributes to the water garden design, in which the island in the water garden is informed by the habitat and shade relationship.
Map 4-9: Traces the on-site drainage path. It contributes to the wetland and circular pond drainage path design.

Map 4-10: Reveals storm water is a critical issue in this area. The location of the water garden was identified through this mapping.
Map 4-11: Illustrates the existing contours of the site. The levels plan was based on this map.

Map 4-12: Identifies the floodplain. It shows the river trails are within the floodplain. So I chose concrete as the material of the trail.
Map4-13: Records the circulation system within the site. The designed cycleway and river trail were integrated into the existing systems.

Map4-14: Shows the bird resting area. It contributes to the form of the island in the water garden.
Map 4-15: Illustrates morning shade and afternoon shade. They were integrated with bird resting area (map 4-14) and habitat and shade (map 4-8) to extrapolate the form of the island in the water garden.
Map 4-16: Records the sun path throughout the year in the Auckland Region. Combing this analysis with noon sun angle and shade (map 4-7) to extrapolate the shadow areas in summer time. This information is used to design with shading gradients, specifically in the platforms and the sitting terrace.

Map 4-17: Reveals the southwest wind is prevailing in the site. Thus the new trees were planted to shelter the event lawn from this wind.
Map4-18: Records the average rainfall during the year. The design of the wetland invert used the data from above map.

Map4-19: Identifies the sunny locations in Tui Glen based on winter sunshine. The location of the event lawn and the platforms were generated from the map to ensure they are benefiting from this sunshine.
Map 4-20: Interprets how sun, shade, rainfall, vegetation, wildlife and human operate on the site.
Map 5-1: Investigates how people use the riverfront currently and unfolds these observations into different potentials for people to re-appropriate the creek. The river trails were designed to unlock some of these potentials.
Map 5-2: Illustrates the water cycle. The hydrological process integrates the land with the creek. The design of the circular pond was inspired by this map and enabled the site to participate in the hydrological process.
Map5-3: Identifies different vegetation types. The planting strategy followed this gradient. This map also records the 2-meter tidal fluctuation. The levels plan of the river trails interacts with the changing water level.
Map 5-4: Identifies different riparian zones. The planting strategy was based on the gradient of the river bank.
Map 5-5: Depicts imperceptible things such as tree roots, shadow and woody debris in-stream. It investigates how wildlife and vegetation perform in the riverfront area. The design of the stepping stones reflected information from this map: the stepping stones provide people access to and across the creek and also create potential habitats for aquatic life. The shape of the stepping stones reflects the woody debris in-stream.
MAPPING ANALYSIS AND SYNTHESIS

To get a multi-scale understanding of the site I investigated water, vegetation, fauna and human activity by examining the site at different scales and compiling different map sets, as follows.
1. Water System

The water system is the prime natural system which characterizes this landscape. Mapping was conducted at 5 scales. From the regional scale it is obvious that Henderson Creek is an inseparable part of the whole regional water system. The creek originates at the headwaters of the Waitakere Ranges and flows through horticultural land, pastoral land and urban fields before merging into the Opanuku and Oratia Streams, which converge at Cranwell Park and Tui Glen Reserve to form the tidal portion of the stream - Henderson Creek - before exiting into the Waitemata Harbour.

Henderson Creek forms a vital riparian link between the Waitakere Ranges, the Waitemata Harbour and Waitakere City, shaping and being shaped by urban systems. At the catchment scale an interesting pattern emerged - lots of tributaries upstream feed into a single river - similar patterns might be witnessed in many riparian areas. This is an important natural pattern which could be referred to when designing with water.

The water of Henderson Creek is fresh at the source and tidal and salty at the estuary. This salinity gradient provides varied environmental conditions for a wide range of plants and animals. This pattern was also apparent at the city-scale; fresh water flows downstream and joins with salt water at Henderson Creek. Another pattern that emerges at the catchment-scale is the stormwater network which clusters across the urban area with no, or very few, stormwater networks elsewhere. A closer look at the site-scale shows that the tide shapes the creek bank and riparian vegetation, and also determines the chemical and physical characteristics of the creek. Tidal effects are therefore factors to be integrated into the design. The stormwater collects sediments, road spills and pollutants from the urban surface and channels these into pipes which then discharge into the creek, modifying the stream ecology dramatically. Ground-water runoff also contributes to the erosion of the creek bank where there is no appropriate riparian vegetation. Tidal water with ground-water runoff and stormwater influence the hydrological dynamics across the site. The water cycle at the riverfront area illustrates a classic interaction between natural and urban systems which come together along the creek. Multiscale mapping reveals that the creek is an important interface between natural and urban systems. Henderson Creek is not just a riparian system; it is also an urban, social and historical entity – a multifaceted feature of the local environment.
Map S-1: Investigates how the water system performs at different scales. Thus the design of water should respond to the systems at different scales. For example, the water garden design connected Tui Glen with the creek, the city and the larger catchment.
2. Vegetation System

Native flora spreads across the Waitakere Ranges and permeates the urban area, joining with discrete patches of exotic vegetation, before meeting the mangroves at the estuary. The Henderson Creek catchment (Twin Streams catchment) is therefore a link between the native forest of the Waitakere Ranges with the expansive mangrove areas where the creek discharges into Waitemata Harbour. The catchment is a very productive environment providing food and habitat for a diverse range of wildlife. However, catchment-scale maps reveal that highly modified mixed vegetation patches are the main characteristic of the lowland, urban area. Relatively large green spaces are mostly concentrated along the streams connecting fragmented residential vegetation patches and roadside trees to form the green matrix of the city.

Vegetation mapping at the site-scale included groundcover quality, tree type and tree value. Deciduous trees are present along the creek and road. Examining the riparian area in more detail I identified a gradient of vegetation from an aquatic to a dry zone. Riparian trees and groundcover have a direct influence on the creek; they stabilize the bank, filter pollutants and improve the water quality. They also supply habitat and food for a variety of creatures. Shade from the deciduous trees can control the water temperature and allows abundant undergrowth thus creating favourable habitats for aquatic life. Riparian mapping was used to address questions arising from the site-scale mapping and will be referred to later in the site planting design. It is important to note that many non-native plants are also of value to urban wildlife because they provide habitat opportunities and food resource.
Map S-2: Reveals the vegetation distribution pattern at different scales: regional-scale and catchment-scale mapping showed that the native vegetation was concentrated in Waitakere Ranges. The site-scale and riverfront-scale mapping identified that the deciduous trees along the creek create favourable habitats for aquatic life. Thus the planting strategy kept this pattern.
3. Native Fauna Habitat

The distribution of native fauna was closely correlated with that of native vegetation. It was apparent from both the regional and the catchment-scale maps that the main native wildlife habitat is located within the Waitakere Ranges with fragmented, generally poor quality habitat in the urban areas. Despite this, Henderson Creek is frequented by a greater diversity of insects, fish and birds, including the endangered native grey duck (*Anas superciliossa*), compared to other urban environments (*Te Huruhuru - Henderson Creek Reserves Management Plan 2003*). While this indicates that native flora is an important habitat for native fauna, it does not necessarily mean that all introduced vegetation is undesirable, indeed, some of it can also provide habitat for urban wildlife. Close study of the riverfront area reveals potential for improving habitat structure. The creek itself provides important habitats for a variety of aquatic creatures and supports vegetation which also supplies food and shelter for wildlife. In particular, riparian vegetation helps to maintain a relatively cool temperature in the creek by providing shade, thereby contributing to a suitable environment for the kinds of aquatic life that prefer these temperature conditions. Additionally, roots of riparian plants stabilize the riverbank and provide shelter for wildlife. Even fallen branches and woody debris are important shelters and habitats for fish, insects, and microbes. Through investigation at different scales we can gain a better understanding of the creeks’ flora and fauna.
Map S-3: Reveals that there are different requirements of fauna habitat at different scales. Regional-scale and catchment-scale reveals native fauna was closely correlated with native vegetation. Riverfront-scale shows the creek, trees, shadows, and even fallen branches and woody debris, can provide habitats for wildlife. Thus the design of the water garden and the stepping stones were motivated by the above map to create conditions for urban wildlife.
4. Social Occupation

This thematic mapping exercise attempts to explore how open spaces are used by humans. Regional-scale mapping depicts the network of open space covering the whole of Auckland City and the urban areas of Waitakere City. Maps at both the regional and catchment scale reveal that open spaces are mostly concentrated in urban areas. This implies that open space is associated with the urban environment and is an important social arena in the urban system. Another mapping exercise shows how the catchment area was used historically. Different inhabitants occupied the land at different times, their occupation patterns being related to the social, economic and cultural circumstances of each period of occupation. City-scale mapping is about human movement patterns across the site. People disperse to different places in different numbers for different purposes. An interesting fact is that although Henderson Creek was a popular place for swimming in the 1920s no one swims there today. This shift can be attributed to the environmental degradation of the creek and social and economic changes, such as the development of indoor aquatic centres.

This site reflects wider social changes; as it changes different opportunities for people to re-appropriate the site are created. This landscape shift cannot be disengaged from social, economic, and cultural change. Examination of the current human occupation of the site can identify some implications for future design. Through studying the movement of people through the site, the intensity of appropriation and ‘hotspots’, one can get a general idea about how people use the site currently. This information will be referred to in a later design stage. This mapping exercise indicates that landscape can never be understood in isolation from its social, economic and cultural background.
Map S-4: Explores how open spaces are used by humans currently and historically. It reveals the human movement pattern and human appropriation intensity at the city-scale and site-scale respectively. The location of the platforms and the pedestrian circulation system was based on the information in this map.
5. Transport System

The transport system is a basic infrastructure of urban environments. Cycle ways in particular bring people into close contact with their surroundings. The Auckland City cycleway system extends and connects with the Waitakere City cycleway to form a regional network. In addition, water routes connect boat ramps and marinas along the coastline from Auckland to Henderson Creek. Transportation and walkway patterns can be seen through catchment-scale mapping - arterial roads, railways, cycle and walkways are all concentrated in the urban area. City-scale mapping gives a clearer picture of the transport networks in Waitakere City, which include roads, railways, cycle and walkways, bridges and jetties; all of which are associated with the creek at various points. These make up the mobile public space for exchange and movement and support everyday urban life. Site-scale mapping shows how these transportation elements work within the site. Roads and carparks support vehicle and pedestrian circulation, while jetties and footbridges provide access to, or across, the creek and link with the existing transport system. Maps of different scales show that the riparian edge of Henderson Creek provides important linkages between pedestrian circulation and the city transport network on the one hand, and that the transport system is a critical dynamic link between the creek and the wider urban environment on the other.
Map S-5: Shows that the riparian edge of Henderson Creek is linked to the pedestrian circulation system which is itself linked to the wider city transport network, thus there is a critical and dynamic link between the creek and the wider urban environment. This contributes to the decision to enhance the circulation system of the site. The map also records the pattern of the existing transport system. The design of the cycle track and the river trail took this information into account.
6. Urbanization Process

To understand the urban landscape we must acknowledge its inseparable relationship to urban growth. Spatio-temporal aspects of urbanization can be mapped. Regional-scale mapping illustrates the process of urban housing growth in Waitakere City; an extension of Auckland City’s development. Catchment-scale mapping includes mapping of archaeological sites and current land-use. This shows that archaeological sites tend to be located in lowland or foothill riparian areas at the confluence of streams. It may be that these sites provided the most productive land for food-growing and could be readily accessed by canoes making them particularly suitable for human settlement. With development, land use increasingly diversifies. Diverse land-use in urban areas is shown in both catchment and city scale maps. Another map represents spatial changes in the urbanization process in three different years. These snapshots show the process by which urban fields have encroached on the Henderson Creek area. The creek was once bounded by urban fabric but is now part of this fabric. Another crucial factor in this urbanization process is population growth. The population has grown tenfold from 1966 to 2006 when it was 56,800. At 11%, Henderson Ward has the highest percentage of residents aged 65 years and over in Waitakere City. The median age is 33 years and just under a quarter (23%) of the Ward’s residents are less than 15 years of age. Compared with Waitakere City as a whole, Henderson Ward has a larger percentage of Maori, Pacific, and Asian residents. The most common occupations of Henderson Ward residents are: professional (18%), followed by clerical and administrative workers (15%) and technicians and tradespeople (15%) (People in Waitakere 2008). These demographic data show the diversity of people living in this area, which reflects larger scale trends of urbanization and globalization. Any proposed landscape design must take into account this ethnic and occupational diversity.
Map S-6: Shows spatio-temporal aspects of urbanization. Urban housing process, land-use and ethnicity diversification have been examined. When designing the programs for people at Tui Glen, the ethnic and occupational diversity shown in this map were taken into account. The design aims to transform Tui Glen into a multifunctional landscape. This was my response to the urbanization and globalization trends unfolded by the above map.
Chapter Three

SITE DESIGN
PHASE ONE

In the first design stage, I mapped elevation, vegetation, slope, erosion, hydrology, stormwater, and the ecological complexity of Tui Glen to unfold the site characteristics and provide information for my design intervention. The first stage of my design was inspired by the catchment shape, which can be abstracted as a leaf-pattern that has evolved and adapted to changing conditions through time. Similar patterns can be seen in fern leaves, branching blood vessels, road systems and other energy gathering and distribution systems. Although different in place, origin and scale their similarity of form is by no means accidental. This fundamental configuration can be used to represent close links between pattern and process, form and function at all scales. Therefore I decided to base my design on this distributive ordering system. The first design included three main parts as follows:

1. Water Garden (see 1D-3, 1D-4)

From the catchment, city and site-scale mapping, I identified the fact that stormwater modified the creek intensively but also provided a link between the creek and urban systems. Consequently, I selected a currently under-used lowland area adjacent to roads and residential properties that is capable of capturing a high volume of runoff from the neighbourhood. I also identified several stormwater manholes which provide the opportunity to direct stormwater into the site to increase the water volume available for the hydrological intervention. The water garden, whose form is generated from the leaf pattern, is a meandering wetland which incorporates natural processes with human and urban systems. The constructed wetland functions at multiple levels: stormwater treatment, wildlife habitat, human recreation and education.
2. **Mutable Space** (see 1D-3)

Based on site-scale mapping of the human appropriation frequency and people flow at the city-scale, I again used the leaf system to design event space to transform the site into a multiple use area. The existing “mutable space” is a nearly flat field with a small mound at the south end. Although it is bounded by several existing popular spots it is itself mainly neglected. The designed space is a hybridized plaza-green that can accommodate a full range of activities from individual to large group gatherings. My intention was to maximize potential uses so that people can find their own way to re-appropriate the site.

3. **Eco-bank** (see 1D-3)

The eco-bank was generated from site-scale mapping of erosion, elevation and vegetation. The eco-bank grades the creek bank slope into 3-4 levels that actively interface with tidal fluctuations. Eco-friendly materials are used to construct the bank and native plants are planted along its length. As the tide rises and recedes, some riparian vegetation will spread along the whole creek bank through tide-dispersed seed mechanisms.
1D-1: The plan of Tui Glen (phase one).

1D-2: The topographic plan of Tui Glen (phase one). Site-scale mapping of elevation (map 4-11), and mapping of drainage path (map 4-9) contributes to this plan.
1D-3: The water garden design used catchment-scale mapping of the waterways (map2-1) to form the wetland. It directs stormwater into the site to create a constructed wetland which functions at multiple levels: stormwater treatment, wildlife habitat, human recreation and education. People can use the boardwalk in winter and in summer can walk along the gravel path as well.

The mutable space used the catchment pattern to organise the circulation and divide the site into different sizes to create a hybridized plaza-green, which accommodates a full range of activities from individual to large group gatherings. Site-scale mapping of human appropriation frequency (map 4-1) and people flow (map 3-16) at the city-scale contributed to the design.

The eco-bank was generated from site-scale mapping of erosion (map 4-6), elevation (map 4-11) and vegetation (map 4-3). The bank has an active interface with tidal fluctuations.
1D-4: the above cross sections illustrate how the wetland functions.
Feedback on the first stage of my design suggested that I needed to look at more specific characteristics of the site and use maps more directly to generate the design. I re-evaluated my design then identified several aspects that needed to be refined.

- The maps I have made contributed to design, but how the maps generated the design and how they influenced each other was insufficiently clear.
- The catchment pattern was important, but rather than be imposed on everything else, form should emerge from the properties of basic units of the site and accurately reflect and correspond to the mechanisms of different systems working at an efficient and appropriate scale.
- The design did not show strongly enough how the creek relates to human activity and the city. The creek needed to be more integrated into the whole design.
PHASE TWO

For the next stage, I concentrated on how different systems operate on the site. I refined the topography, vegetation and hydrology mappings and studied how the sun, stormwater, rainfall, vegetation, wildlife and people operate on the site.

After mapping the site at five different scales, I obtained a multi-level understanding of its conditions. Following Corner’s emphasis on “life on the ground”, I also focused on representing the power of the key systems operating at the site. I explored interactions between water, vegetation, fauna and people through synthesized mapping. By manipulating these maps I verified how multiple scale mapping can help, not only to understand, but also to ask better questions about the site and to reveal and realize potentials. As is the case with vegetation mapping, the distribution pattern of deciduous trees (along the creek) became clear through the site-scale mapping. Riverfront-scale mapping revealed the relationship between the tree shadow and the riparian habitat structure which gave me clues to the questions that arose at the site-scale. In consequence, these maps indicated that the design of riparian vegetation should keep this pattern. I am also aware that landscape is always interconnected to other systems and changes over time. To understand landscape requires a holistic view and systematic thinking, so design should concentrate on process, system, programme and event. Thus I attempted again to work with the ‘key players’: water, vegetation, fauna and human activity, and set some physical conditions to re-connect or enhance linkages from the site to larger systems. This approach has the potential to make the site more adaptive to change. The design outcome is not focused on achieving a finished physical form or to provide predefined functions, but rather, through the designed concrete elements, to initiate links between the site and the larger systems and wider context. It should also enable the site to participate in the various indeterminate natural and social processes that constitute it.

Layering is another effective technique which can be employed in the design development process. McHarg has demonstrated different information can be layered and combined geographically to identify suitability for different types of development and land use. Today, McHarg’s layering approach is still widely used by landscape architects to provide basic information for landscape analysis and plans. In my view, layering has the ability to identify where different activities, functions and conditions coincide physically and spatially, and to show different intensity gradients. It reveals some unseen or imperceptible relationships that would still be hidden without this process. In the final design stage, I overlaid different
human activities to identify the most favourable human occupancy areas, and then created some landscape conditions to actualise more potential, such as the river trails, the event lawn design. I observed human occupancy preferences across the site, many times, under different conditions and at different times (see Fig 2D-3-1-1, 2D-3-2-1, 2D-3-3-1, 2D-3-4-1, 2D-3-5-1, 2D-3-6-1).

For ease of description, I am going to discuss the design in terms of its effect on different geographical sections of the site. That is not to say the design emphasizes the spatial formation of the site, on the contrary, it concentrates on breaking away from physical boundaries to resonate with the fluctuations of larger systems and processes.
EXISTING CONTEXT
1  MANUKA SHADE (heritage site)
2  FOOTBRIDGE
3  JETTY
4  CARPARK
5  KAYAK CENTRE & PUBLIC TOILET
6  COMMUNITY CENTRE
7  SCOUT CENTRE
8  FALLS PARK
9  AQUATIC CENTRE
10  CRICKET COURT
11  CRANWELL PARK
12  RESIDENTIAL PROPERTIES
13  COTTAGES
14  HENDERSON TOWNSHIP
DESIGNS
1. RIVER TRAILS & RAMPS
2. EVENT LAWN & SITTING TERRACE
3. CIRCULAR POND & STONE WALLS
4. PLATFORMS
5. WATER GARDEN
6. CYCLE TRACK & WALKWAY

EXISTING CONTEXT
7. MANUKA SHADE (heritage site)
8. FOOTBRIDGE
9. JETTY
10. CARPARK
11. KAYAK CENTRE & PUBLIC TOILET
12. COMMUNITY CENTRE
13. SCOUT CENTRE
14. FALLS PARK
15. AQUATIC CENTRE
16. CRICKET COURT
17. CRANWELL PARK
18. RESIDENTIAL PROPERTIES
19. COTTAGES
20. HENDERSON TOWNSHIP
1. RIVER TRAILS & RAMPS
2. STEPPING STONES
3. FOOTBRIDGES
4. JETTY
5. PAVING
6. SITTING TERRACE
7. KAYAK CENTER & PUBLIC TOILET
8. PLATFORMS
9. STONE WALLS
10. CIRCULAR POND
11. PEBBLED BROOK
12. WATER GARDEN
13. CYCLE TRACK & WALKWAY
14. CARPARK
15. SCOUT CENTRE
16. COMMUNITY CENTRE
17. COTTAGES
18. AQUATIC CENTRE
19. CRICKET COURT
20. CRANWELL PARK
1. **Riverfront** (see 2D-2-2-2, 2D-3-1-2, 2D-3-1-3)

The riverfront area is a critical zone within Tui Glen as it is the interface between land and water and supports a diversity of flora and fauna. Ironically, the riverfront and the creek are currently neglected by humans. The challenge was how to make this area attractive to people.

From the regional-scale mapping it was apparent that pedestrian walking tracks and water routes have the potential to link Tui Glen with a larger transportation network and bring people back to the creek. The creation of riverside trails would be one way of encouraging people to reappropriate this area.

The following mapping contributed to the design of the trajectory and width of the riverside trails (see 2D-3-1-1):

- City-scale mapping of human activity and movement showed the trail trajectory should be parallel with existing pathways and human movement patterns.
- Site-scale mapping of tree value indicated that the trajectory should be kept away from the high value trees.
- City-scale mapping of human activity suggested that the river trails should be widened where there are more human activities.
- Site-scale mapping of human appropriation frequency suggested that areas close to popular spots should be widened to allow scope for more people to access these spots.

I combined the following maps to design the elevation of the river trails (see 2D-3-1-1):

- Site-scale elevation mapping indicated that the river trails should follow existing contours and that more steps should be made in the steep creek bank.
- Riverfront-scale mapping of tides showed that the varied elevations of the river trails should relate to the 2-meter tidal fluctuations.
The elevated river trails and ramps at multiple elevations are either close to, or away from, the creek. This adds another layer to the riverfront and provides opportunities for a variety of activities through which people can engage with the creek.

Stepping stones were also generated from mapping at two different scales. Human appropriation frequency mapping at the site-scale identified where there was a need to improve the connection between places. Habitat mapping at the riverfront-scale (fallen branches and woody debris provide habitats for aquatic life) suggested the form stepping stones should take. The concrete stump-shaped stepping stones reflect the existing shape of wooden debris in the creek and provide human access across the creek while also creating habitat for aquatic creatures.
RIVER TRAIL AND RAMP (A cross section)

LOW TIDE

HIGH TIDE

RIVER TRAIL AND RAMP (B cross section)

LOW TIDE

HIGH TIDE

2D-3-1-2 Cross Section of Riverfront
2. Event Lawn and Sitting Terrace (see 2D-2-2-3, 2D-3-2-2, 2D-3-2-3)

A two metre high slope faces a flat lawn centred in the site. Overlaying city-scale human activity and site-scale human appropriation frequency maps suggested this area has the potential to accommodate a wide range of activities and events. City-scale mapping of human activity and land-use illustrated how people currently appropriated the land and what events took place around the site; demographic mapping provided a profile of the residents; and historical mapping recorded the historical human occupancy of the land. Site-scale mapping of human appropriation frequency registered human movement patterns and popular spots. I prioritized these maps among the map sets as the design of this area should focus on programs and events which could be based on studying maps of human activity patterns (current > historical, intimate > indirect). Consequently, I used this information to suggest events or programs that could be accommodated in this area. It is safe to predict that the kind of human activity that takes place at the site will change through time. The more the site is used, the more it will be changed by human activity and the more adaptive it will be to future change.

I decided how to arrange the event lawn and sitting terrace geographically as follows: (see 2D-3-2-1)

- Site-scale mapping of human appropriation frequency identified that the event lawn should be located relative to well-used areas and popular spots.
- Site-scale mapping of existing trees revealed that these trees provided a natural backdrop for outdoor performances.
- Site-scale mapping of the elevation indicated that the event lawn should be located in a flat area; while the sitting terrace could be integrated into the existing slope to provide naturally elevated seating for audiences.
- Site-scale mapping of sun and shade ensured that most of the event lawn was sunny and the sitting terrace was located around the fringe of the shadows cast by the trees.
- Site-scale mapping of wind direction suggested where to plant new trees to act as a wind-break against the prevailing south-west wind.

Outdoor concerts, art festivals, weekend markets, playing fields and car shows could all occupy the site at different times.
HUMAN APPROPRIATION (site-scale) → well-used area & popular spots

ELEVATION (site-scale) → flat area & slope

SUN (site-scale) → sunny place

SHADE (site-scale) → tree shadows

WIND (site-scale) → wind direction

HUMAN ACTIVITY (city-scale) → current human occupancy

LAND-USE (city-scale) → suggest events or programs

CENSUS (city-scale) → profile of the residents

HISTORY (city-scale) → historical human occupancy

HUMAN APPROPRIATION (site-scale) → well-used area & popular spots

arrange event lawn & sitting terrace

LAYERING

- event lawn is close to well-used areas & popular spots
- event lawn is located in a flat area
- sitting terrace is integrated into the existing slope
- event lawn is sunny
- sitting terrace is around the fringe of tree shadows
- new trees break against the prevailing south-east wind

2D-3-2-1 Design Development of Event Lawn and Sitting Terrace
EVENT LAWN & SITTING TERRACE (cross section)

C CROSS SECTION

D CROSS SECTION

2D-3-2-2 Cross Section of Event Lawn and Sitting Terrace
EVENT LAWN + SITTING TERRACE
3. **Circular Pond and Stone Wall** (see 2D-2-2-4, 2D-3-3-1, 2D-3-3-2, 2D-3-3-3)

Site-scale mappings of view and elevation identified that this area had a good visual linkage with other parts of the site and the creek. Therefore I designed this zone to enhance visual linkages with the surroundings and establish a hydrological linkage to the creek at the same time. The circular shape of the pond was drawn from the city-scale historical mapping (Maori dug holes at the top of the hill to preserve food) and view mapping at the site-scale (circular pond located in the visual focal area); while the location of stone walls takes into account site-scale mapping of view and trees (stone walls would be located to preserve existing views). City-scale mapping of human activity, land-use and demography revealed current human activities occurring on and around the site that could be referenced when designing programs for this area. I designed the drainage path based on site-scale mapping of hydrological dynamics and elevation. The circular pond is deliberately designed at the top of the mound and connected to the creek through overflow pipes. It is designed as a shallow pond fed only by rainfall. It could be used as a children’s paddling pool and could provide drinking water for birds and dogs after storm events. The requirement for regular flushing and maintenance needs to be considered at the detailed design stage. Although man-made, it is connected to the site’s natural hydrological processes and is intended to raise people’s awareness of these. The stone walls provide a variety of viewing points for people to appreciate the site and the creek from different angles.
CIRCULAR POND & STONE WALL (cross section)

F CROSS SECTION

G CROSS SECTION

2D-3-3-2 Cross Section of Circular Pond and Stone walls
CIRCULAR POND + STONE WALL
4. **Platform** (see 2D-2-2-4, 2D-3-4-2, 2D-3-4-3)

The platforms are a set of triangular wooden structures placed along the fringe of the deciduous trees’ shadow.

I utilised mapping for the design of platforms in the following ways (see 2D-3-4-1):

- I located the platforms by referring to mapped city-scale patterns of human activity (platforms were located near human walking and running tracks and dog walking paths) and frequency of human appropriation at the site-scale (platforms were close to a popular spots).
- Site-scale mapping of sun and shade identified locations where platforms would get a good balance of sunshine and shade through the day.
- I chose triangles as the shape of the platforms to reflect the shape of the adjacent tree leaves and provide maximum flexible sight lines.
- I used timber as the material of the platforms in order to relate to the history of the creek (city-scale history mapping recorded the creek was once a busy waterway for transporting timber from the Waitakere Ranges).

City-scale mapping of human activity, land-use and demography incorporated with site-scale mapping of human appropriation frequency suggested desirable programs in this area. I designed these platforms to be different sizes (big tree=big shadow=big platform) and levels (adapted to site elevation) to provide diverse opportunities for people to use them in different weather conditions. These decks are intended to provide a literal ‘platform’ for new patterns of human activity to emerge; possible uses include sitting, picnicking, or sunbathing.
2D-3-4-1 Design Development of Platforms

**HUMAN MOVEMENT** (city-scale)

**HUMAN ACTIVITY** (city-scale)

**HUMAN APPROPRIATION** (site-scale)

**SUN** (site-scale)

**SHADE** (site-scale)

**TREE** (site-scale)

**VIEW** (site-scale)

**HISTORY** (city-scale)

**HUMAN ACTIVITY** (city-scale)

**LAND-USE** (city-scale)

**CENSUS** (city-scale)

**HUMAN APPROPRIATION** (site-scale)

**ELEVATION** (site-scale)

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**Identify popular spots**

**Layering**

- get a good balance of sunshine and shade
- reflect the shape of the adjacent tree leaves
- provide maximum flexible sight lines

**reflect the history**

**material: timber**

**current human occupancy**

**suggest programs & activities**

**profile of the residents**

**well-used area & popular spots**

**level plan**
2D-3-4-2  Cross Section of Platforms
PLATFORM
5. Water Garden (see 2D-2-2-5, 2D-3-5-1, 2D-3-5-2, 2D-3-5-3)

Site-scale mapping of hydrological dynamics, stormwater dynamics and human appropriation frequency identified this under-used area had the potential of capturing a high volume of runoff and stormwater from the neighbourhood. In addition to referring to the same catchment pattern used in stage one in the design of the water garden, I also took sun, tree, shade and bird resting areas into account to extrapolate favourable habitat areas (the tree shadow in the morning and afternoon overlapped a lot with bird resting areas) to form ‘islands’. I mapped the average rainfall of the Auckland region in different months and integrated this information with stormwater, hydrology and elevation mapping at the site-scale to design the elevation. The water depth of the wetland should interface with the volume of average rainfall and stormwater; the designed contour was based on the existing contour and only needed a small amount of excavation and backfilling. The wetland drainage path followed with the existing drainage pattern on site from site-scale mapping of the hydrological dynamics. Catchment-scale mapping informed the general form of the water garden, while site-scale mapping revealed the life and mechanisms operating at the site. Used together, mapping at these two scales informed every line of the design and brought life to the ground. The design harmonises different scales and integrates mechanisms of multiple systems working at multiple scales. The water garden diverts and collects water on site and, in addition, captures water from the adjacent areas by directing water from the existing stormwater system. The site collects stormwater and uses this to support a constructed wetland. As a dynamic system, the wetland will progress through various types of vegetation and sustain a varied ecosystem. The wetland is envisioned as a means of connecting the site with the creek and larger catchment, and encouraging people to experience water, vegetation and wildlife through the use of boardwalks, islands, lookouts and seating. In addition, habitats for wildlife are created.
Design Development of Water Garden
2D-3-5-2 Cross Section of Water Garden
6. Cycle track and Walkway

Regional-scale mapping of cycle and walkways, catchment-scale mapping of walkways and site-scale mapping of human appropriation frequency all indicated that pedestrian movement is essential to bring human activity to the site.

The access points and trajectory of the cycle track and walkway were informed by the following (see 2D-3-6-1):

- City-scale mapping of cycleway suggested where I could set up linkages with the existing pedestrian circulation.
- Site-scale mapping of human appropriation frequency suggested where I could add more pedestrian circulation near the high human appropriation frequency areas.
- City-scale mapping of human movement aligned the trajectory of the cycle track and walkway to be parallel with existing human movement patterns.
- Site-scale mapping of tree value indicated that I should keep the trajectory away from high value trees.
- Site-scale mapping of views advised me where the cycle track and walkway should be widened, or intersections placed in the visual focal area.

The resultant cycle tracks and walkways have the potential to link the site with the neighbourhood, city and larger contexts.
Design Development of Cycle Tracks and Walkway

- **CYCLEWAY (city-scale)**
- **HUMAN APPROPRIATION (site-scale)**
- **HUMAN MOVEMENT (city-scale)**
- **HUMAN ACTIVITY (city-scale)**
- **HUMAN ACTIVITY (city-scale)**
- **HUMAN ACTIVITY (city-scale)**
- **TREE VALUE (site-scale)**
- **VIEW (site-scale)**

**Layering**

- Identify where to improve connections
- Trajectory is parallel with existing human movement patterns
- Trajectory should be kept away from the high value trees
- Cycle track and walkway are widened, intersections placed in the visual focal area

2D-3-6-1 Design Development of Cycle Tracks and Walkway
Site scale mapping of rainfall & stormwater (map4-18) and habitat & shade (map4-8) incorporated with riverfront-scale mapping of riparian planting zone (map5-4) contributed to the wetland planting strategy. Wetland vegetation species can adapt to different water levels and dry or wet seasonal change. At the same time it can provide habitats for wildlife. The planting strategy was to divide the wetland area into different planting zones and specify appropriate native plants.

2D-4-1  Riparian Planting

The riparian planting strategy is generated from regional-scale mapping of vegetation (map1-7) and native fauna habitat (map1-9), site-scale mapping of tree type (map4-3), riverfront-scale mapping of vegetation & creek (map5-3) and riparian planting zone (map5-4). It aims to create favourable habitats for aquatic creatures, birds and insects. Deciduous trees provide shade, fodder trees provide food, ground cover protect river bank. The variety of plant types provides the range of species required to develop the habitat structure.

2D-4-2  Wetland Planting

Site scale mapping of rainfall & stormwater (map4-18) and habitat & shade (map4-8) incorporated with riverfront-scale mapping of riparian planting zone (map5-4) contributed to the wetland planting strategy. Wetland vegetation species can adapt to different water levels and dry or wet seasonal change. At the same time it can provide habitats for wildlife. The planting strategy was to divide the wetland area into different planting zones and specify appropriate native plant species.
EVALUATION

Mapping played a productive role in the interpretation, interrogation, speculation, exploration and creation of the final design. This process included multiple iterations and can be understood as a research by mapping process. Mapping is both an instrument and an outcome; an integral part of the creative design process. Mapping is inevitably a highly personal and subjective exercise that inevitably reflects the intent and interest of the map maker. Nonetheless, so long as this is recognised, mapping is a productive tool in landscape design that allows the visualisation of different elements of a site and simultaneously enables the designer to actively intervene in the design process by means of a more open-ended and bottom up approach.
Chapter Four

REFLECTIONS
ADVANTAGES OF MAPPING

- Mapping is an open-ended process. This can be understood at two levels: firstly, mapping as a design strategy is open to new information; new data may be added at any time to generate new designs. As Corner (1999) argues, landscape is a milieu which is a real middle surrounded by other middles, in a field of connections, relationships, extensions and potentials. Mapping identifies and works with these middles, and therefore spontaneously inherits their characteristics. In consequence, the resultant design is not closed but open to future modification. In phase one of the design of the mutable space I used a leaf motif taken from catchment mapping to inform the design, but subsequently found that it could not respond to mechanisms of the landscape at the site scale. So I did more site-scale mapping to study how people, vegetation, sun, wind and elevation interact on the site currently, which, in turn, generated a more convincing design. Secondly, freed of the need for comprehensive accurate representation of territory, mappers can manipulate data into any number of visual representations. Every time mappers employ different criteria and agendas, they can manipulate different data in different ways, each time with new and diverse consequences. This is a process open beyond anything presumed. For instance, in phase one, site-scale mapping addressed elevation, vegetation, stormwater and human appropriation frequency. However, I found that this was insufficient to reveal how the site works. Accordingly, I mapped how the sun, shade, water, vegetation, wildlife and people interact on the site, and synthesized maps through different scales and different map sets. Through this iterative process of mapping, evaluation, remapping and interpretation, I was able to construct a generative field for operation – a medium for landscape transformation.

- Mapping is a bottom-up process. As Corner argued, unlike planning, which imposes a more-or-less idealized project from above, mapping entails searching, finding and unfolding complex and latent forces in the existing milieu; it is generated from the ground up (Corner 1999, p.228). In the case of the design of the event lawn, I did not predefine its function; instead, I mapped human activity and occupancy at different scales to suggest events or programs that could be accommodated in this area. Mapping the existing condition of the site suggested possible translations into the designed environment. Mapping revealed patterns of human activity that would have remained hidden without this process.

- Mapping is an integral part of the design process. Obviously mapping occurs prior to landscape and urban formations. In other words, what
conditions develop around the project largely depends on how we select, schematize and synthesize data graphically. In this sense, mapping already participates in the making (design) process. It is less about representation and more about exploration, discovery and enablement, setting the stage for what comes next. In this project, I wanted to create some landscape conditions to encourage people to re-appropriate the site. Hence my mapping concentrated on mapping relevant information for the unfolding of this kind of landscape conditions. The map protocols and my design agenda already made the mapping a process of thinking and making.

**DISADVANTAGES OF MAPPING**

- Mapping is a partial expression of the actual ground conditions that inevitably involve a process of selection, schematization and codification. There is an irreconcilable contradiction between the desire for comprehensiveness in representing the world, and the impossibility of representing something so vast and infinitely subjective. On the one hand, maps are constructed on a set of internal instruments, codes, techniques and conventions. What can be mapped is derived from what realities are susceptible to these techniques. On the other hand, the cartographer's personal authorship and intent to a large extent decide mapping outcomes. It can only ever be a personal interpretation of the world. In this project, my mapping was inevitably an imperfect and idiosyncratic version of the landscape. I mapped those aspects of reality that were susceptible to my own mapping protocols and techniques, which, in consequence, influenced my understanding of the site and the resultant design. The resultant design is therefore an incomplete, and a personal, interpretation of the landscape's potential.

- Mapping as a static two-dimensional medium has its limitations in representing the multidimensional dynamic world and indeterminate natural and social systems and processes. I used mapping to investigate relationships between people, vegetation, fauna and the creek at the riverfront-scale, and to interpret interactions between different systems at the regional-scale and site-scale. These maps helped reveal relationships and represent interactions within the landscape and enabled me to acquire systems thinking ability. However, it is impossible to totally translate interactions and systems that exist in multidimensional space into a static 2D plane.

- In this project I focused more on employing mapping as a research instrument to interpret, speculate on and explore the landscape. While
I paid explicit attention to the mapping process, consideration of creative mapping techniques *per se* are beyond the scope of this project. Cognitive maps (Kevin Lynch), mapping of everyday (Robert Venturi), psychogeographical maps (the Situationists) have made advances in the visualisation of information previously thought of as either intangible or irrelevant. As Bowkett (2004) contends, mapping experiments have given rise to cross-disciplinary approaches involving art, architecture, psychology, science, literature and other disciplines. Cross-fertilisation and hybridisation of multidisciplinary techniques may allow new mapping techniques to emerge.

- As mentioned before, layering is an effective method for identifying relationships between different types of functions, activities and landscape conditions. It is useful for dealing with spatial and physical information, but is unable to effectively address time and complex systems. Layering is a simplified version of reality based on a linear explanation mode. The greater part of observed phenomena cannot be reduced to simple elementary behaviours without losing their essential characteristics (Waldrop, 1992). Landscape systems are too complex to represent, therefore layering only unlocks one of the many possibilities. It is impossible to predict the exact future. Despite prolonged observation of the site under different conditions and at different times, it is not possible to map exhaustively. For instance, all human occupancy preferences are unstable, contingent, unpredictable and ever-changing. Mapping and layering can never capture the complexities, and must ultimately rely on standardization of data. Thus, mapping and layering are effective but not perfect tools in landscape design.

As one cartographer put it, most maps not only fail to reflect all the details of the environment they project, but they also have systematic errors caused by the processes that encode them into a graphic field. As Cosgrove and Domosh stated, “...we are creating artefacts that impose meaning on the world … These stories are to be read not as approximations to a reality, but as tales of how we have understood the world…” (Denis Cosgrove and Mona Domosh 1993, p.37). Admission of mapping’s inherent limitations do not negate the important role mapping plays in the contemporary world but increase the freedom for cartographers to engage more creatively in design.
CONTRIBUTIONS OF MY APPROACH

- I used mapping as a research instrument to drive the design process. Instead of pre-defining what to map and which site to design, I utilised mapping to identify key elements for further mapping and to identify the project site as well as stimulate concrete design ideas.

- Multiple scales afford multiple-level perspectives of the site and give a clearer view of how different systems perform while avoiding the oversimplification which often accompanies single scale mapping. Multiscale mapping involves mapping the site at different spatial scales and mapping processes in the temporal dimension. For example, I initially used multiscale mapping (from regional-scale to city-scale) to identify Tui Glen as the site with the highest human appropriation in the river corridor. But why? I reviewed the selections of this site by putting it back into its large scale contexts. Regional-scale mapping of water routes indicated that several waterways from Auckland to Henderson Creek had the potential bring more people to this site. But why did the water route stop at Tui Glen? From the city-scale mapping I found the site was located at the confluence of tidal water and fresh water, which means this area is at the end of the navigable section of the creek. Site-scale mapping identified a jetty at the site which could enable people to undertake a range of activities from the creek to the riverfront. City-scale historical mapping revealed that this land had been used by different inhabitants for different purposes at different times. Other maps, such as catchment-scale mapping of walkways, city-scale mapping of human activity and land-use can all be used to interpret why this site has the highest human appropriation and how the site performs. At first, I used mapping as ‘maps’ to identify the project site. In the following stages, ‘maps’ began working as ‘mapping’. Through the interpretation of multiscale mapping we can reveal the performance of the landscape, which, in turn, enable us to use the information to produce new landscape potentials. The meaning of maps arises from the map-making and the interpretation process.

- I used on-site mapping to capture non-visual site information such as people movement and human appropriation frequency, which were inferred from city and site-scale maps respectively. I attempted to map imperceptible things, such as sun, shade, tree roots and rainfall. This kind of mapping is useful to reveal the life in the landscape.
Perceptual psychologist and art theorist Rudolf Arnheim wrote in his influential book *Art and Visual Perception*, "all perceiving is also thinking, all reasoning is also intuition, all observation is also invention" (Arnheim, 1964, p.viii). Central to this project is the idea that in order to achieve a responsive landscape design it is necessary to develop critical ways of understanding how the landscape performs and actualise its potential for change. Mapping as an important activity for making sense of the world but also one that inevitably involves our personal interpretation, assumption and imagination. It is a pivotal process by which we translate our thinking and understanding into design. This project has explored how multiscale mapping can benefit the design process through “construing and constructing” (Corner 1999, p.213) a virtual representation of the landscape and has attempted to reveal the profound efficacy of mapping in exploring and shaping new realities within the landscape.

Nowadays, mapping has shifted to a combination of both subjective and objective process. This shift expands the definition of, and subjects aligned to, mapping (Bowkett 2004). Contemporary landscape architects have utilised mapping as a design tool to negotiate with the world, investigate landscape situations and enable their potentials. Mapping has been employed as a design framework to illustrate phasing prospects and landscape transformation processes. Mapping is becoming an eidetic design language and an effective working methodology to set up design logic and engender responsive design results. However, in my opinion, the resultant large scale maps are more like an outcome of mapping, rather than a productive instrument to produce design. In addition, they alone are insufficient to represent how the landscape works and what occurs on the ground.

Multiscale mapping can provide a complete view of the landscape and many landscape planning and management projects have utilised it to explore the environmental dimensions of the landscape. However, it has rarely been used in small-scale landscape design. This project employed multiscale mapping to design a small-scale landscape project. I have gained confidence with multiscale mapping which allows me to visualise different information and thereby enable various landscape potentials.

This project was a research by mapping process. At the beginning, I produced a series of maps at different scales to represent the site. But I did not pay explicit attention to their interpretation, and I did not look for relationships between different scales and different map sets. Consequently,
I realized that manipulating these maps and interpreting them were an important and productive part of the design process through which the ‘maps’ unfold and create landscape potentials to motivate the design. For example, after I synthesized different scale maps and different map sets, I obtained a better interpretation of the performance of people, water, vegetation and fauna at different scales, which better informed my further designs.

The project has demonstrated that mapping is a productive research instrument constituting both the means and the outcome. It shows that mapping is more than a mere reflection of the landscape; it participates in the creative design process in its own right. I have found, in a very real and personal way, that mapping generated information and understanding. It has enabled me to reformulate existing conditions and helped me to interpret, speculate, inaugurate and create a landscape situation at appropriate scales by motivating specific design moves. At first, I used mapping itself to identify key elements in the site for further mapping. Then I used these thematic elements to conduct mapping at multiple scales to identify the project site. Consequently, I related the site back to its multiscale contexts to interpret how the site works and unlock landscape potentials to inform the design. It was apparent that mapping drove the whole design process. For instance, in the first stage of the water garden design, catchment mapping provided a prototype of the wetland. But why should I choose this pattern and how could I ensure that it will work at the site scale? These questions pushed me to conduct further mapping. After integrating more refined maps I produced a more responsive design which addressed the mechanisms of multiple systems functioning at multiple scales. Hence, I regard mapping as an integral part of the design process and can now use it both as a process of thinking and a process of making. What maps do and the process of mapping are more important than what maps represent and the mapped outcome.

I employed multiscale maps as multiple lenses to comprehensively observe how the landscape operates at multiple scales. Multiple scales afforded multi-level perspectives of the landscape. Different information was teased out from the different scales, for instance, by using large scale maps to study the natural and social processes, relationships, patterns and linkages, while investigating various landscape performance requirements through small scale maps. In this project, regional-scale and catchment-scale mappings focus on how different natural and urban systems operate at different scales. Some important patterns emerged at these large scales, such as human settlement, transportation pattern,
catchment pattern, vegetation distribution and fauna habitats. These patterns revealed important relationships between different systems. This kind of mapping showed the profound effects humans have on natural and urban systems. Large scales cultivated a holistic system-thinking which informed how the design can set up new landscape conditions that allow complex exchanges between the site and its larger *milieux*, thereby avoiding the narrow and partial vision obtained by small scale mapping alone. Conversely, large scale mapping is too coarse to reveal what really happens on the ground. Multi-scale mapping allowed me to actualize unseen or unrealized potentials and design the landscape from the bottom up. In the case of the water garden design, multiscale mapping fed into the design process. It is obvious in regional-scale mapping that Henderson Creek is part of the larger water system; it is connected to both inland water bodies and the sea. Henderson Creek is not an isolated waterway; it is always in a state of flux and constantly interacting with its *milieux*. This indicates that water is a crucial link between the site and its wider context. Catchment-scale mapping depicts the riparian pattern which is critical when designing with water. Site-scale mapping of sun, tree, shade and bird resting areas have been taken into account to extrapolate ‘islands’ of favourable habitat for birds. This kind of small scale mapping reflected the life and mechanisms of the site at a detailed scale. Without using a multi-scale mapping process, I cannot justify why I designed the water garden in the way I did. While recognising that the information that emerged from the multiscale maps was influenced by the mapping protocol and agenda I used, I suggest that multiscale mapping offers a potentially powerful framework for an improved understanding of landscape, which in turn, may generate a design capable of responding to different conditions at different scales.

Mapping, like any other design instrument, has intrinsic deficiencies. First, as discussed above, the capacity of mapping to translate the dynamic complex world into a static, codified two-dimensional graphic system has restrictions and limitations. However, through mapping the physical or mappable features of the landscape we can gain some clues as to the complexity and intangible features of the world. For example, it is impossible to really represent relationships and interactions between different systems by mapping. However, I was able to map some invisible phenomena, such as human movement and activity, to reveal a human occupancy pattern that would otherwise have remained hidden. Second, because rules and protocols are used to establish any mapping process, it is clear that mapping will always be based on assumptions and personal interpretations of the landscape. Theoretically, there is no way to verify mapping through design. Last, but not least, as Allen and Hoekstra (1991) suggest, scale is not a property of nature alone but rather something associated with observation and analysis. The scale of a process is fixed only once the
observer has specified the actors in the system. That is to say, the scale of observation is arbitrarily derived from the observers’ decision. All these conditions make mapping a highly artificial and fallible construction, which depends on how we see and act (Corner 1999).

Like books, maps can be viewed as agents of change and affect how we understand the world around us. However, mapping has tended to be regarded primarily as a passive device for projecting power-knowledge; useful but clearly relatively low in the intellectual hierarchy of landscape architectural practice. Given the increased complexity and uncertainty of the landscape milieu, we should recognize the value of mapping as a liberating, enabling, creative activity which feeds into the design process. Every map per se is an open system changing with the projected milieu through time and providing a field for the designer to practice ‘finding’ then ‘founding’. As Corner argues, “mapping, as an open and inclusive process of disclosure and enablement, comes to replace the reduction of planning” (Corner 1999, p.252). However, Corner also reminds us that while there is no shortage of new theories and ideas in design and planning, there is a lack of advancement and invention of the accompanying tools and techniques. To achieve unexpected and creative outcomes that are beyond scenographic or environmental amelioration we must develop new creative techniques. This is a priority for further research.


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