WATER DRIVEN

NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

by

Pholkrit Sangthong

B.A.S. (Bachelor of Architectural Studies)
Carleton University
Ottawa, Ontario CANADA (2004)

Submitted to the Department of Architecture
in partial fulfillment of the requirements for the degree of

Master of Architecture

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2008

Author.....
.....
Pholkrit Sangthong
Department of Architecture
May 23, 2008

Certified by...
.....
Andrew Scott
Associate Professor of Architecture
Thesis Supervisor

Accepted by....
.....
Julian Beinart
Professor of Architecture
Chair of the Department Committee on Graduate Students

WATER DRIVEN
NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

by

Pholkrit Sangthong

Submitted to the Department of Architecture
on June 23, 2008 in partial fulfillment of the requirements for
the Degree of Master of Architecture

ABSTRACT

The devastating struck of Hurricane Katrina in New Orleans in late summer of 2005 was deadly and immense. The storm destroyed over 170 drinking water facilities and 47 wastewater treatments around the city, and resulted the shortage of fresh water supply. The mixing of industry chemical, debris, bacteria and decomposing bodies in flooded water made this water horribly poisoned. Thus, the water supply condition was contaminated and become unfit for drinking. Although the government did not declare the lack of clean water in New Orleans as a major issue during Hurricane Katrina disaster, it is in fact a compounding element in the overall disaster, which should have greater priority. Drinking water needed to be delivered from elsewhere, running water was shut down because the clean water facilities were destroyed. Yet the only water available was contaminated. These issues created dire difficulty for those who provided help and those who needed assistance. Thus, the focus of this thesis lies in the issue of water and architecture in which will be perceived through the eye of sustainable architecture. More importantly, the thesis highlights ways to integrate and employ water in architecture in the most desirable and efficient fashion. The thesis rebuilds a new City Hall for the City of New Orleans as a design project. In this endeavor it aims to combine a sustainable technology blending in with the symbol of government in a building. Thus a new City Hall spirit is encapsulated in the government building to project out beyond the 21st century.

Thesis Supervisor: Andrew Scott
Title: Associate Professor of Architecture

WATER DRIVEN
NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

TABLE OF CONTENTS

WATER DRIVEN
NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

CHAPTER 1

INTRODUCTION

Hurricane Katrina struck New Orleans on Monday, August 28, 2005 as a category 3 storm. With over one hundred and ten miles per hour of wind speed, everything seemed vulnerable. Since the city is mostly below sea level, the levee system becomes the only armor against harmful water. The powerful wind and storm surge caused levee branches to fail, resulting in water pouring into the city and raising to the level with Lake Pontchatrain. Eighty percent of the city went under the water.[1]

The Superdome was designated to be the "shelter of last resource" for those people who were not able to evacuate from the city. Although the Superdome was used in the same purpose prior to Hurricane Katrina, this time the situation was historical. The storm destroyed over 170 drinking water facilities and forty-seven wastewater treatments around the city, resulting in the shortage of fresh water supply. The mixing of industry chemical, debris, bacteria and decomposing bodies in flooded water made this water horribly poisoned.[2] Thus, the water condition was hazardous. During this period, the city of New Orleans was working with the Department of Defense (DOD), the Department of Transportation (DOT), and the Federal Emergency Management Agency (FEMA) to supply clean water to the survivors and the city.[3] However, it took tremendous efforts to reach those who in need because the access to the Superdome

Above: Food and water are being delivered to the Superdome
Below: Image from the Superdome

was obstructed by floodwaters.[4] Moreover, this contaminated water took over thirty days to recede. Subsequently, the city took another thirty days to flush clean the water system to make sure that there were no toxic residues left in the system.[5]

Although the government did not declare the lack of clean water in New Orleans as a major issue during the Hurricane Katrina, it is in fact an important issue that cannot be neglected. Drinking water needed to be delivered from elsewhere, running water was shut because the water facilities were destroyed, and yet the only water available were contaminated; these issues created difficult situations for those who provided help and those who needed helps. As the resources for clean water were limited, the situation became very stressful to all that sheltered in the Superdome area. If fresh water was to be readily available at that time, many problems such as illness caused by sanitation, hygienic medical treatments or even looting for food and drinking water would have been reduced. Water are not seem to be a big issue at the time, but if it has been available, the situation would have been improved tremendously.

Thus far, as a response to this incident, the opportunity for architect to be rethought is at hand. While the current trend of architecture has mostly concentrated in developing passive buildings that are able to generate and sustain their use of energy, little attention has been paid to the possibility of architecture that deals with water. This thesis will look at ways to design architecture that passively generate

and with the integration of water in order to employ its own use and preserved for its future needs.

Therefore, this thesis focuses on the issue of water and architecture, which will be perceived through the lens of sustainable architecture. More importantly, this thesis will seek for ways to integrate and employ water in architecture in the most celebrated and efficient fashion. To do so, firstly, various ways that water is being employed in contemporary architecture will be studied and examined. It is crucial to understand how water is being used and integrated in architecture presently by numerous techniques of water use. The techniques are: 1) Water as Aesthetic, 2) Water as Mechanical System, 3) Water as Form, and 4) Water as Technology. Looking at these case studies allows us to better understand the way water works in contemporary architecture, and to foresee the possible ways to improve. The second part of this thesis will focus on the various methods of water harvesting. The method such as harvesting water from air, rain and dew will be study in this section.

The thesis has also chosen to rebuild a new City Hall for the City of New Orleans as a design project. Subsequent to the impact of Hurricane Katrina, the City of New Orleans has an attempt to reconstruct the city, merely not to recovery, but to recreate a new city for upcoming future. For this reason, to project the image of resurrected city to the world, the effort to replace a current 1955 City Hall complex has emerged. The new City Hall will sit on the site of the current City Hall complex. This site marks the edge of the Financial District, locates at the corner of Poydras Street and Loyola Avenue. City Hall as a symbolic landmark for civic pride should be manifested in the New Orleans significant cultural heritage.

This project aims to combine the sustainable technology with the symbolic gesture of government building in order to erect this new City Hall as a role model for the government building of the 21st century. Since water is a vital element to our lives, yet looking back to the Katrina disaster, this new City Hall aims to become a place to supply that vital element for the city when needed to. Hence, creating a City Hall that uses water as inspiration for the sustainable technology reflects the intention of being a guardian to the city in the crisis time.

Notes

[1] Jainey K. Bavishi, *Building Community Capacity in the Rebuilding of New Orleans: The Role of Philanthropic Funders Post-Katrina.* Massachusetts Institute of Techonogy, 2007.

[2] Department of Homeland Security. The Federal Response to Hurricane Katrina: Lessons Learned, 2006. Washington, DC: 2006. pp 37.

[3] Ibid,. pp 39.

[4] Ibid.

[5] Guy Gugliotta and Peter Whoriskey, "Extraordinary Problems, Difficult Solution: Massive Floods, Pollution Make for 'Worse Case'" Washinton Post Staff Writes, 10 Sept. 2005. http://www.washingtonpost.com/wp-dyn/content/article/2... (accessed Apr. 28, 2008).

WATER DRIVEN
NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

CHAPTER 2

CASE STUDIES: Water in Contemporary Architecture

Introduction

Since ancient times, water has been a common feature of architectural design. In the Roman era, water was closely related in culture. The Romans were the first to integrate water into their landscape design and later use it in their engineering inventions. Later, the French introduced water in their architecture mainly as part of landscape design. In Versailles, ponds and canals reflect sky; they function as connectors between ground and sky.[1]

Currently, many architects integrate water as a feature in their design. Some schemes use water as decorative features, some use it as a symbolic gesture, and some as a decorative or working feature. Japanese contemporary architecture is known for its extensive use of water in its design. Tadao Ando is a notable example. Although Ando is known widely for his use of natural light, he also employs water in a notable way. His use of water in the 2002 Modern art Museum of Fort Worth, Texas, enhances the experience of being in the place. The water extends the landscape of the visitors from the gallery areas, and visually connects the viewing experience of cityscape to the gallery spaces.

Water is also widely used as a part of mechanical systems to heat and cool buildings because it requires less energy to operate than heaters and air-conditioning.[2] Vincent James has introduced the concept of a water-wall as

a cooling system to be used in buildings in a warm and humid climate, a use which can be seen in the University Center of Tulane University in New Orleans.

Some architects have looked at water as an inspiration for the forms of their buildings. For example, in the structure of the National Swimming Center for Olympic 2008 in Beijing, the Australian architecture firm of Arup and PTW has introduced form and structural system derived from water-bubbles, known as the Water Cube. In this case, the structural logic of water-bubbles was extracted and studied in depth in order to apply it to the skin-structure of the building.[3]

Currently, integrating water with technology is becoming a large trend in architecture. Carlo Ratti, head of MIT's SENSEable City Laboratory, has taken a further step by creating a Digital Water Wall that will be used as a skin of a building, which will be displayed at the Expo Zaragoza'08.[4]

Water is now being adapted into every frac tion of architecture, from skin to structure. Yet, few attempts have looked at water in a possibility of being a sustainable feature of the building which expresses part of the architectural design. It is therefore important to observe the use of water features in contemporary architecture -- whether decorative or technological -- and analyze how these features can be improved and advanced.

This thesis will investigate the use of water in contemporary architecture in four different categories: 1) Water as Aesthetic, 2) Water as Mechanical System, 3) Water as Form, and 4) Water as Technology. An example of a project is given in each category to demonstrate each type of use. This paper will offer an overview of different ways in which the use of water can be rethought in contemporary architecture. Finally, these analogies will be use as basic concepts of integrating water that will convey symbolic gesture yet operate in the most efficient way, and will be further in the new design of New Orleans City Hall.

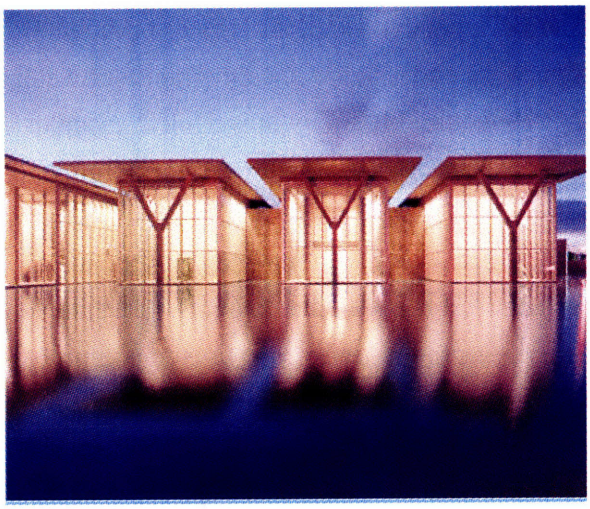
Background

Water and architecture have been associated together since ancient times. The Romans were the very first to apply water as an element of their landscape design. Later on they incorporated water as an essential part of their architecture due to the advancement of their engineering inventions.[5] They created aqueducts to direct water into the city and constructed fountains for the city. After that, water became an essential part of their culture. Fountains and bathhouse were created at this time.[6] Thousands of years later, the French introduced water into their architecture design, mainly as part of their garden elements. However, unlike the Romans, the French used water only as a means to achieve aesthetic quality in their architecture.[7] Water was perceived merely as a decoration in their eyes.

Water is a vital element of our lives. The decline of average annual rainfall and the increase of population challenge us to seek ways to do our best to sustain our water supplies.[8] However, the trend in sustainable architecture has focused mainly on reducing

the energy consumption, rather than on using water. Architecture needs to respond to this issue by searching for techniques that employ water most efficiently. In order to do so, it is important to observe and understand current ways of employing water in contemporary architecture.

We can distinguish water use in contemporary architecture into four categories; 1) Water as Aesthetic, 2) Water as Mechanical System, 3) Water as Form, and 4) Water as Technology. Looking at these case studies allows us to better understand the way water works in contemporary architecture, and foresee the possible ways to improve it.



Above: Fort Worth Museum of Modern Art, Texas

Water as Aesthetic

Water is becoming a common element in the design of contemporary architecture; however, often, it is merely for aesthetic purpose. Water is introduced in contemporary architecture as an ideal element for landscape design. Water fountains in gardens, fishponds, artificial waterfalls or even man-made lakes are examples of this category. In contemporary architecture, landscape is a crucial element; it allows the connection between architecture and its surroundings. In other words, the landscape completes and enhances the experience of being in the architecture. Water allows this connection to happen in the most seamless way through its colors, movements, sounds and even its smells. It is these "experiences" of water that have allowed water to become a "universal element" in landscape design in contemporary architecture.[9]

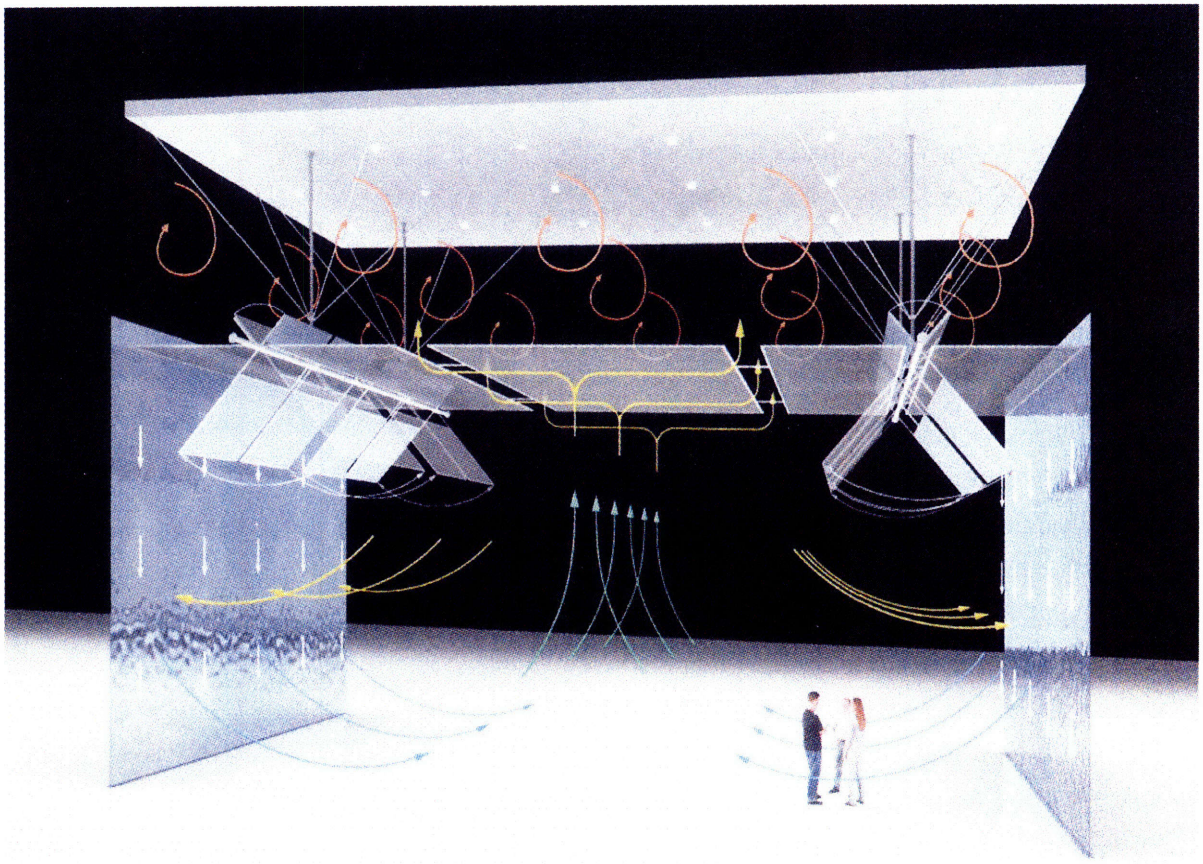
Japanese architects are the masters of integrating water into their architecture. Tadao Ando is a notable example. His use of natural light is second to none; his integration of water in architecture is equally powerful. In each of Ando's projects, his greatest effort is expressed through the refined details and materials selection. Water becomes a material in Ando's architecture, a material that contains movements, sounds and smells, which he uses to communicate his architectural intention of the building.[10] Water, with its special characteristics, allows people to engage and experience his architecture in a precise way. To Ando, water is meant to be experienced sensually way.

In the Fort Worth Modern Art Museum in Texas, Ando created an artificial lake on the site, extending out from the building to achieve a visual connection between the museum and the cityscape further away. The depth of the shallow lake was carefully measured so that the water is level with the interior ground floor of the gallery spaces, creating a feeling of continuity from the interior to the exterior. Once the visitors perceive the illusion of lengthened ground, created by water, they enter into the gallery spaces. The visual connection moves from the interior to the exterior, from the floor of the gallery onto the water on the outside and continues on to the landscape, enhancing the experience of viewing the downtown horizon. The integration of this artificial lake in the Modern Art Museum of Fort Worth has an impact on the viewing experience not only from the interior to the exterior, but from the outside in as well. A large one-and-a-half acres of lake that sits against the foot of the building makes a large concrete building seems as if it is floating on the reflecting surface of the water.[11] The massive twenty-three thousand cubic yards of concrete construction seem like a feather sitting on a bed of water.[12]

In Ando's hand, the element of water in the Modern Art Museum of Fort Worth is integrated in a superior way. Water serves the purpose of being an element that conveys an aesthetic aspect of architecture in the highest degree yet enhances the dramatic experiences of the visitors. Ando's Fort Worth Art Museum integrates water in a purely aesthetic manner. However, it is questionable whether that gigantic amount of water has reached its maximum potential of being useful to the building in other ways. The aesthetic aspect is valuable to architecture, but at the same time it can bee seen as a waste of resources. Perhaps if that large amount of water could be employed further into a simple mechanical heating or cooling system of the building and still maintain it aesthetic and sentimental quality, this building would achieve a more efficient way to employ water in architectural design.

Water as Mechanical System

In the realm of sustainable design, reducing energy use in buildings is important. In order to create a comfortable environment, heating and cooling buildings in extreme climates require a significant amount of energy and overall operating cost.[13] In response, many architects begin to look at ways to reduce energy used in the heating and



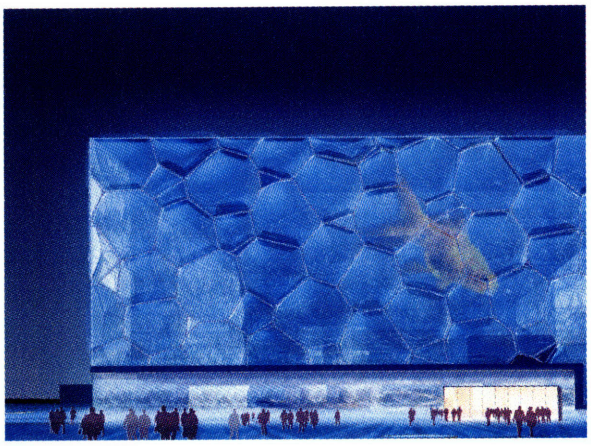
cooling systems. Using water as part of heating, ventilating and air conditioning (HVAC) system is common in today's practice. Much research has looked at ways to reduce energy consumption by looking at the technical aspect of the system. For examples, Cassidy and Stack have observed the impact of the speed of cooling tower fans on reducing energy consumption,[14] Braun and Doderrich have designed a systematic method that will search the most advantageous fan speed for the least energy consumption,[15] and later Lu Lu and Cai have looked at the mathematical models in order to vary the water flow rates and air flow rates to achieve the most efficient way to consume energy.[16] However, despite the fact that this research has made a useful contribution to the field, It has been conducted only from the engineering aspect. Water can be applied more creatively as an architectural feature that combines both engineering and aesthetic.

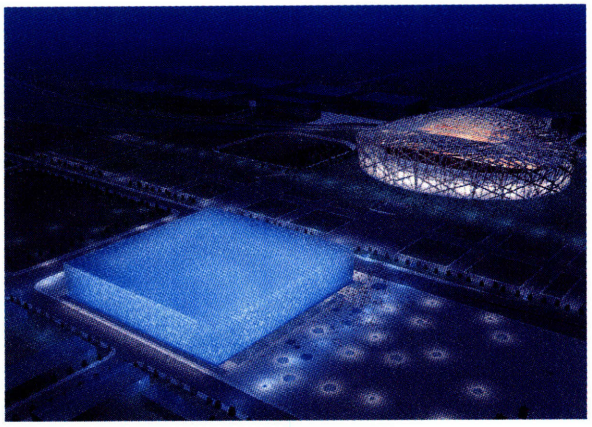
In New Orleans, where the climate is relatively hot and humid, it is crucial that buildings have cooling mechanisms to create comfortable spaces for their inhabitants. This has been mostly accomplished by using air-conditioning. The design proposal for the Tulane University Center in New Orleans by James Carpenter demonstrates a way to

Above: Waterwall concept, Tulane University Center, New Orleans

use water as part of the cooling system in the building. In New Orleans, where the climate is relatively hot and humid, Carpenter introduced the concept of a waterwall as part of the design for the entrance space. This system simply uses chilled water to deliver a cool breeze to the space. In the original design scheme, two seven meter high walls facing each other made up of stainless steel mesh with chilled water running down, created a threshold space for the University Center. The central chiller plant cools this running water before it runs down the wall. Pendulum fans blow warm air onto the wall, condensing warm air into the water-wall, creating a large dehumidifying effect on cool air and producing a cool breeze into the space. As the cooled air flows into the space, the hot air rises upward; some excess hot air flows through the ceiling to exit the building and some is forced onto the waterwall again to repeat the cooling procedure.[17] In short, waterwalls are not only cooling mechanisms in the building but also act as decorative elements in the building.

James Carpenter uses water as a working feature in his architecture yet expresses the aesthetic quality through its setting. This use of water is in contrast to Ando's work, where water is used merely for aesthetic purpose. From the sustainability aspect, Carpenter uses water in his architecture more efficiently than does Ando. On the other hand, Carpenter does not create as much of a sentimental effect from his use of water, as Ando does in the Modern Art Museum of Fort Worth. Perhaps if we combine both approaches together, water can

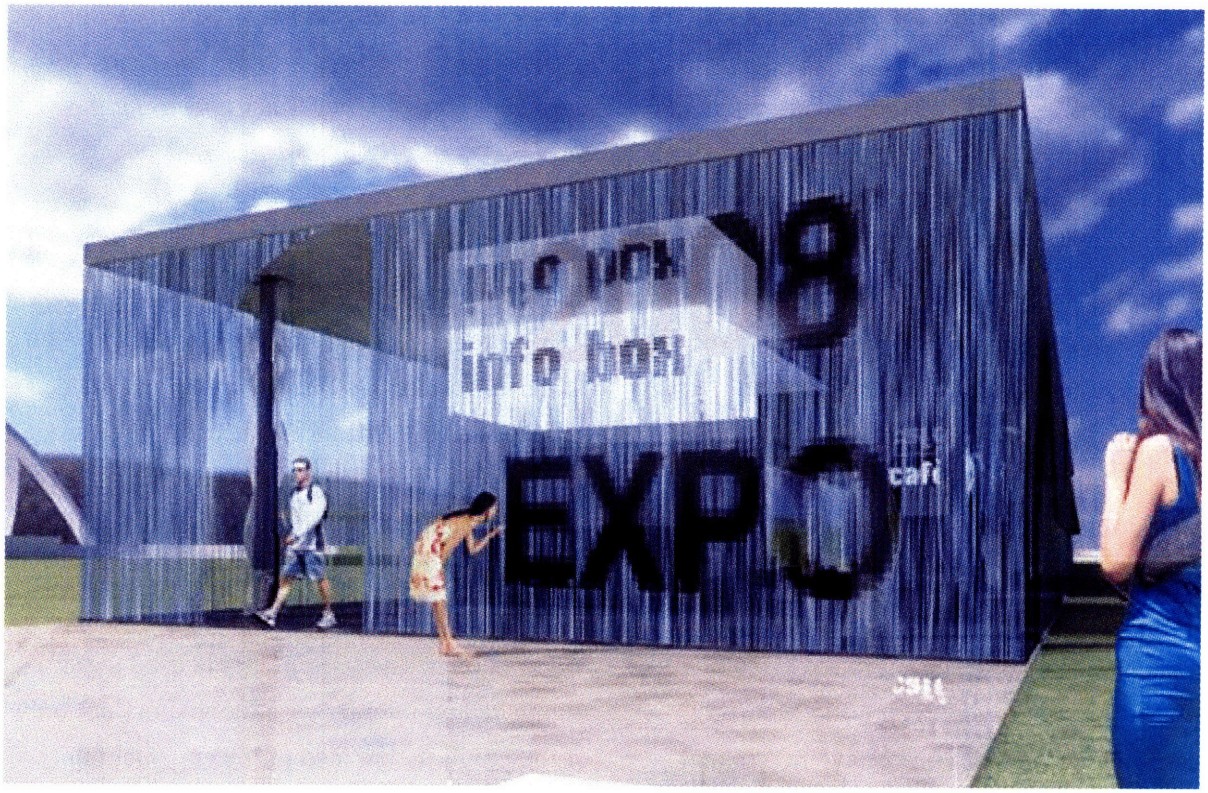




Above: Elevation of the National Swimming Center, Beijing

Below: National Swimming Center in context with the "Bird nest" composing Yin and Yang

Opposite: The Digital Water Pavillion, Zaragoza



be used in a way that breaks new ground.

Water as Form

Water can be inspiring in many ways. The National Swimming Center designed for the Beijing Olympics in 2008, known as the Water Cube by Peddle, Thorp and Walker (known as PTW), an Australian firm, demonstrates a way that water can inspire form.

The Water Cube expresses its association with the idea of water on many levels, ranging from the symbolized form that signifies the program of the building to its structure, which is extracted from "a random, organic and homogeneous cluster of foam bubbles."[18] Because this is the National Swimming Center, the form of this building creates a strong connection between the form and the program:

The bubble concept was not simply applied as a pattern of circles of different diameters to the surface of a conventional structure, but became the basis for a radically new approach integrating aesthetic, environmental and structural agendas into an "insulated greenhouse" concept.[19]

However, to achieve such form, the extreme engineering that expresses the lightness of water bubble yet performs exceptional strength had to be developed. Arup, a well-known structural engineering firm, aided the architects in coming up with structural solution.

The design for the Water Cube derived from a square base that extruded into an orthogonal form 177 square meters wide and 31 meter high. Visually suggesting the idea of water requires a particular characteristic of cladding material for the envelope of the building. Hence, the façade is treated with ETFE – Ethylene Tetrafluoroethylene – a special kind of plastic film that allows translucency.[20] This material allows a great deal of durability yet very lightweight compared to other material of a similar property. The translucency of the material allows light to glow from inside, giving an effect of glowing light blue Water Cube. This building sits adjacent to the glowing red, round stadium (by Herzog & de Meuron), completing the Chinese believe of Yin and Yang in larger scale - blue water as 'Yin' and red fire as 'Yang'.[21]

Using water as an inspiration to derive form is not a new idea, but the National Swimming Center by PTW uses the notion of water in an extraordinary way. It touches on many levels: urban, architectural and engineering. This project manifests another way to achieve great architecture derived from the idea of water, but in a very distinct way to those previous projects. Although water is used in this project as an idea rather than as an actual object, the quality of "water" is central to the project we have seen.

Water as Technology

Imagine a building made of water. It features liquid curtains for walls - curtains that not only can be programmed to display images or messages but can also sense an approaching object and automatically part to let it through. – Patti Richards, 2007 [22]

The most unconventional project of all that incorporates water as the main scheme in the design has to be the Digital Water Pavilion designed for the upcoming World Expo 2008 in Zaragoza by Carlo Ratti, head of MIT's SENSEableCity Laboratory. This project combines water with interactive digital technology to demonstrate how architecture of digital age can be responsed to people in a public space.[23] Water becomes a medium that is used to communicate and interact with the visitors not only of the pavilion, but also of the surrounding area.

Sitting at the entrance of the Zaragoza Expo, the pavilion consists of water walls that enclose on four sides. These water walls created by drops of water that drips from the roofs and controls by computer-controlled pumps and valves, which will allows these water walls to display images, texts and interactive with its surrounding environment. This system controls droplets of waterfalls in very precise measurements in order to control gaps in the waterfalls and create patterns on water wall. The idea similar to those of screen pixel, but using water drops instead of illuminated points. The façade of the pavilion will display information to the visitors of the Expo in texts and graphic patterns. The pavilion has a sensor system that would acknowledge any approaches of people or objects that coming near it. Once the sensor

senses the movement approaching the pavilion, it will signal the water wall to create an opening automatically, allows people and objects to move through. This concept resembles the ideas of conventional automatic, but uses programmed water as medium. Moreover, these openings can be inserted at any points of the water wall, unlike conventional doors that are fixed in place.

The Digital Water Pavilion is the first to occupy a method that combines water and digital technology create architecture. Although there have been attempts to control water droplets, this is the first time that this idea has been introduced on an architectural scale. This project aims to demonstrate the possibility of exploring architecture that interacts to activities of inhabitants. It has always been a fantasy to have an architecture that is able to expand and contract when according to user's needs. This project uses water to demonstrate this notion since material such as concretes and bricks are extremely difficult to work with kinetically.[24] Water offers possibility that other materials cannot offer.

The way water is being thought of in this project is very different than in previous projects. Ratti does not see water as sort of inspiration or aesthetics, but as a medium that is used to explore architectural ideas that emerged from the characteristic of water. The flexibility and adaptive nature of water is being explored to create architecture of the digital age.

Conclusion

Each case study demonstrates ways water can be employed in contemporary architecture. Innovative strategies to employ water efficiently yet articulate sentimental experience in contemporary architecture requires architects to hone and enrich their technical and artistic skills together. However, to attain such quality is never easy because efficiency often seems to require trade off between aesthetic and practicality.

This paper has looked at four different projects that use water in four distinct ways in order to understand the advantages and disadvantages of each approach and to find ways to implement the advantages into my future design. I discovered that water could be perceived as more than just an architectural object for decoration. It can be interpreted as material, inspiration, or even as a mechanical system. By recognizing water in these manners, the opportunity to employ water in more creative ways will emerge. By examining the different ways architects have used water, we can generate architecture that uses water more beneficially and productively.

Notes

[1] Peter Davey, "Water Water - Use of Water in Architecture," *Architectural Review*, The. Dec 1998. FindArticles.com. 14 Apr. 2008, http://findarticles.com/p/articles/mi_m3575/is_1222_204/ai_54036012

[2] Sandro Marpillero, *James Carpenter: Environmental Reflections*, (New York: Princeton Architectural Press, 2006), pp 130 – 139.

[3] Kirsten Orr, "Thinking Beyond the Square: Innovation Theory and Technology Transfer as They Apply to The Beijing Water Cube," http://epress.lib.uts.edu.au/ocs/index.php/AASA/2007/paper/viewFile/78/55

[4] Dennis Frenchman and Francisca Rojas, "Zaragoza's Digital Mile:Place-Making in a New Public Realm," *Media and the City.* pp 16-25.

[5] Peter Davey, "Water Water - Use of Water in Architecture,"

[6] Ibid.

[7] Ibid.

[8] Scott Drake, "The Third Skin: Architecture, Technology and Environment," University of South Wales Press Ltd, Sydney, Australia. pp 128.

[9] Robert Woodward, *New Waterscape*, pp10

[10] Tadao Ando, *Details*, pp10

[11] Sipes, Childers, "Art and architecture converge in concrete: World-class museum results from artful design and construction." *Concrete International.* June 2003 Vol. 25, no. 6, pp42-45.

[12] "The Modern: mammoth concrete structure—unlike any other - project of the month - Modern Art Museum of Fort Worth, Texas - Brief Article". *Concrete Construction.* April 2003. FindArticles.com. 21 Apr. 2008. http://findarticles.com/p/articles/mi_m0NSX/is_4_48/ai_100736193

[13] Lu Lu, and others, "HVAC System Optimization-Condenser Water Loop," Aug 2002.

[14] Cassidy, Stack, "Applying adjustable speed AC drives to cooling tower fans." Annual Petroleum and
Chemical Industry Conference, 1988

[15] Braun, Doderrich, "Near-optimal control of cooling towers for chilled-water systems." ASHRAE Trans, 1990, 806-13.

[16] Lu, "HVAC System Optimization-Condenser Water Loop,".

[17] Sandro Marpillero, pp 138.

[18] Kirsten Orr, "Thinking Beyond the Square: Innovation Theory and Technology Transfer as They apply to Beijing Water Cube," pp 2.

[19] Ibid., pp 5.

[20] Ibid.

[21] Ibid.

[22] Patti Richards, "MIT news: MIT architects design building with 'digital water' walls." 10 July 2007. http://web.mit.edu/newsoffice/2007/water-building-0711.... (accessed Mar. 10, 2008).

[23] Dennis Frenchman, and Francisca Rojas. "Zaragoza's Digital Miles: Place-Making in a New Public Realm." pp 16.

[24] Richards, "MIT news: MIT architects design building with 'digital water' walls."

WATER DRIVEN
NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

CHAPTER 3

SUSTAINABILITY RESEARCH: Water Harvesting

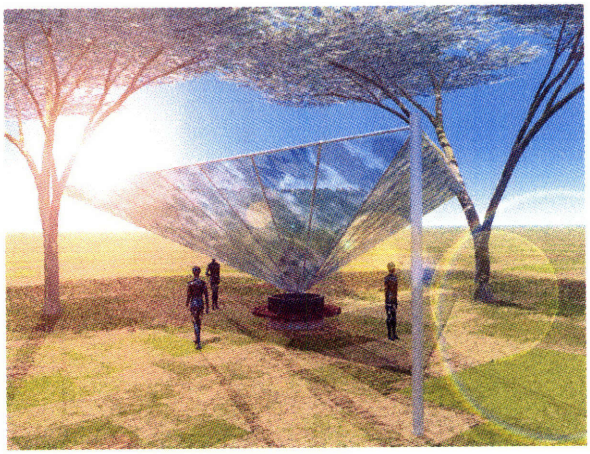
Introduction

Water Harvesting is a passive process to collect and generate water from natural sources in order to use as potable supply, domestic water, agriculture and livestock. In remote areas that do not have access to fresh water sources like river or pond, harvesting water from rain, dew and air are commonly found. This chapter will look at these water-harvesting methods in order to incorporate as a water-generating feature in the design of New Orleans City Hall.

Harvesting from Rain

Rainwater Harvesting is one of the most common and promising water harvesting process for over 4000 years.[1] It is the way to catch the rainwater from a surface such as roof, land surface or rock catchments before it runs into the drainage system or soil.[2] Rainwater can be use for potable, agriculture, and livestock. There are many techniques found for rainwater harvesting, it can be as simple as placing a container in the rain, or as complicate as constructing a basin or swale contour to intercept the rainfall.[3] This depends on quantity of rainwater that needs to be collected and the durability for live span of the catchments device.

Currently, many places and cities around the world require new constructions to include rainwater collectors. Bermuda and



Above: Image of dew water on spider web
Below: WATAIR project by Joseph Cory and Eyal Malka

Virgin Island are the notable ones. In urban context, rainwater harvesting grants numerous benefits, some examples are providing supplement water for city's requirement, increasing soil level for greenery, increasing ground water table through artificial recharge, mitigating urban flooding and improving the quality of ground water.[4]

Statistically, New Orleans has an annual average precipitation of 61.88 inch,[5] distribute evenly throughout the year. This gives an astonishing edge to rain water harvesting in the New Orleans Climate.

Harvesting from Dew

Dew Harvesting can be found usually in deserted areas and developing countries in hot climate.[6] Water is condensed during nighttime when dew point is about 0 to 6 F with moderately high humidity atmosphere.[7] However, the technique of dew harvesting can be seen since ancient times; for example a crushed pile of stone form artificial hill in the former USSR where fresh water is found running under the pile and the dew pond from the Middle Ages in England.[8] These dew catchers were constructed in a very simple manner. They were mostly large excavated basin in the dry land, covered with straw and a layer of clay then compacted with stones.[9] In early 20th century, many scientists tried to duplicate the technique of water condensing of the ancient times by using massive construction of rocks or stones. Nonetheless, the results have never matched those of the predecessors.

In the modern days, the technique of

dew harvesting has evolved from a massiveness of stones to a lightweight of membrane. The study says that an "ideal" condenser must be light in order to cool quickly during nighttime like grass in the meadow or spider web on the tree.[10] Joseph Cory and Eyal Malka designed an award winning dew catcher device called WATAIR in 2006. This project demonstrates the concept of lightweight water condenser. WATAIR is designed for gathering water for barren land where water is hard to find. It is in a shape of inverted pyramid that composed with lightweight dew-collecting panel that imitate the property and form of spider web. It was tested to capture 48 liter of water from its 96 square meter of collecting surface.[11]

Water condenseds from dew is relatively clean and safe to use as a potable water for most places.

Harvesting from Air

Harvesting water from air is similar to harvesting water from dew; rather, it does not need to be done during nighttime. They both take form of condensation to condense vapor in the air to a liquid state, usually happen when temperature reaches its dew point.[12] We often encounter condensation in building in a form of dampness between a wall gap and sometime water drops on the windows. Dampness created by the high humid air from the internal space caused by people comes to contact with a cool surfaced of windows and walls.[13] Nowadays we can find machine that is designed to condense water for drinking purpose almost everywhere; ranging from household size to commercial size. Nonetheless, these machines need sufficient electricity to operate and produce an adequate amount of water.

Although there is no rigid innovation for passive daytime harvesting water from air using condensation technique, this procedure – condense air to water - seems to be very promising as a method for harvesting water.

Conclusion

This chapter has looked at water-harvesting methods in order to highlighting the way that water can be found and produces by natural process. By understanding these processes and methods, the design of the City Hall is immensely impacted. However, these engineering features need to be simplified in order to apply as essential integrating feature in the architecture aesthetically, rather than taking the system and placing onto the building.

Notes

[1] "Rainwater Harvesting Resources." n.d. http://www.jrsmith.com/products/rainwater_harvesting/i... (accessed May 11, 2008).
[2] Ibid.
[3] City of Tucson. *Water Harvesting Guidance Manual*, 2005. Tucson, AZ: 2005.
[4] "Rainwater Harvesting Resources."
[5] http://www.met.utah.edu/jhorel/html/wx/climate/normrain.html (accessed May 10,2008)
[6] Anil K. Rajvanshi, "Large Scale Dew Collection as a source of fresh water supply", *Desalination.* Maharashtra, India.
[7] *Basic Introduction Night Distillation System*, A2WH Night Radiant IR Long Wave Condenser. XDOBS.com LLC
[8] "International Organization For Dew Utilization" n.d. http://www.opur.u-bordeaux.fr/angl/question1_ang.htm (accessed May 11, 2008)
[9] Ibid.
[10] Ibid.
[11] Evelyn Lee, "WATAIR: Turning Air into Water", *Inhabitat*, April 16, 2007., http://www.inhabitat.com/2007/04/16/watair-turning-air-into-water/ (accessed April 20, 2008)
[12] International Union of Pure and Applied Chemistry. "condensation in atmospheric chemistry". *Compendium of Chemical Terminology* Internet edition.
[13] http://www.buildingpreservation.com/Condensation.htm *Building Preservation* (Condensatireiron - the basics)

WATER DRIVEN
NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

CHAPTER 4

PROJECT: Design of the NEW Orleans City Hall

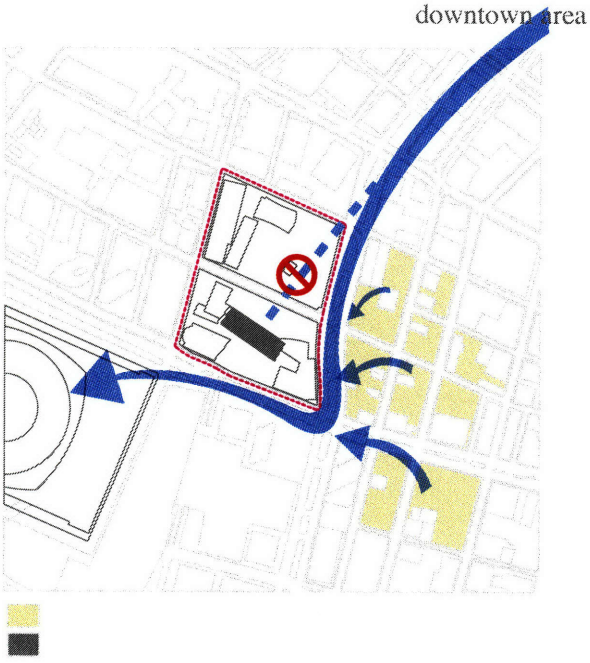
Introduction

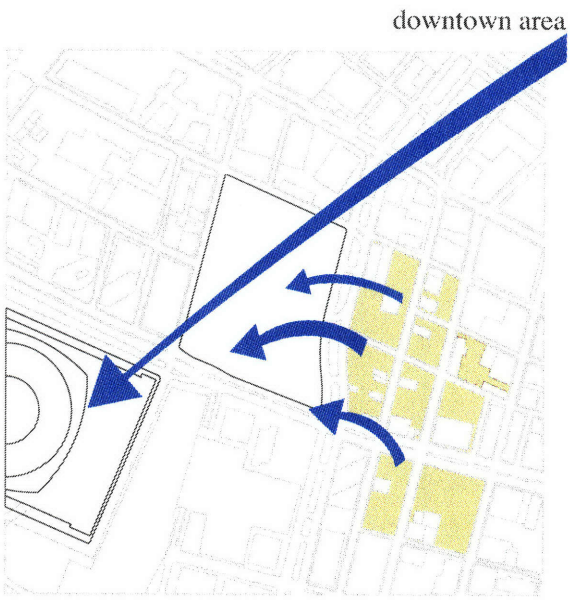
The City Hall as a civic center for the 21st century has many roles to play beyond a mere house for the administrative activities of the city. It is necessary to focus the relationship between architectural representation and its city's house of governance. Furthermore, the new design entails the importance of New Orleans's rich tradition of music and art activities. Thus, City Hall as a Civic Center for the 21st century has to demonstrate the notion that the government is friendly, accessible and proactive.

The site is at the corner of Loyola Avenue and Poydras Street located at the edge of the business district of New Orleans civic core. Moreover, it offers a connection to the two buildings--Duncan Plaza, an unused states office building and the public library, to which can be incorporated to the City Hall site. With these conditions, this project occupies an enormously large ground allowing a great potential to reshape and redefine the urban form and public space of its surroundings to create a stronger sense of urban scale.

This project also expresses a strong importance of integrating sustainable design to the architecture. In this case, finding ways to incorporate water in the most efficient way is the main focus.

Thus, the goals that the new design of the New Orleans City Hall aims to accomplish





Parking Lot
Current City Hall building

Left: Diagram illustrating the path of pedestrian movement as the current city hall still exist

Right: Diagram showing the pedestrian movement if the current city hall is demolished in order to activate and open up the site to let the pedestrian through

are as follows:

1. To create a public space that is truly activated as a strong public plaza;
2. To enhance the densification of the site and its surroundings;
3. To establish a linkage between the civic core of the city and its periphery area (the "Superdome");
4. To redefine the role and importance of the City Hall to the city; and
5. To redesign the City Hall in the sustainable manner.

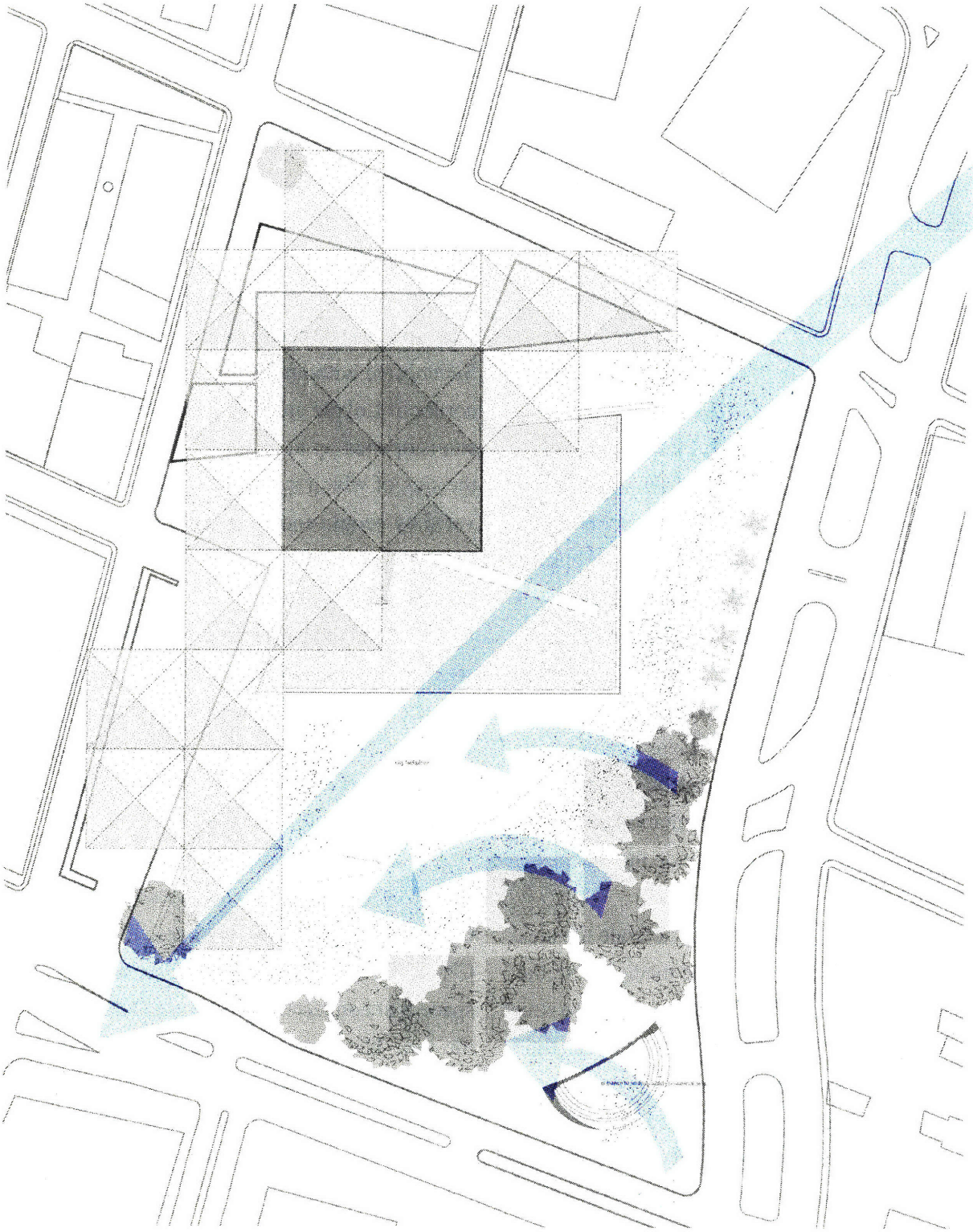
The design is executed in 3 scales: urban, architectural and details.

Urban Scale

In this scale, the urban strategy is analyzed in order to understand the relationship between the city and the site. Thus, the site plan is emerged by this procedure.

- **Urban Strategy**

There are many parking lots around the City Hall site that is fully packed when there is an event heldg at the Superdome. On the contraty, other than those event periods, the parking lots are normally vacant. The site locates at the edge of the civic core of the city, separating the Superdome from the core. The influx of people moves through this area to



Above: Site plan

go to the Superdome. However, the site of the City Hall has never been activated by this cause. According to this fact, by activating the City Hall site, the path of people movement has to be redirected to move through the site. By allowing and redirecting people to naturally move through the site, the edge of the city and the civic core that has been separated will get reconnected again.

There are main reasons why people are not using the City Hall site as a passing path from the city to the Superdome. First, people cannot walk through the site due to the enclosed fences that has been used to keep out the homeless from Duncan Plaza. Duncan Plaza is currently prohibited from any kind of trespassing. Second, the construction and the orientation of the current City Hall building create a condition like a "wall-effect" to the site. Currently, the building gives the impression of "the end of the path" and being the "destination" to the people in operating hours. On the other hand, it leaves nothing to the people when it closes; nobody wants to go there since it is not their destination anymore. Hence, the site is empty outside the business hours.

Therefore, in order to activate the site, a few adjustments need to be made. First, the site needs to be joined by eliminating the street cut between City Hall and Duncan Plaza and then merge them together into a single site. By doing this, the fluidity of the ground is created. Second, the existing City Hall needs to be demolished because it blocks the direction of pedestrian flow and the building also fails to function as a civic center for 21st century.

Now that the site is a one large continuous ground, the direction of the pedestrian movement needs to be reinforced from the northeast corner to the southwest corner of the site. This "diagonal path" is important because it creates a direct connection between the city core – downtown area, and the French quarter- on the northeast to the Superdome that is located on the south west side of the site. This passage way will allow the pedestrian movement to move directly from the city core to the Superdome without having to walk around the corner of Loyola and Poydras. This way the site is opened up to an influx of people through the site, of which will allow the site to be activated by people and their activities.

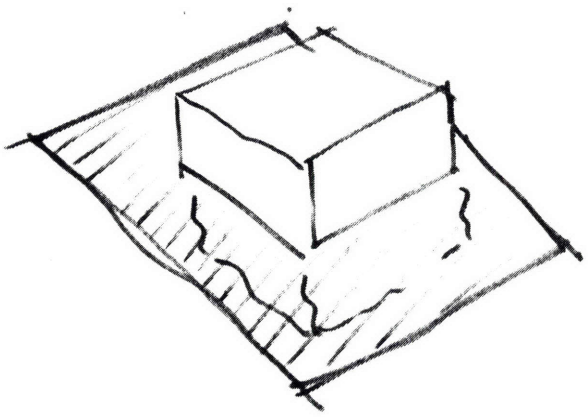
- **Site Strategy**

Following the result of urban analysis, the site plan emerged. The passage way divides the site into 2 parts. One is the north corner section and the other is the south corner section that is by the intersection of Loyola Avenue and Poydras Street.

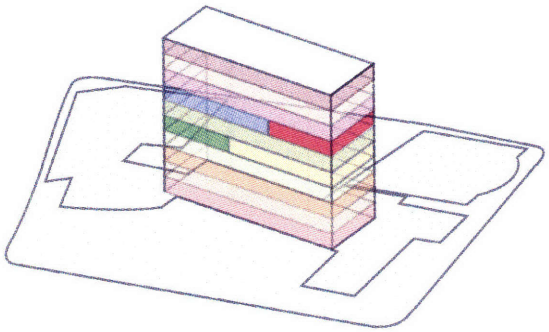
The south part of the site is more suitable to be left opened as a plaza for the new City Hall design. This is because it gives the City Hall plaza a strong setting for an urban space that connects with the open lots around the site. The city open spaces can flawlessly flow into the City Hall Plaza. The pedestrian arrives automatically to the plaza. Therefore, the north side of the site is used for the construction of the new City Hall building. Placing the building on this side, the north side,

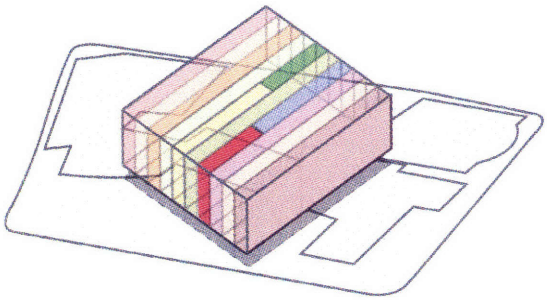
imposes the pedestrian to view the new City Hall building while walking through the site.

Although the construction will be placed on the north side of the site, "soft edges" created by open space needs to be place along the street side to create a soft arrival of the visitor to the building. This allows 10 - 12 meter set back of the building from the street. "Soft edges" help creating the sense of inviting to the building rather than having the edge of the building right up to street. This allows visitors to ease into the property without giving the sense of intrusion that can be resulted in the feeling of uninvited. "Soft edges" also need to be applied to all the corners and edges that have streets running into them in order to help giving the sense of welcoming and soften up the experience of arriving at the City Hall.



Above: Plan od New Orleans, LA
Below: Initial Sketch





Above: Original organization
Below: Propose organization

Architectural Scale

In this scale, the design has touched on the form and the organization of the City Hall building. The form and the organization are responded to the notion of delivering a civic center for New Orleans of the 21st century.

- **Form**

The general form of this building is a cube sitting on the bed of water; signifying the idea of "monumentality" and a purest object being displayed and celebrated. The cube has a geometry that represents simplicity, pureness, and uncorrupted form, and yet denotes the strength and solidity of the city's governance.

The footprint of the building is derived from the grid pattern of New Orleans city block. The dimension of the footprint is 70 meter by 70 meter (230 ft x 230 ft) forming a perfect square base. This building has the height of 35 meter (115 ft), which is half of its length. In spite of this, the reflection of the building on the water surface will add another 35 meter to the building height and complete the perfect geometry of the cube.

The bed of water is merely for sentimental and aesthetic purpose. It helps celebrating the building by creating a distance of viewing the building for visitors. With the boundary of water around, the City Hall is perceived as a precious and untouchable object on a display.

- **Organization**

The City Hall as a civic center of the 21st century, the organizational idea expresses and enhances friendliness, invitation and accessibility.

Current City Hall building is a 10-storey building that has one single entrance and one single core where each department staggered on top of each other. This form of organization does not deliver a sense of invita-

tion and easy accessibility. The organization forces the visitors first to come through this one entrance and to the one core in order to later disperse to their destination. It takes a lot of times and processes before arriving the destination, which makes the experience to the City Hall less pleasant than it should be.

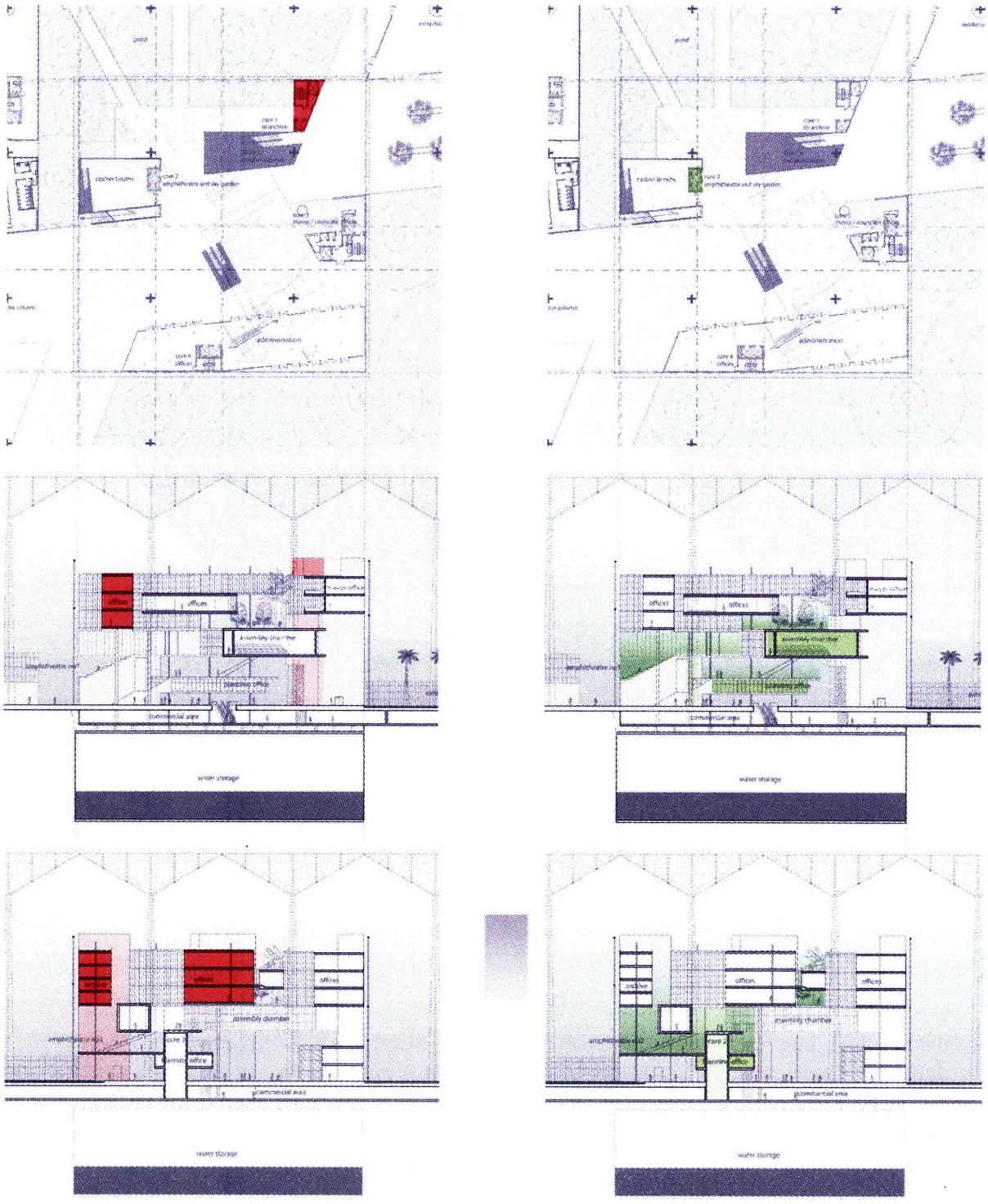
Here, to indicate the notion of accessibility and welcoming, schematically, the program can be organized in the horizontal manner rather than staggering vertically. This way all the designated departments will have their departments touching to the ground and creating their own direct entrance to the department. By having the City Hall organizes its program this way, the visitors will be able to shorten and save their time of visit. Moreover, they can have a direct access to their destinations. The accessibility to the "city" is enhanced and more welcoming to the citizens.

Thus, in the design of the new City Hall building, the building is organized with 4 cores. Each core is dedicated to specific destination in order to allow multiple access point to the building. The building does not have "a door" or "a main entrance" to indicate the threshold between the interior and the exterior of the building, but the threshold is expanded from the moment the visitor arriving at the City Hall area to the moment the visitor entering the core.

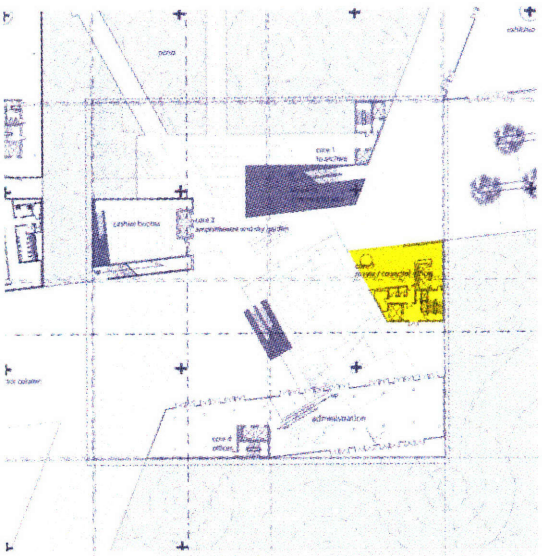
The first core is mainly used for the archive, and also able to access to the office spaces above. This core is located at the north side of the building, as the archive area has to be a well-protected area from the intense sunlight. The visitors coming to archive can take the elevator in this core and access directly to the archive area.

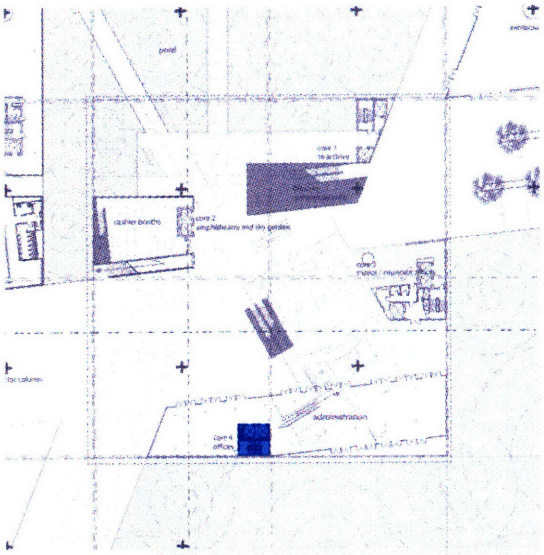
The second core is dedicated to the more public programs. This core locates at the west side of the building next to a large stairs. The elevator in this core take the visitor up only to the 3rd level, but the visitors can take stairs up to the sky garden located at the 5th floor. This core takes the visitors up to the outdoor sky lobby on the 3rd floor, to which 2 amphitheatres are located at this level. The visitors also have an access to the Assembly Chamber from this core. The planning bureau situates on the second level of this core, the visitors can take the large stairs directly up to the office or the elevator if preferred.

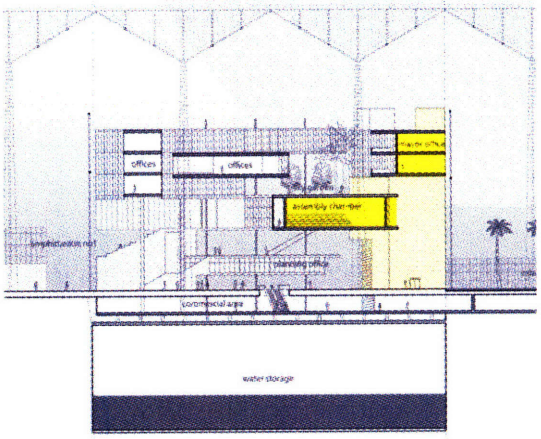
Located on the east side of the City Hall, the third core is merely for the Mayor and the council officers. This core is directly linked with the Mayor's office and the council offices above, yet accessible to the administration offices that locate on the same level. The Mayor's office locates on the top level at the southeast corner of the building. This gives the view of the City Hall Plaza below and yet enhances the sense of power over his city. This core also allows the Mayor and the council officers to have a direct access to the Assembly Chamber on the 4th floor, which increases the sense of security and confidentiality of their appearances. The visitors who come to meet with the officers and the Mayor can take this core directly. The security table is located on the ground level of this core in order to provide security check for the visitors.

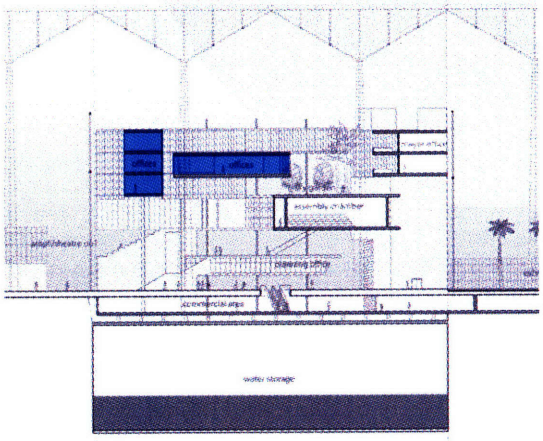


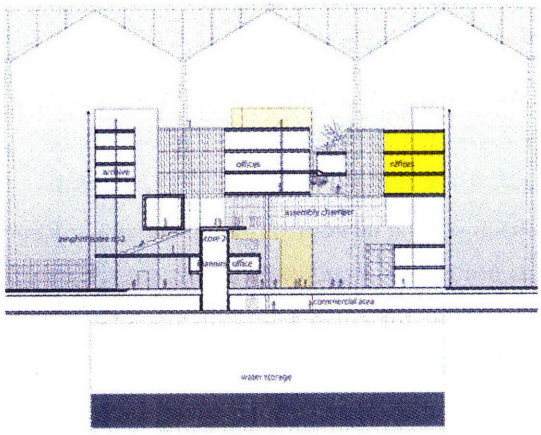
From left to right: showing core 1, 2, 3, 4 and their linked organization program. Core 1 connects to archive and also able to get to the office. Core 2 for public program, sky lobby - sky garden. Core 3 for Mayor and council offices. Core 4 to the offices

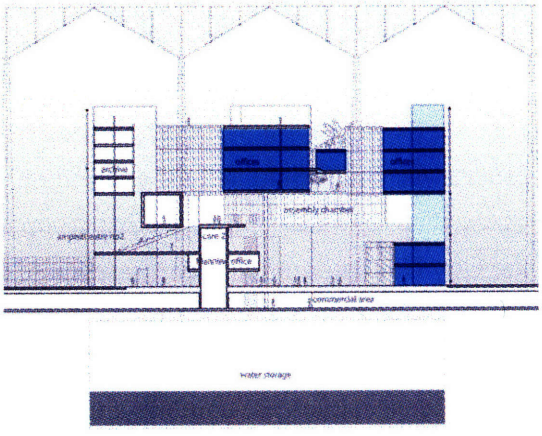

cashier booths
administration
offices

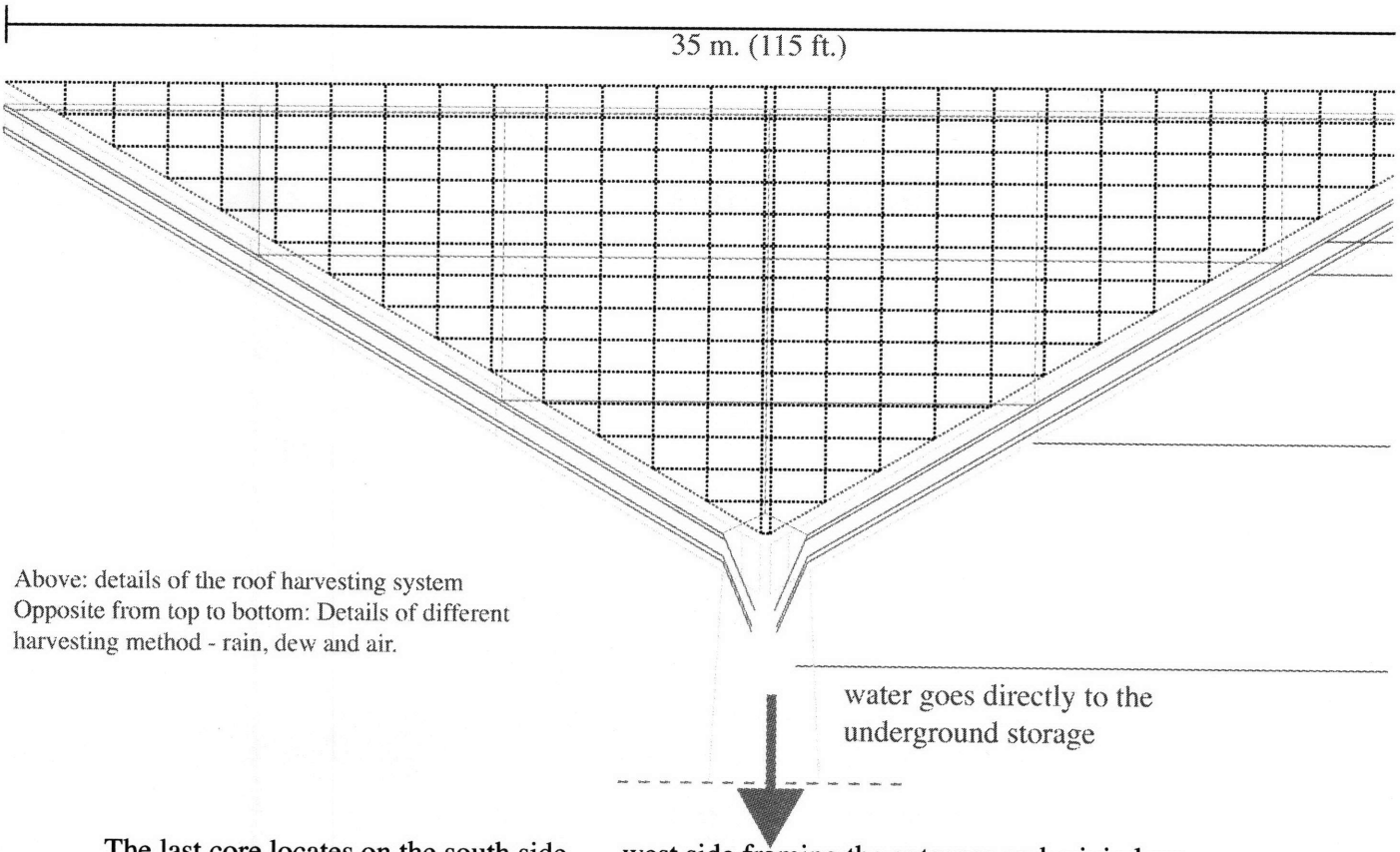

cashier booths
administration


offices
offices
assembly chamber
planning office
commercial area
water storage


assembly chamber
commercial area
water storage


offices
offices
assembly chamber
planning office
commercial area
water storage


assembly chamber
commercial area
water storage



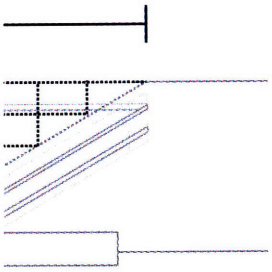
Above: details of the roof harvesting system
Opposite from top to bottom: Details of different harvesting method - rain, dew and air.

The last core locates on the south side of the building given to the administrative office and smaller offices. This core is mainly for the staffs of the City Hall as it takes them directly to their offices.

There are 3 buildings set separated from the main City Hall building. These buildings are the extension of the administrative offices, the auditorium and the exhibition hall. These three buildings provide a backdrop to the City Hall building in order to separate the visual connection between the City Hall building and its neighbor buildings. The administration office is the largest building among these three. In this building, the cashier counters for fine paying and the café can be found. Furthermore, there is stairs leading to the parking garage underground. The auditorium is on the west side framing the entrance and mini plaza of the City Hall building. The roof of this auditorium functions as a performance stage for the amphitheatre on the sky lobby. The auditorium and the roof-top performance stage emphasizes the strong tradition of New Orleans musical root as open for local performers to perform at any time. The exhibition hall locates at the northeast side of the City Hall building. It is a large multi purpose space that use to hold events and exhibitions for the city.

The underground space is primarily set for commercial purpose. There are multiple entrances to the underground level, but the main entrance can be found at the southeast of the City Hall Plaza, next to the intersection of Loyola Avenue and Poydras Street.

In short, the organization of this build-

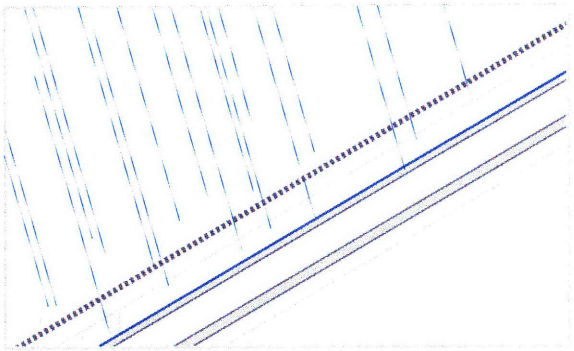


Light weight dew-collecting panel (spider web like membrain)

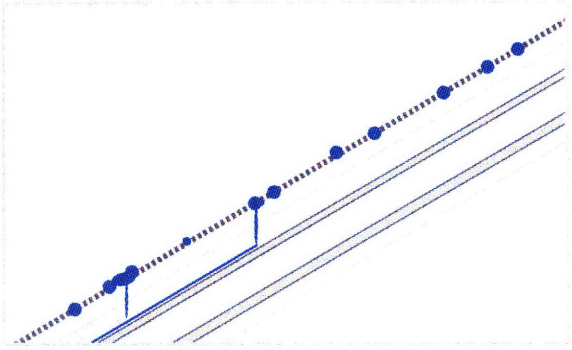
2 layers of glass
rain / air collector
(embedded PV panel, providing shade)

Structure

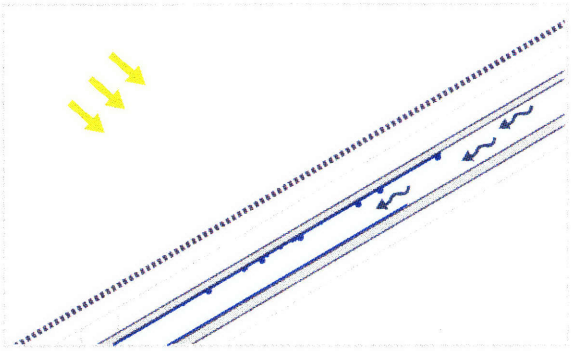
Draining pipe



Rain collecting



Dew collecting



Air collecting

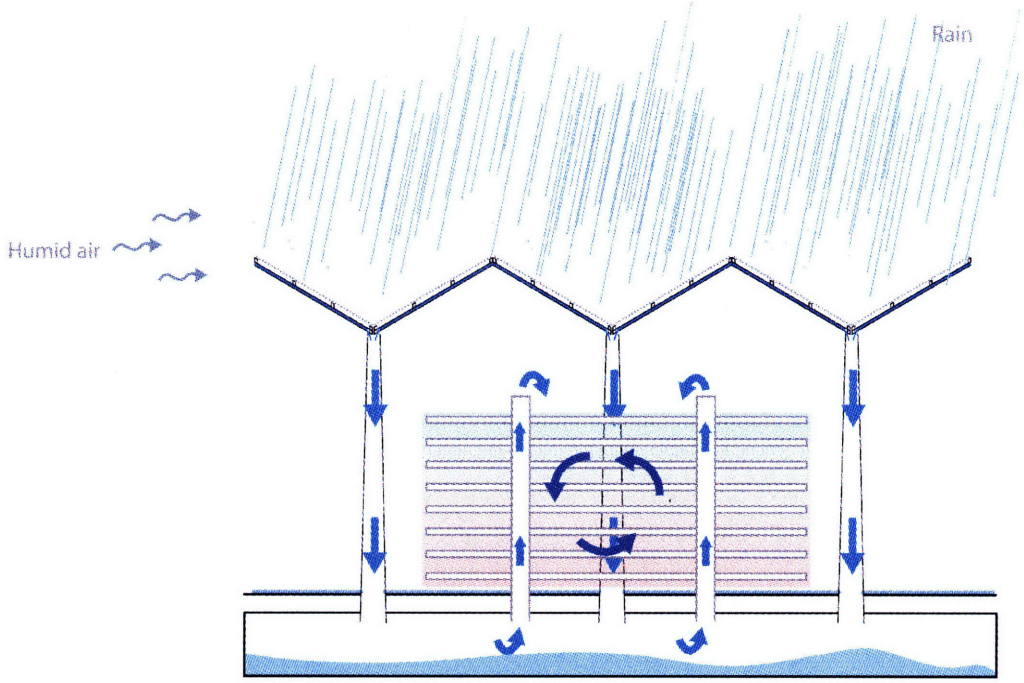
ing distinguishes each component of the City Hall and creates a direct access point to those components. It allows the visiting experience to the City Hall faster and more convenient for the visitors and helps the staffs to move in the building in the more organized fashion. The insertion of the sky lobby and the sky garden emphasize the idea of public integration to the building as a city's civic center, rather than having the building merely to the Mayors and staffs.

Detail Scale

This scale, the design touches on the aspect of sustainable technology occupied by the building, which is the water system of the building. The skin design is also included in this section.

- **Water Harvesting System**

This building is equipped with water harvesting device that allows the building to collect water from sources like rain, dew and air in order to use and preserve. This harvesting device has the inverted pyramid form, made out of glass, which the tip of the pyramid



Above: Water system diagram

sits on the top of the column that extended beyond the building height. Each pyramid has a square base with the length of 35 meter (115 foot) on its side, a total of 13,255 square foot of catchment area. There are total of 20 of these devices connected to each other forming a gigantic roof over the City Hall. This roof covers only the north side of the site allowing the diagonal walkway and the City Hall Plaza to expose to the sky.

The catchment surfaces compose of a layer of lightweight dew-collecting panel (a spider web like material) and 2 layers of glass for rain and air collecting that embedded with PV screen in order to partly collect sun light and provide shade to the building at the same time.

The dew-collector is taken from the WATAIR project done by Joseph Cory and Eyal Malka. WATAIR is able to collect 48 liters (12.6 Gallon) by the 96 square meter (1000 sq ft) surface area of dew collector in the remote area.[1] The climate of New Orleans is great for dew collecting as stated in the research of A2HW website, a retailing company for the XDOBS night radiant condensation system.[2] This system states that it can collect approximately 3-4 gallon per 100 square foot area in an acceptable condition.[3] According to A2HW report, New Orleans is considering to be in an acceptable area for this type of harvesting. As a matter of fact, there is no exact amount of water collected per surface area in the climate of New Orleans stated in any of these systems. The amount of water collected in the New Orleans City Hall will be an esti-

matation of the average amount of water collected by these 2 systems; the WATAIR and the XDOBS. Therefore, the estimate amount for dew-collector in the climate of New Orleans is approximately at least 23.5 gallons per 1,000 square foot of catching area. In the design of New Orleans City Hall, the total surface area for dew collecting is 264,500 square foot, which gives about 6,216 gallon of water per day.

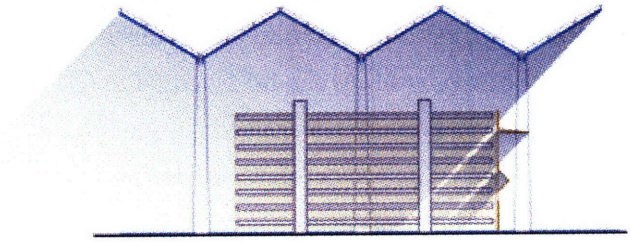
The amount of water harvesting collected by rain is simpler to calculate as this type of water harvesting can be found commonly. The annual average of rainfall in New Orleans is 61.88 inch and distribute evenly through out the year.[4] In New Orleans the amount of rain can collect annually per 1,000 square foot of interception area is approximately 41,340 gallon.[5] According to this data, the amount of water collected by rain is approximately 11 million gallon of water per year.

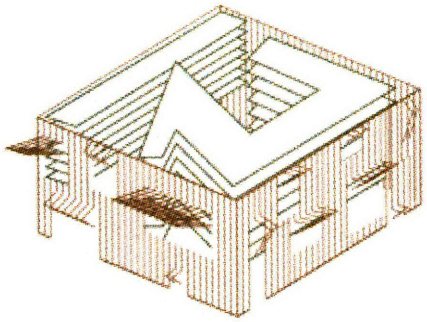
The amount of water collected from daytime condensation by air is still unknown. As a result, it will not be included into the water-harvested measurement. However, this portion of water gained must not be ignored once the calculation method can be found.

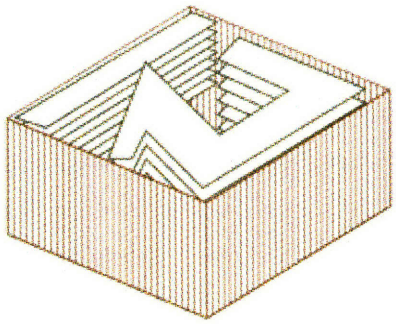
Once water is being harvested, it goes directly to the water storage underground. 5,000 gallon of water or more will be taken to use in the building as potable and domestic water everyday. This amount of water is calculated from the average daily water used by American, which is around 100 gallon per person for domestic used. Two-third of this total is used for showering and toilet.[6] Furthermore, approximately 8-10% of daily water used is by toilet, as on average, people use toilet about 5 times per day and take about 1.6 gallon per flush.[7] In office building water is being used mostly in the restroom. Hence, the water used in typical office building can be assumed to be around 10% of average water used per person that is around 10 gallon per person per day from toilet and faucets used. Therefore, if the City Hall has the around 500 staffs working everyday, the water consumption is approximately 5,000 gallon per day.

In fact, the water collected by dew harvesting system alone is sufficient to supply for daily water use. After the water is taken up to use in the building the remaining will be preserved. On average, 9:1 ratio for operate and preserve respectively. Beside domestic used, the water is also employed by HVAC system, however HVAC works as a closed system that does not require fresh water on daily basis. For this reason, the water used in HVAC is not critical to the amount of water collected by harvesting system.

Around 1,000 gallon of water harvested from dew will be preserved everyday. This is a significant amount as it accumulates for one year. This amount of water is sufficient as potable water for 24,000 people that would last for one month, which comes from dew harvesting alone. Together with water collected from rain the City Hall can preserve approximately 12 million gallon of water annually. With this amount, over 70,000 people can have supply of drinking water for a year. With this system of water harvesting, the City Hall will be able







Left: Shading diagram
Right: Skin concept

to have running water during difficult time and will be able to help its unfortunate citizens without difficulty.

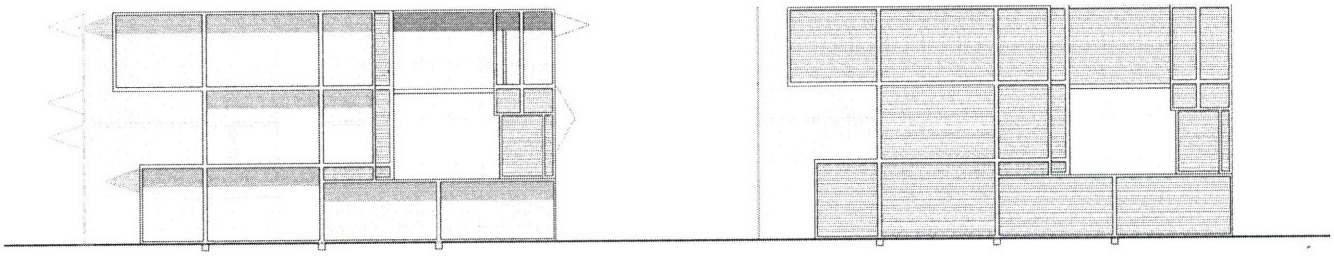
In addition, the water collected by harvesting systems is not associated with the water sitting in the pond around the building. The water in the pond is only for aesthetic and sentimental purpose, unlike those from harvested. Thus, they are working separately. This is because the water in the pond is exposed to the environment outside at all time, therefore in order to prevent the majority of preserved water from contaminating in the event of flood, these system ought to be occupied distinctively.

- **Skin System**

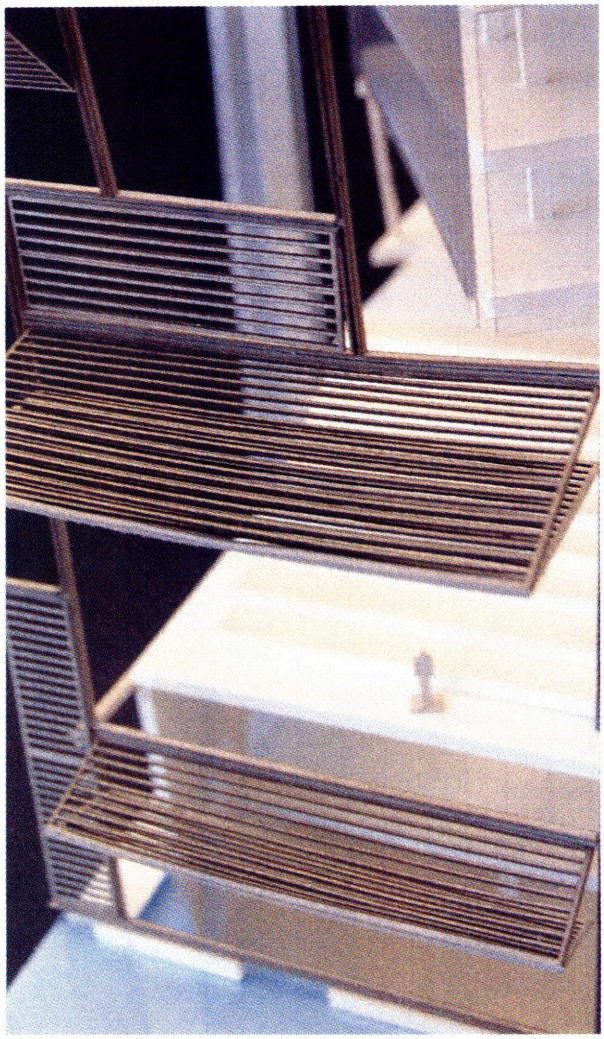
A large shaded roof prevents the City Hall from the intense sunlight of a hot climate. For this reason, the skin system does not require much performance and protection in keeping the City Hall cool and ventilated. Therefore, there are 2 types of enclosures in this building. First, there are the operable windows that enclose locally through out the building. Second, there is the louver system that wraps around the building.

The operable windows are placed through out the building as a part a curtain wall system. This system helps the building to be able to adjust temperature locally and allows natural ventilation to enter the building when needed.

The louver skin that wraps the entire building is merely for aesthetic purpose except those on the south façade where the sun hit the building directly. They can be opened and closed. However, they are mainly dealing with the issue of visibility. This louver once opened, it allows the direct visibility from both inside out and outside in. It forms canopies



Above: Facade elevations. when open and close
Below: Physical model for facade study



over the space to prevent sunlight to enter the building directly. These canopies benefit the most from the sun protection on the south side of the building, where part of the façade is exposed to the direct sunlight, otherwise merely dealing with visibility purpose. Hence, these louver skins once closed, they reduce some amount of direct sunlight entering the building but not by much. Nonetheless, they create a partial visual barrier between the interior spaces and the exterior.

This louver skin is important to the aesthetic purpose of the City Hall. When they are opened, they indicate that the building is in the operating mode. The building is perceived as a lively, energetic and vibrant civic center that welcoming all visitors. As the overall form of the building is intended to be a cube, but the floor plates are fractured into pieces, the form of a cube can hardly be understood. This lou-

ver skin helps the City Hall to retain the perfect geometry of a cube. Once they are closed, they help complete the cubic form of the City Hall-- signify the representation of strength, solidity and dignity of the city's governance.

Design Conclusion

In short, the design of the City Hall of New Orleans is done in 3 scales: urban, architectural and detail in order to emphasize the relationship between architecture and the city's house of governance and representation. Through the planning, form and organization, the new City Hall as a Civic Center for the 21st century demonstrates the notion that government is friendly, accessible and attractive. The new design for New Orleans City Hall has exhibited a new quality for the building of its kind.

The design also expresses a strong importance of integrating sustainable design to the architecture where incorporating water in the most efficient way is the main focus. It is important that the City Hall takes leading step toward sustainable design to become a role model for up and coming project. More importantly, the design of the water system in this project indicate that the City Hall as the home of city's governance is prepared to reach out for its citizens in difficult time.

Notes

[1] Evelyn Lee, "WATAIR: Turning Air into Water", *Inhabitat*, April 16, 2007., http://www.inhabitat.com/2007/04/16/watair-turning-air-into-water/ (accessed April 20, 2008)

[2] *Basic Introduction Night Distillation System*, A2WH Night Radiant IR Long Wave Condenser. XDOBS.com LLC

[3] Ibid.

[4] http://www.met.utah.edu/jhorel/html/wx/climate/normrain.html (accessed May 10,2008)

[5] "A Source Book for Green and Sustainable Building", Harvested Rainwater Guideline, http://www.greenbuilder.com/sourcebook/RainwaterGuide1.html#capacity (accessed May 10, 2008)

[6] River and Water Facts, http://www.rivers.gov/waterfacts.html, (accessed May 10, 2008)

[7] "Conducting a Household Water Audit", Maryland Department of Environment, Water Supply Program, Maryland.

WATER DRIVEN
NEW Orleans City Hall as a Sustainable Civic Center for 21st Century

CHAPTER 5

CONCLUSION

In conclusion, this project demonstrates a way that the City Hall as a civic center for the 21st century can be rethink. As mentioned in the last chapter, the City Hall must take role beyond the home of the city's administrative activities. Therefore, its architecture requires to reflect this matter. The architecture of the NEW Orleans City Hall emphasizes the role of the government as a "friend"; that is friendly, easily reached, inviting and welcoming. Moreover, in difficulties, it can be a "guardian" that can help, protect and provide to its citizens. The design is clearly manifested these roles of "friend" and "guardian" through all aspects ranging from: the planning of the site, the organization of the building, the symbolic form the architecture and the sustainable technology embedded in the building.

This thesis highlights ways to integrate and employ water in architecture in the most desirable and efficient fashion in order to take lead that aims to combine a sustainable technology blending in with the symbol of government in a building. Water has always been the most critical issue in New Orleans during its disaster time, and yet always been the least mentioned issue as well. The new City Hall addresses this problem and provides solution through the design of the encapsulated water-harvesting feature. Thus, with this intention, a new City Hall spirit is encapsulated in the government building to embark a new role of a

civic center for the 21st century.

This project is an integration of a parallel process between architecture and technology. The most challenging aspect lies in the process of incorporating the engineering features of the project – water-harvesting devices – into the City Hall without disturbing the spatial quality of architecture. Although in many project, the engineering features is often placed in such a way that they appear invisible, this project, instead, see the necessity to highlight their existence and appearance as well as celebrating as part of the architecture. With their bold and strong appearances, the harvesting devices become a dominant structure for shading and roofing, yet framing the public plaza in a subtle delicate manner.

However, by integrating the sustainable technology into the NEW Orleans City Hall alone is not competence to achieve the civic center for the 21st century. In fact it is all the combination of social, urban, architectural and technology aspect that help this building to function beyond merely the house of administration of the city. If the City Hall is indeed the place for the city to meet its citizens as well as the place where the citizens access the city rather than merely an office for the city's officers. The civic pride and the cultural significant of the city of New Orleans will be strengthen, enriched and forwarded imminently.

BIBLIOGRAPHY

"A Source Book for Green and Sustainable Building", Harvested Rainwater Guideline, http://www.greenbuilder.com/sourcebook/RainwaterGuide1.html#capacity (accessed May 10, 2008)

Anil K. Rajvanshi, "Large Scale Dew Collection as a source of fresh water supply", *Desalination*. Maharashtra, India.

Architecture Water. Edited by Cristina Paredes and Catherine Collin. CN - Italy: LOFT Publication, 2008.

Basic Introduction Night Distillation System, A2WH Night Radiant IR Long Wave Condenser. XDOBS.com LLC

Bavishi, Jainey K., *Building Community Capacity in the Rebuilding of New Orleans: The Role of Philanthropic Funders Post-Katrina.* Massachusetts Institute of Techonogy, 2007.

Braun, JT and GT Doderrich. "Near-optimal control of cooling towers for chilled-water systems." ASHRAE Trans (1990): 806-813.

Cassidy, MP and JF Stack. "Applying Adjustable Speed AC Drives to Cooling Tower Fans." *Annual Petroleum and Chemical Industry Conference.* (1988).

City of Tucson. *Water Harvesting Guidance Manual, 2005.* Tucson, AZ: 2005.

"Conducting a Household Water Audit", Maryland Department of Environment, Water Supply Program, Maryland.

Davey, Peter. "Water Water - Use of Water in Architecture." Architectural Review, Dec. 1998.

Department of Homeland Security. The Federal Response to Hurricane Katrina: Lessons Learned, 2006. Washington, DC: 2006. pp 37.

Drake, Scott. *The Third Skin: Architecture, Technology and Environment.* Sydney: A UNSW Press Book, 2007.

Evelyn Lee, "WATAIR: Turning Air into Water", *Inhabitat*, April 16, 2007., http://www.inhabitat.com/2007/04/16/watair-turning-air-into-water/ (accessed April 20, 2008)

Frenchman, Dennis and Francisca Rojas. "Zaragoza's Digital Miles: Place-Making in a New Public Realm." Media and the City (n.d.): 16-25.

Gugliotta, Guy and Peter Whoriskey, "Extraordinary Problems, Difficult Solution: Massive Floods, Pollution Make for 'Worse Case'" Washinton Post Staff Writes, 10 Sept. 2005. http://www.washingtonpost.com/wp-dyn/content/article/2... (accessed Apr. 28, 2008).

Hudson, Audrey. "Making Water from THin Air." WIRED, 06 Oct. 2006, http://www.wired.com/science/discoveries/news/2006/10/... (accessed Apr. 10, 2008).

http://www.met.utah.edu/jhorel/html/wx/climate/normrain.html (accessed May 10,2008)

http://www.buildingpreservation.com/Condensation.htm Building Preservation (Condensat ireiron - the basics)

"International Organization For Dew Utilization" n.d. http://www.opur.u-bordeaux.fr/angl/question1_ang.htm (accessed May 11, 2008)

International Union of Pure and Applied Chemistry. "condensation in atmospheric chemistry". *Compendium of Chemical Terminology* Internet edition.

Lu, Lu, Wenjian Cai, Yeng Chai Soh, Lihua Xie, and Shujiang Li. "HVAC system optimiza tion–condenser water loop." Energy Conversion & Management no. 45 (2004): 613-630.

Marpillero, Sandro. *James Carpenter: Environmental Refractions*. New York, NY: Princeton Architectural Press, 2006.

Moore, Charles W. *Water and Architecture*. Ann Arbor, MI: University Microfilms Internation al, 1957.

Moore, Charles W. *Water and Architecture*. Harry N. Abrams, Inc., 1994.

Orr, Kirsten. "Thinking Beyond the Square: Innovation Theory and Technology Transfer as They apply to Beijing Water Cube." (2007):

"Rainwater Harvesting Resources." n.d. http://www.jrsmith.com/products/rainwater_ harvesting/i... (accessed May 11, 2008).

Richards, Patti. "MIT news: MIT architects design building with 'digital water' walls." 10 July 2007. http://web.mit.edu/newsoffice/2007/waterbuilding-0711.... (accessed Mar. 10, 2008).

River and Water Facts, http://www.rivers.gov/waterfacts.html, (accessed May 10, 2008)

"The Modern: mammoth concrete structure—unlike any other - project of the month - Mod ern Art Museum of Fort Worth, Texas - Brief Article." Apr. 2003. http://findar ticles.com/p/articles/mi_m0NSX/is_4_48?pn... (accessed Apr. 21, 2008).

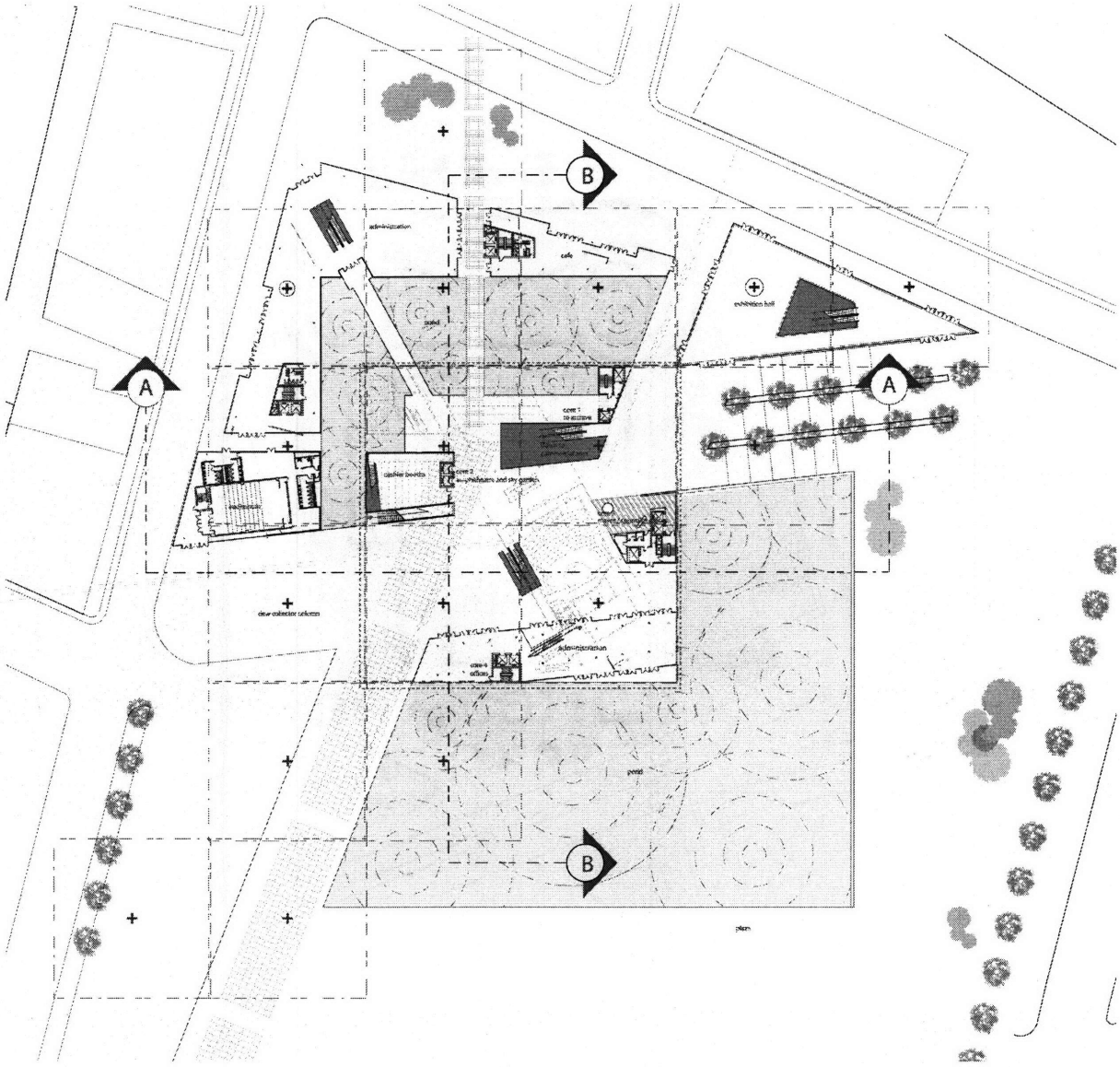
Sipes, Paul and Rollie Childers. "Art and architecture converge in concrete: World-class mu seum results from artful design and construction." *Concrete International*, June 2003, 42-45.

Tadao Ando Details 2. Edited by Yukio Futagawa. Tokyo: A.D.A. Edita, 1997.

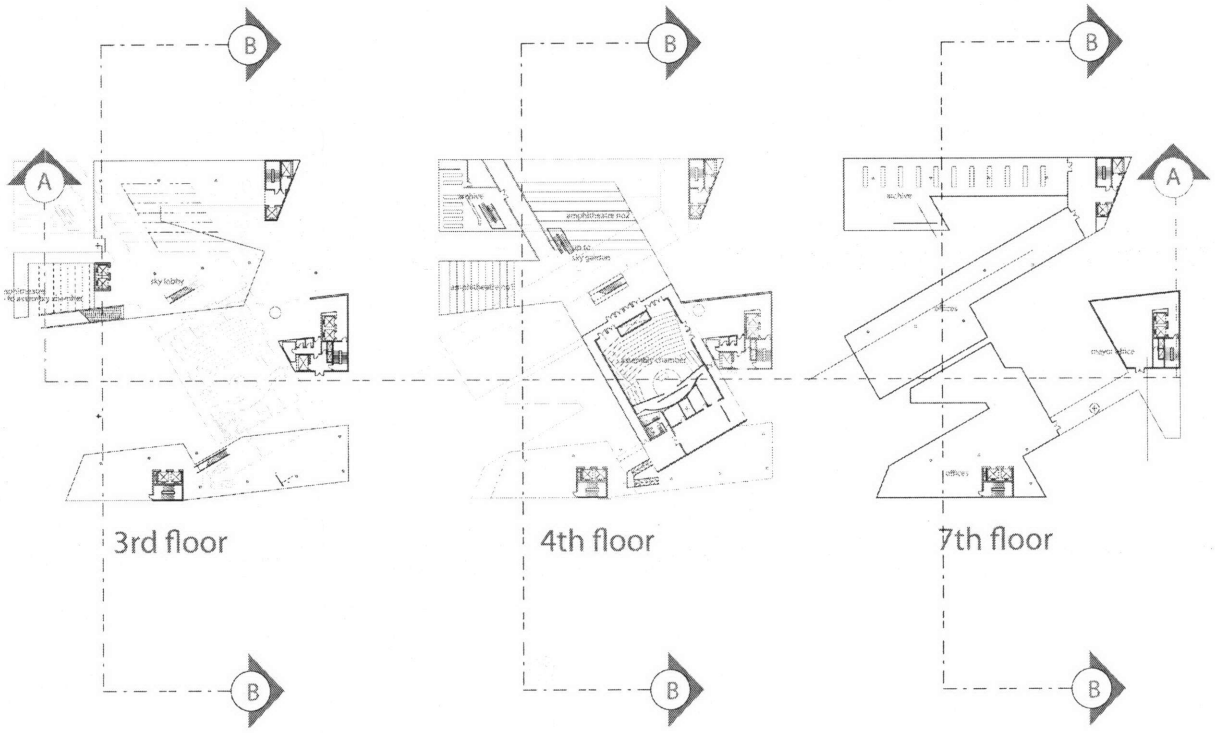
Webb, Micheal. "Water and light: a new musem dedicated to the relics and techniques of an cient Japanese water engineering is a series of soaring spaces that lyrically synthe size water and light." *Architectural Review,* Feb. 2003,

APPENDIX [I] Site Plan

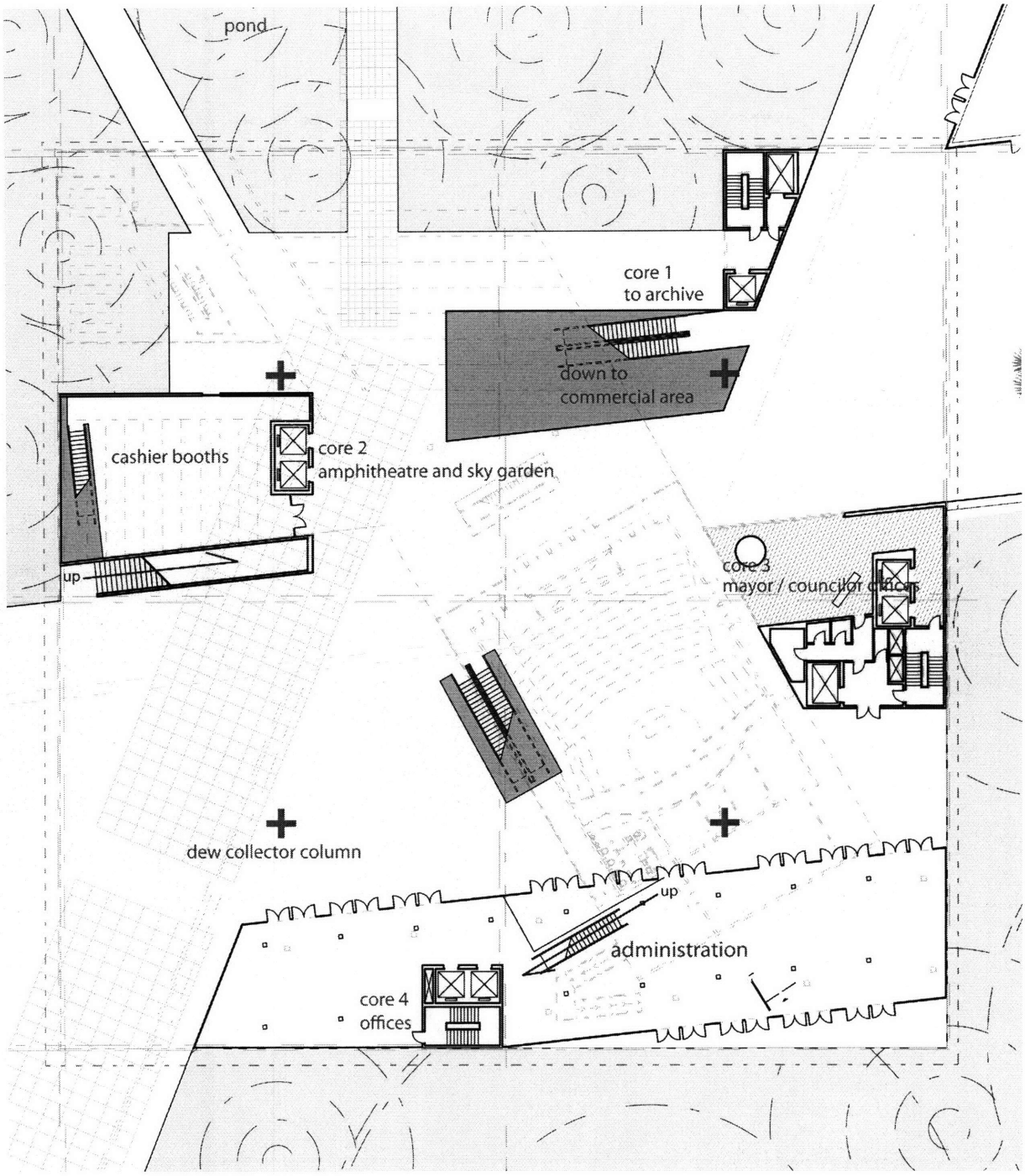
APPENDIX [II] Plans



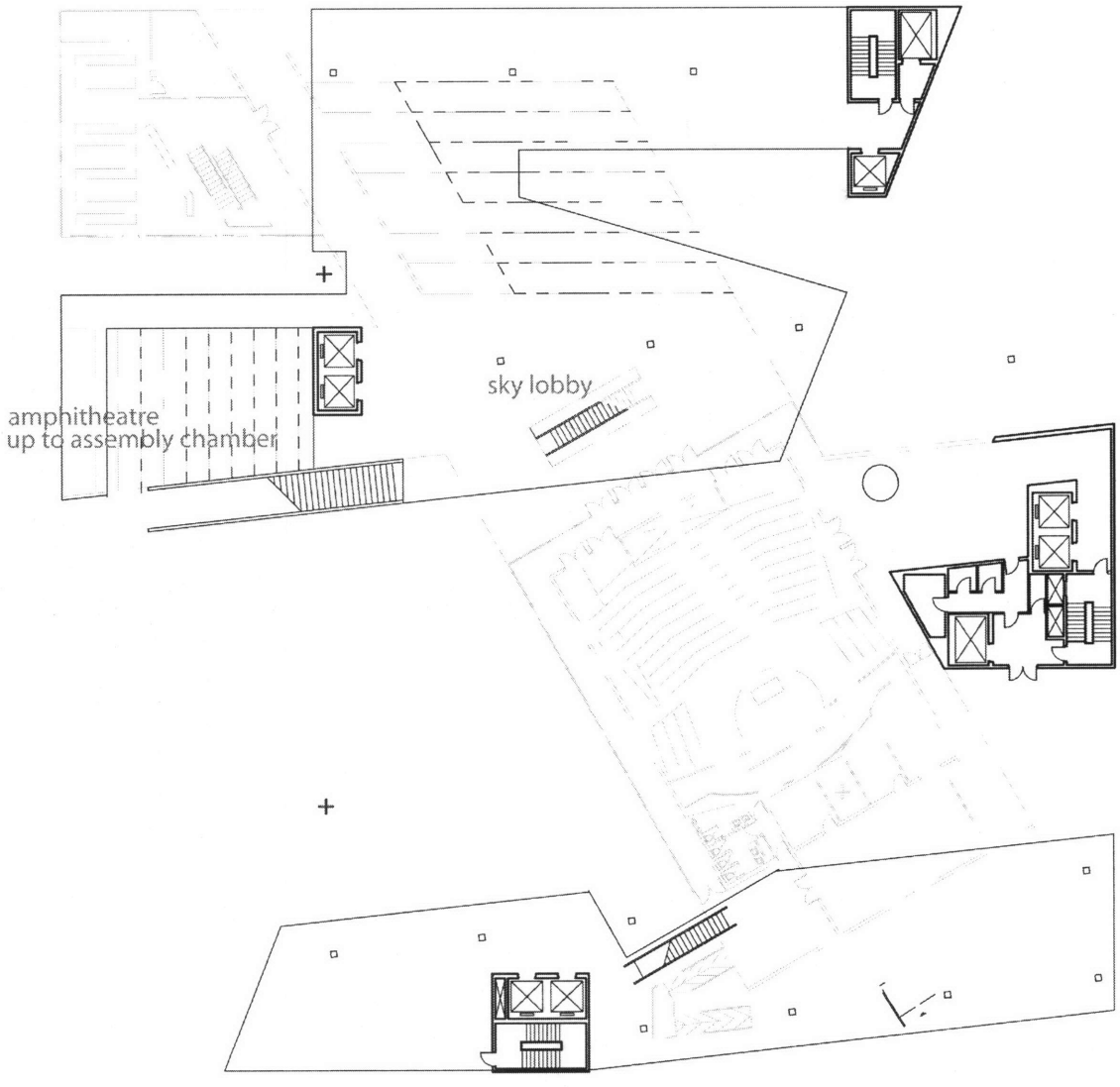
Ground floor plan



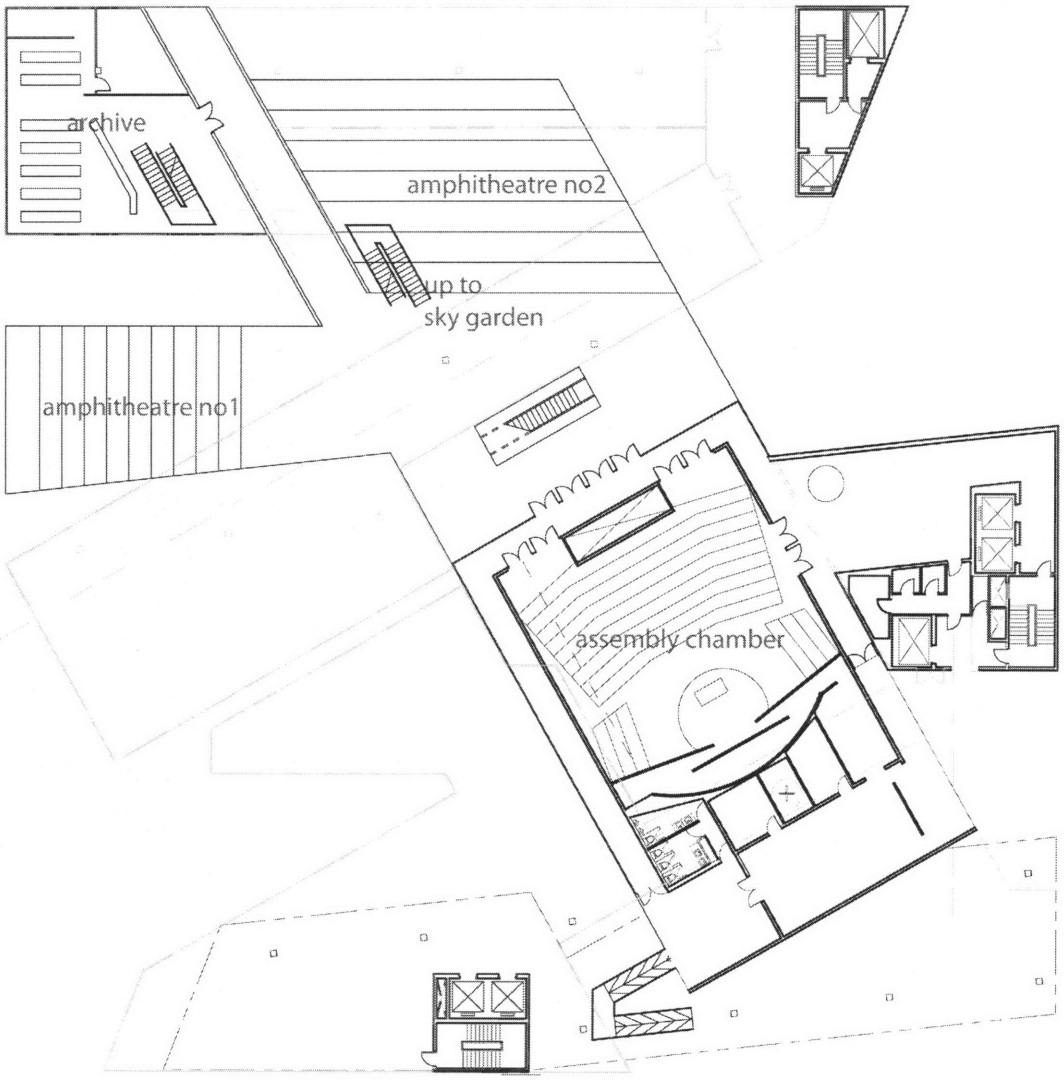
Upper floor plans



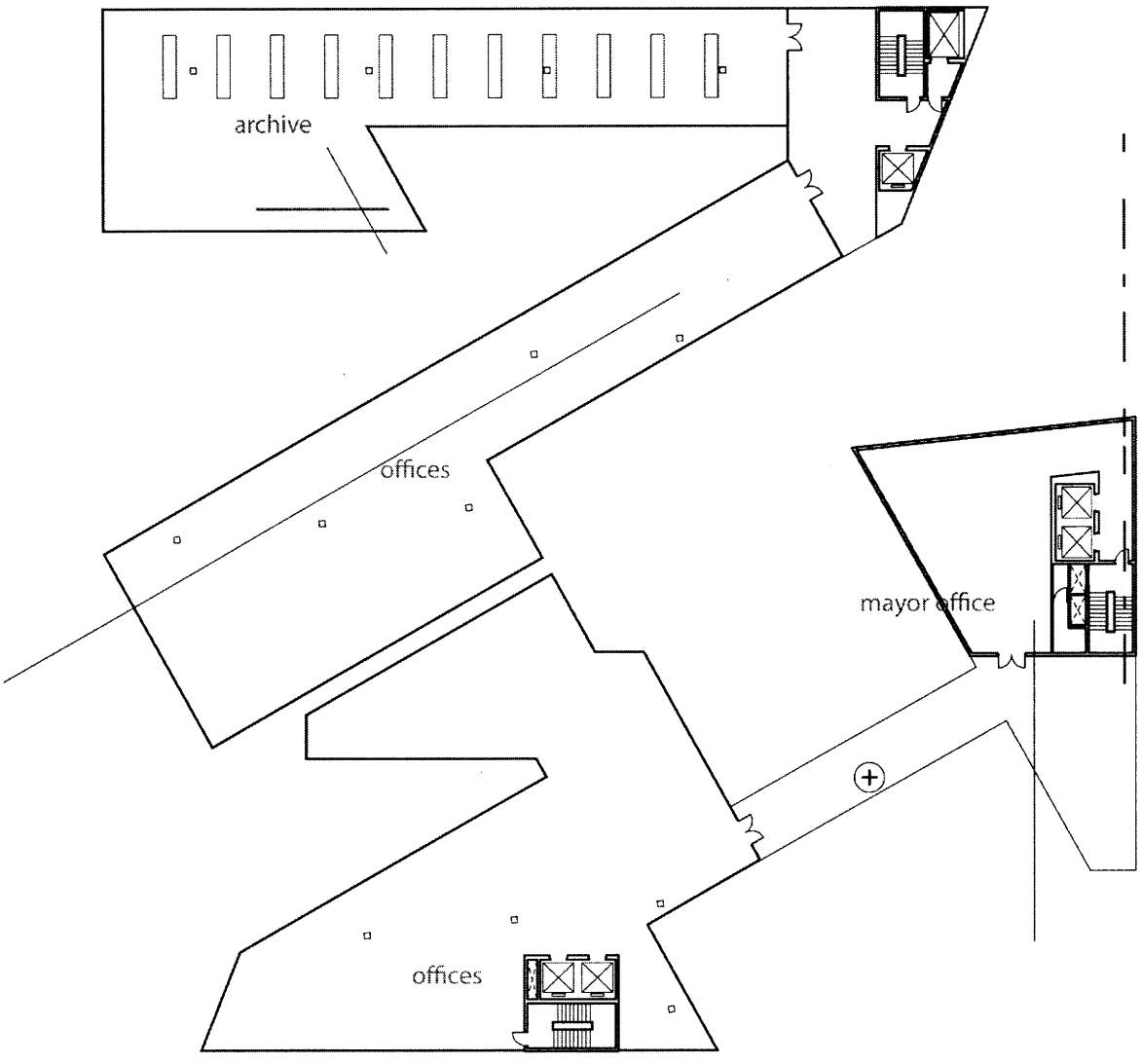
Ground floor



3rd floor

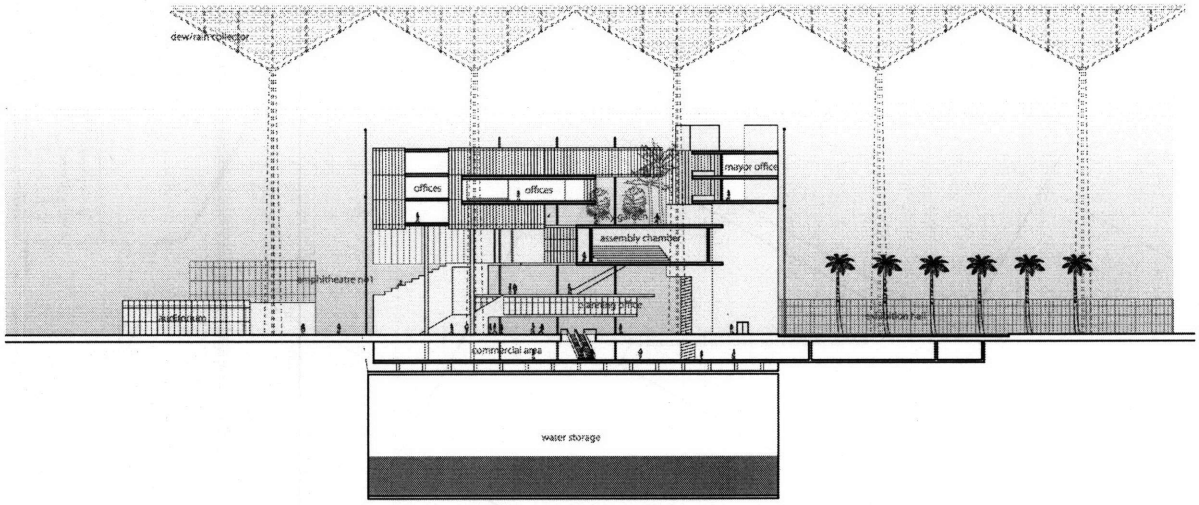

archive
amphitheatre no2
up to
sky garden
amphitheatre no1
assembly chamber

4th floor

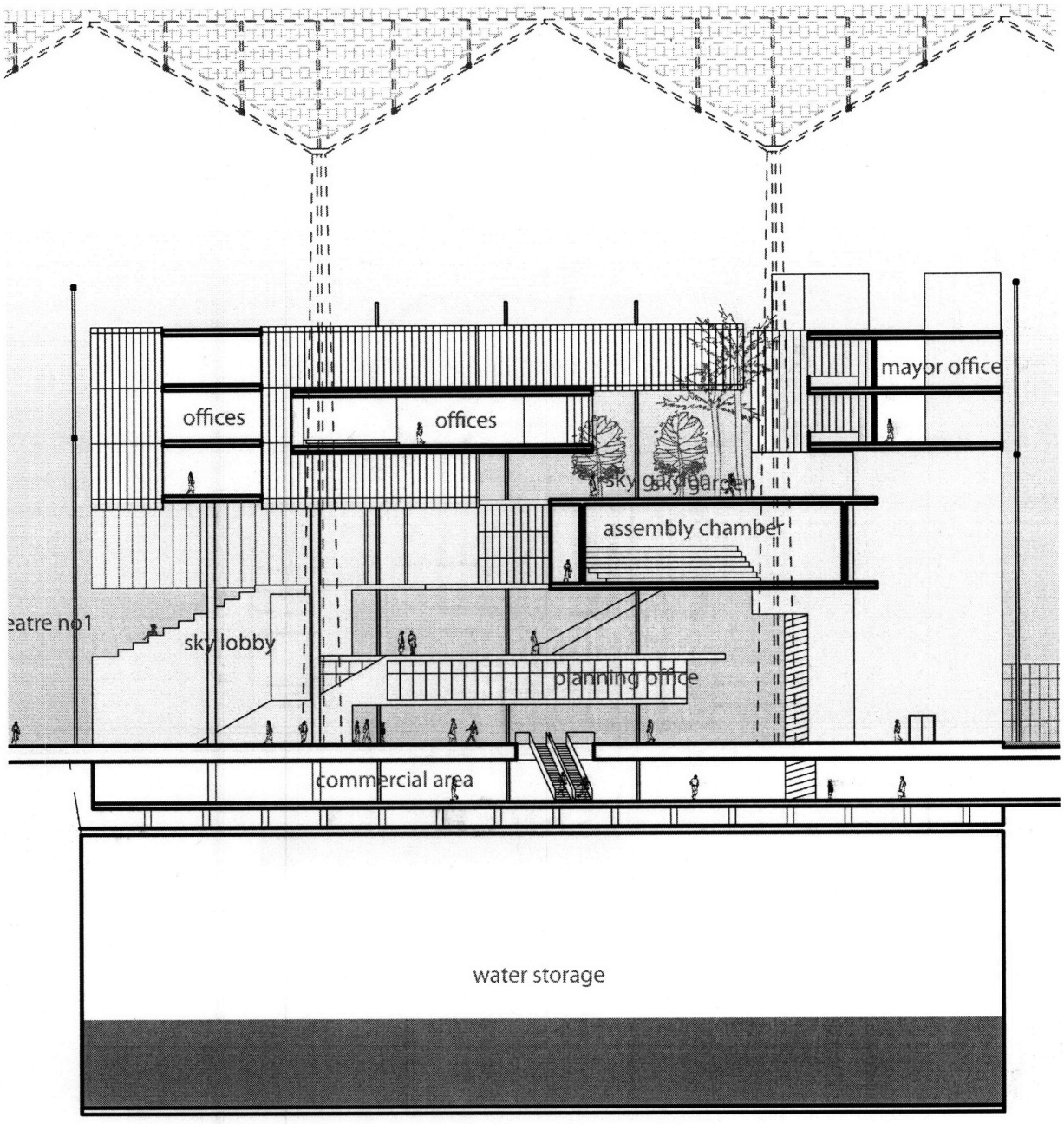


7th floor

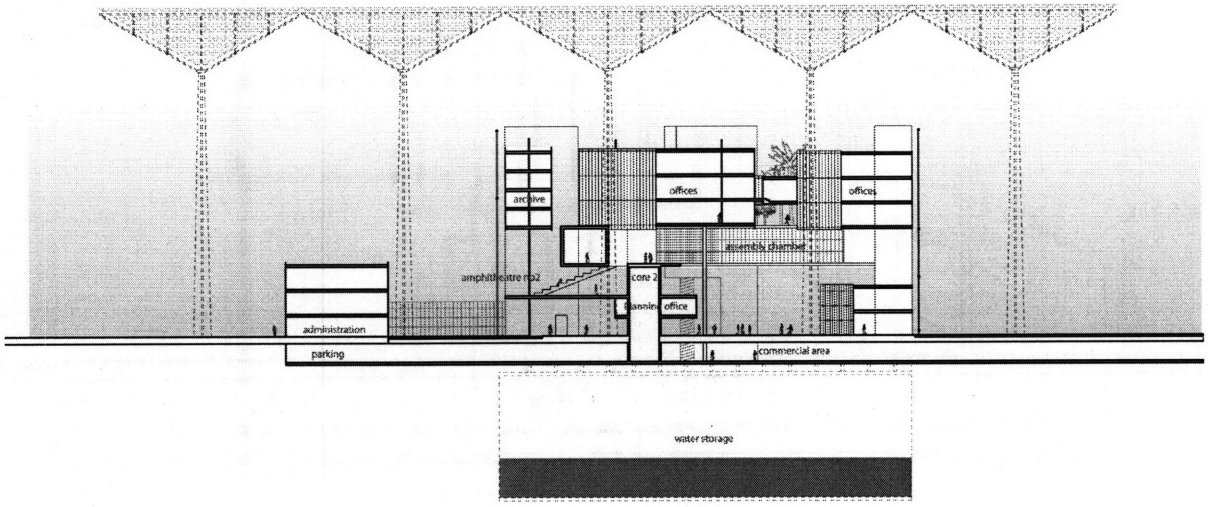
APPENDIX [III] Sections



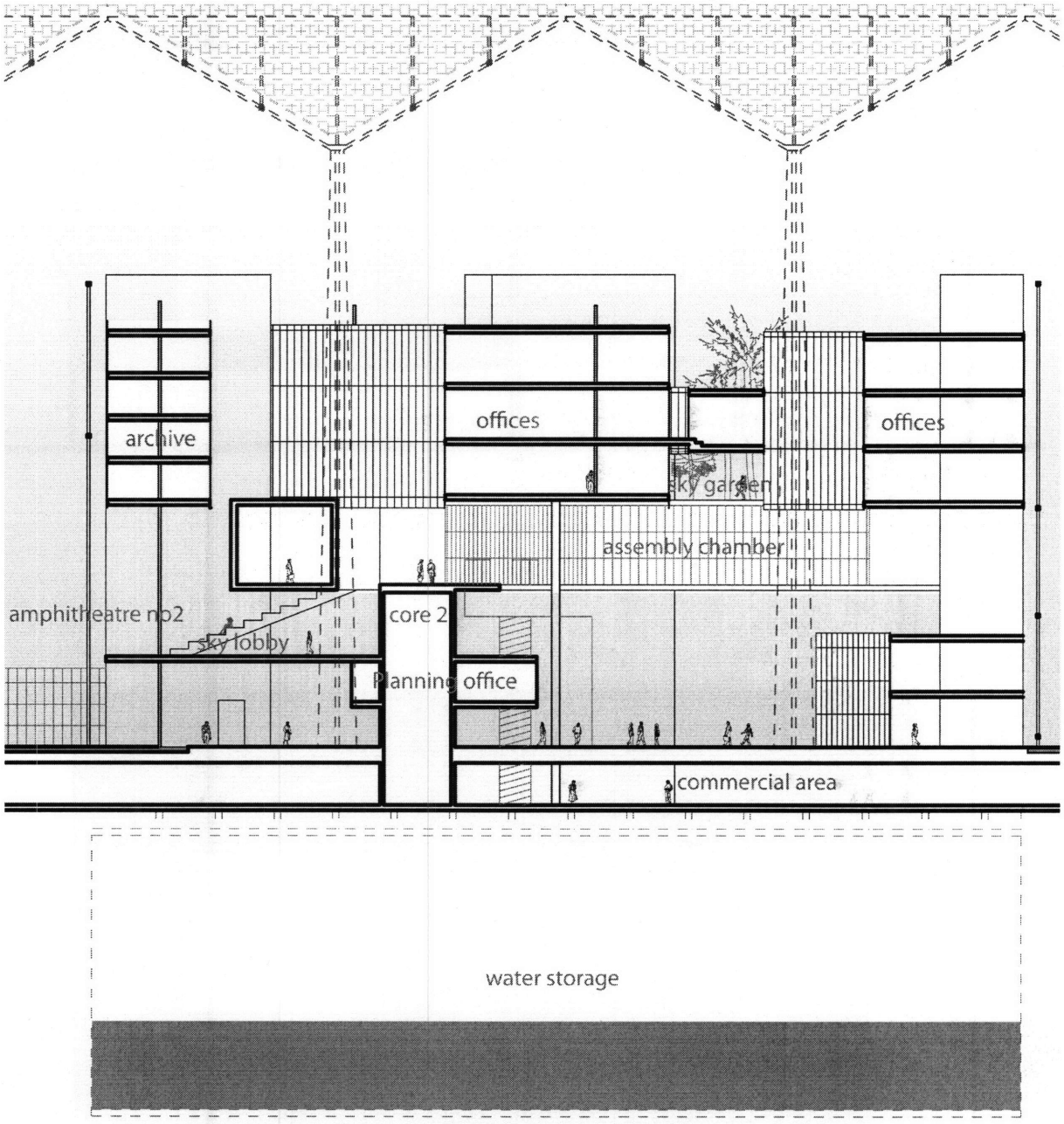
Section A



Section A (enlarge)

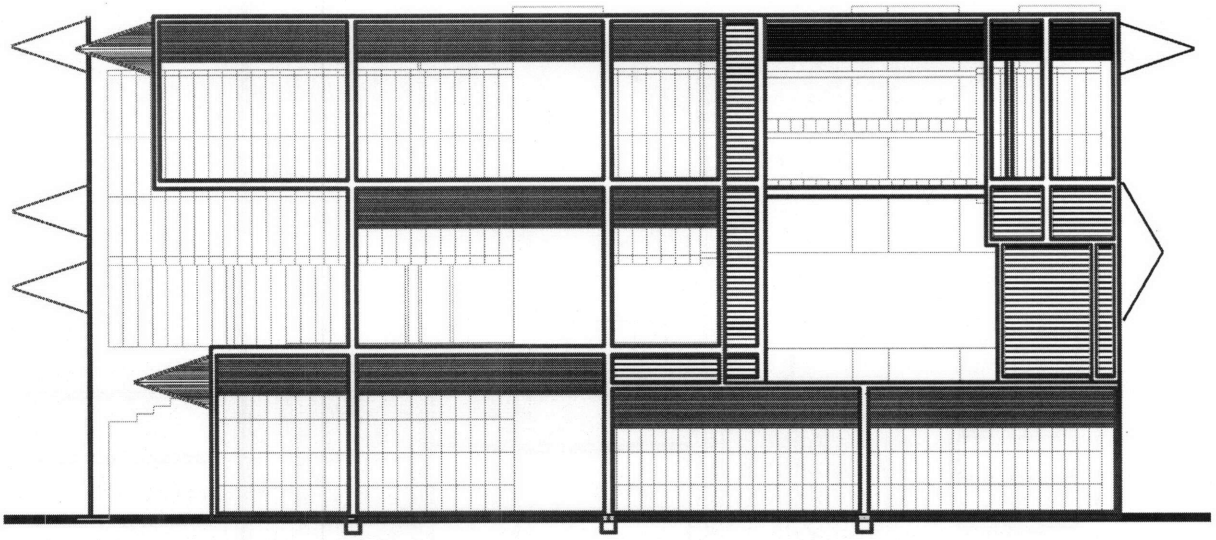

offices
archive
offices
assembly chamber
amphitheatre no2
core 2
office
administration
parking
commercial area
water storage

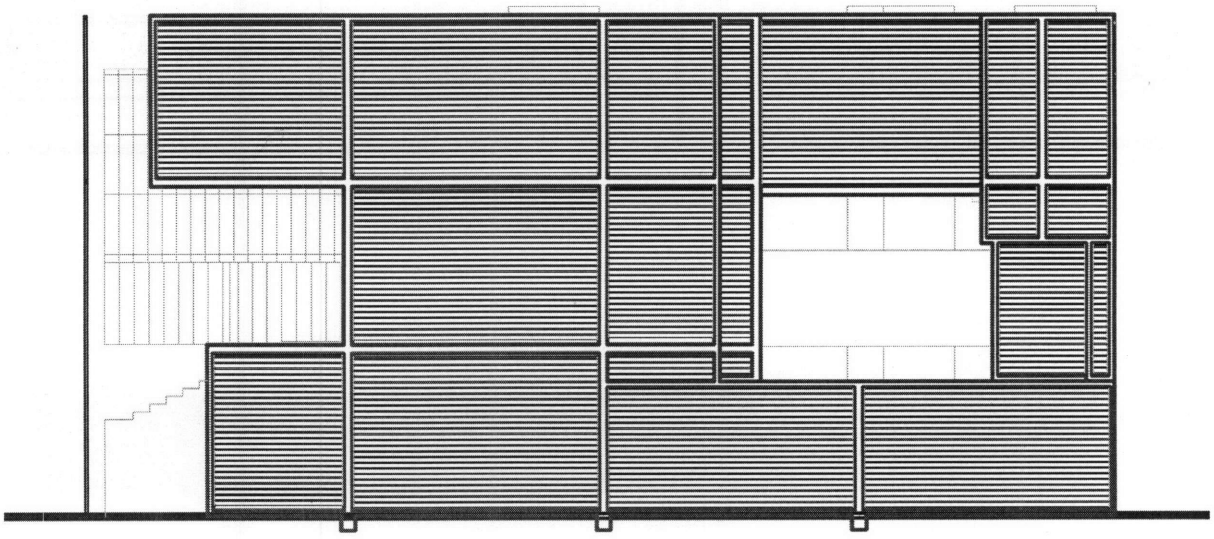
Section B



Section B (enlarge)

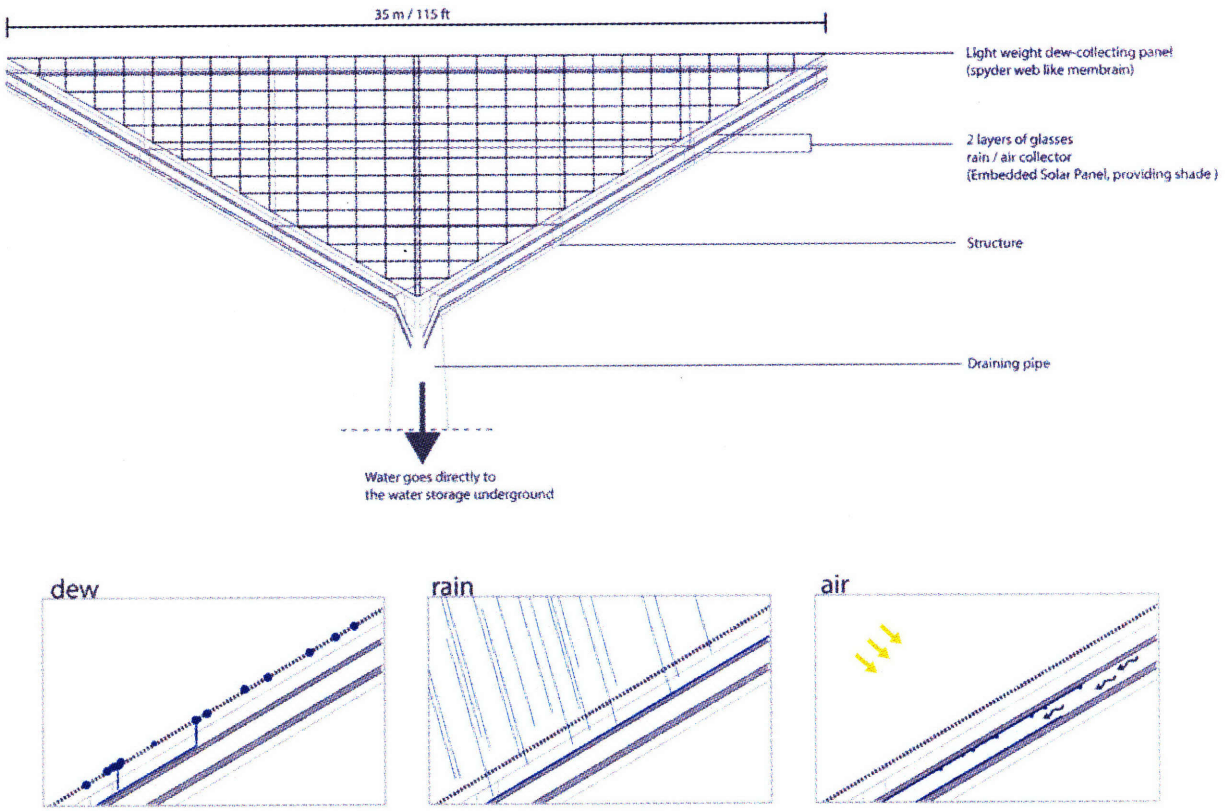
APPENDIX [IV] Elevations



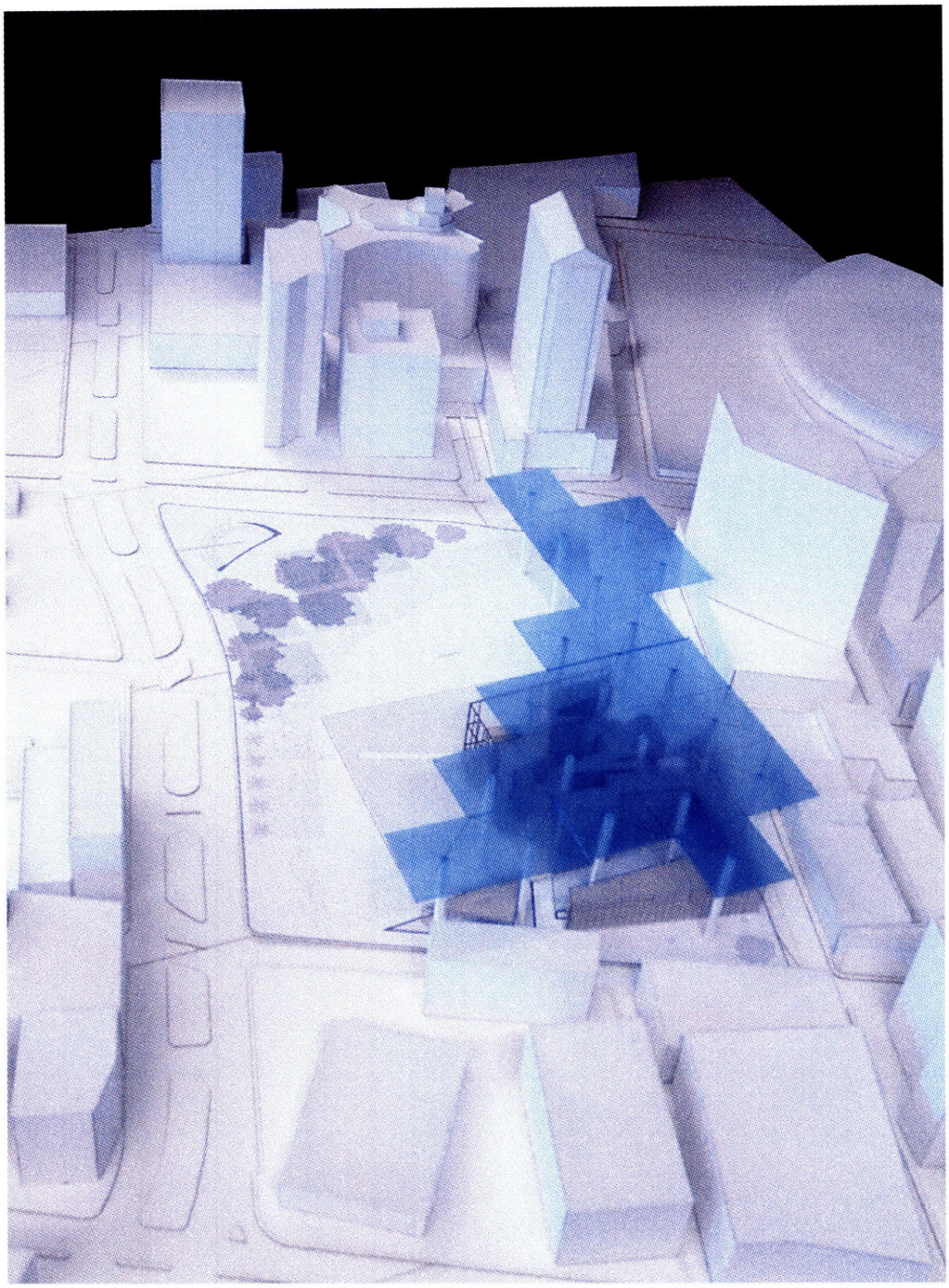


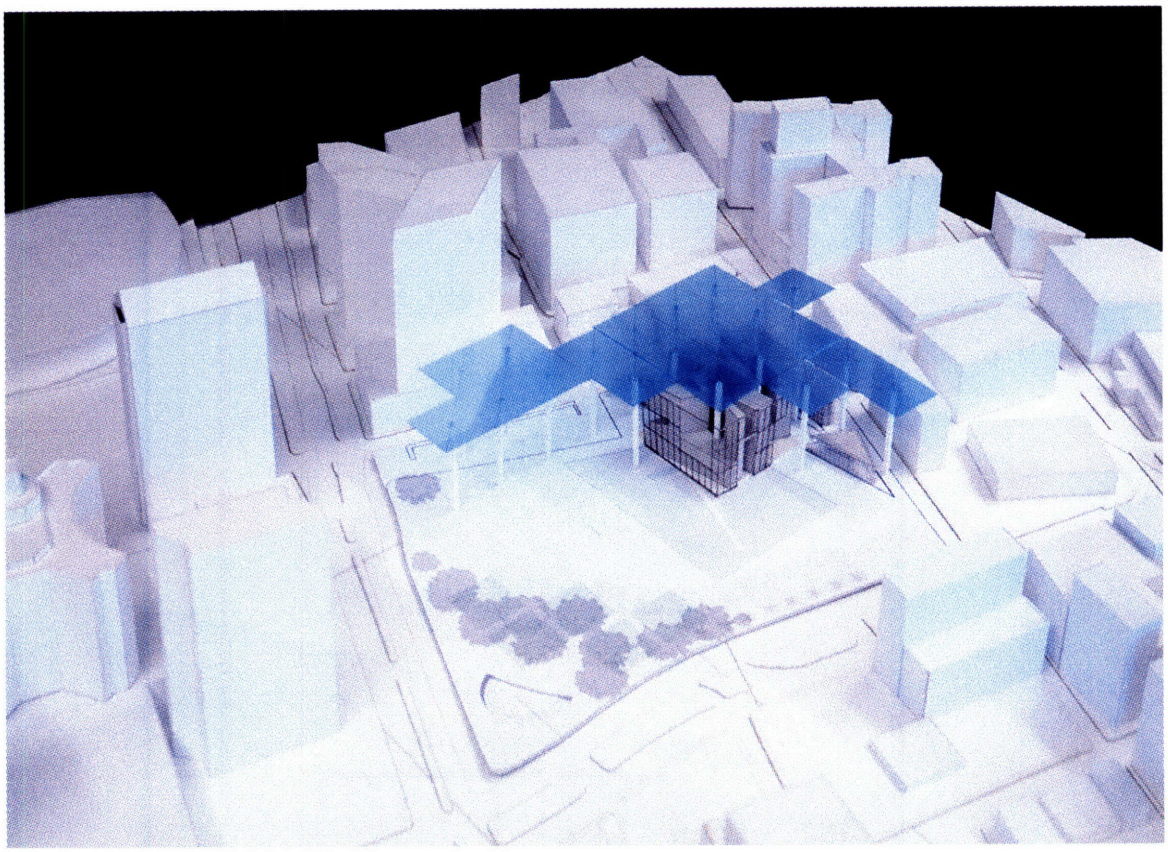
Above: South facade when open Below: South facade when close

APPENDIX [V] Water-Harvesting Details

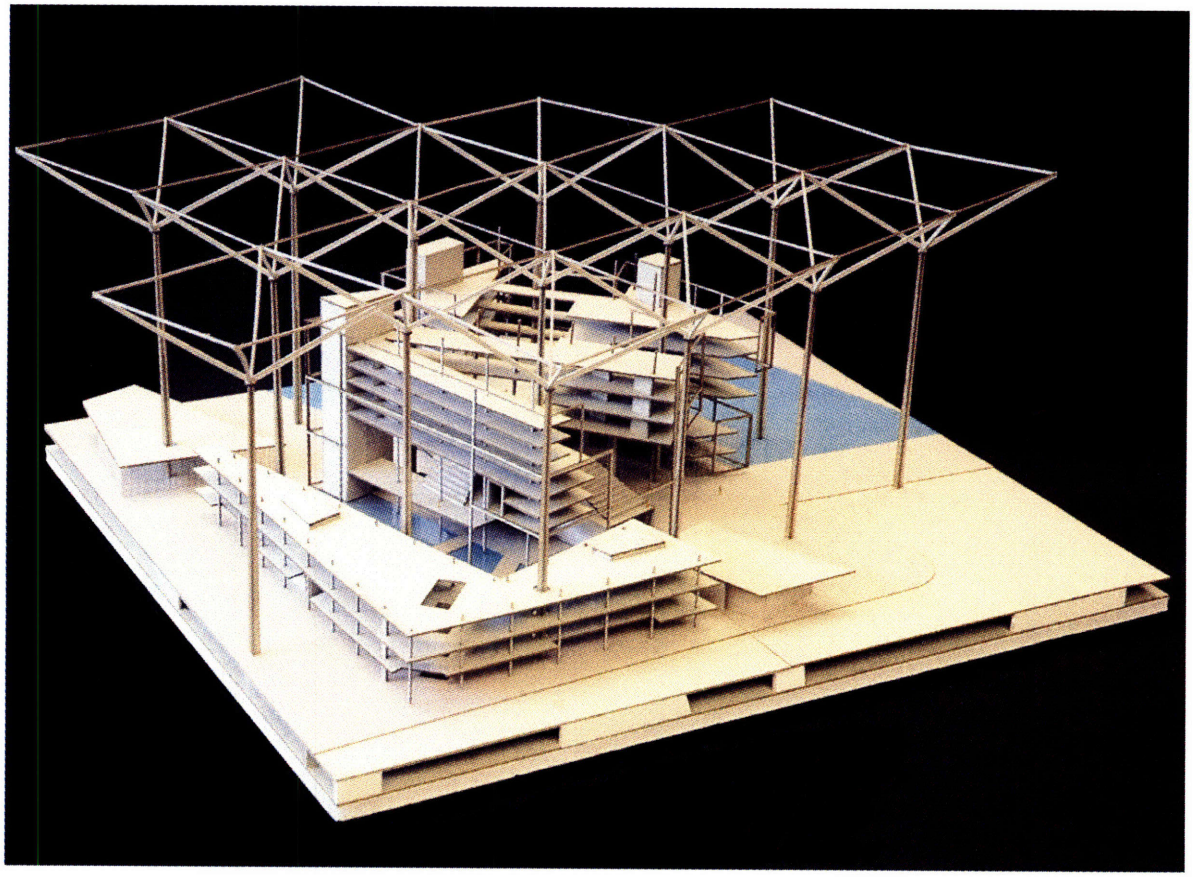


APPENDIX [VI] Models

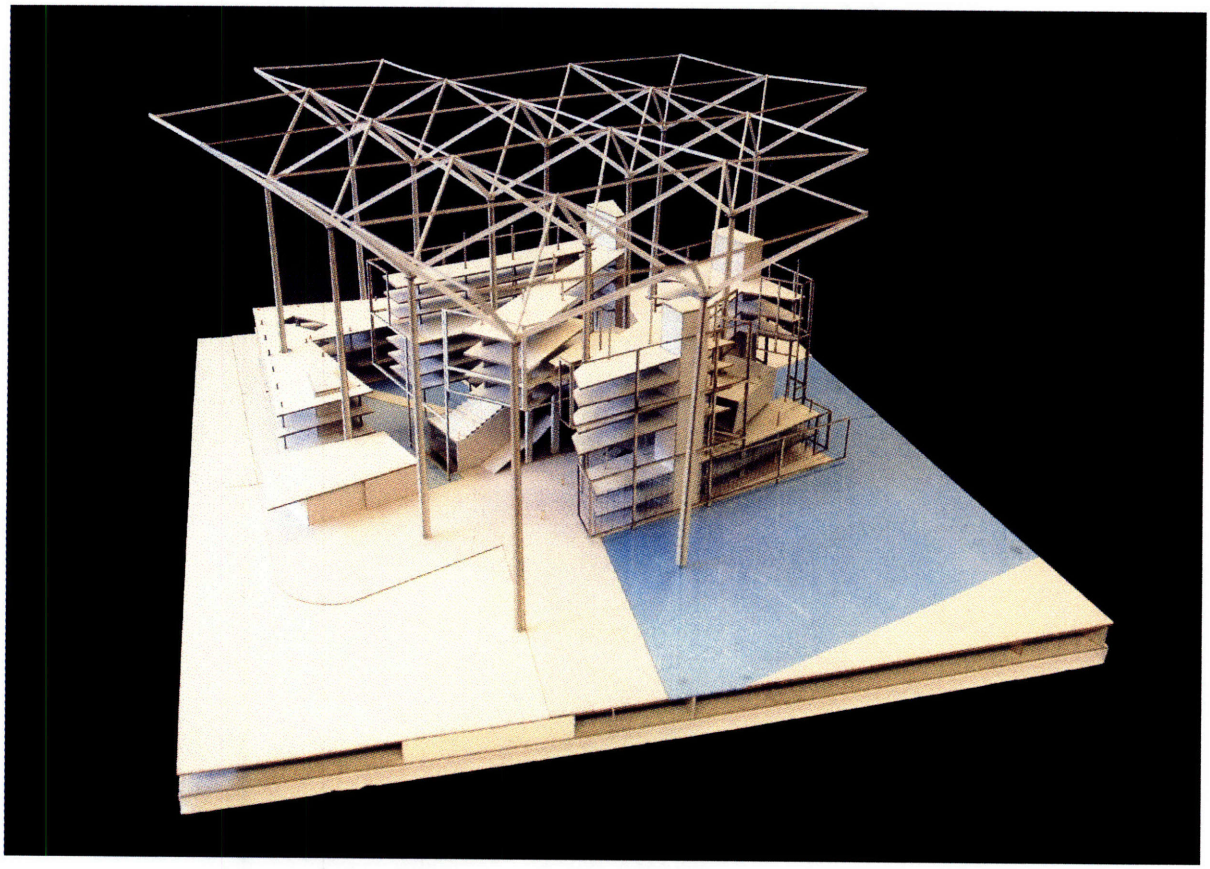




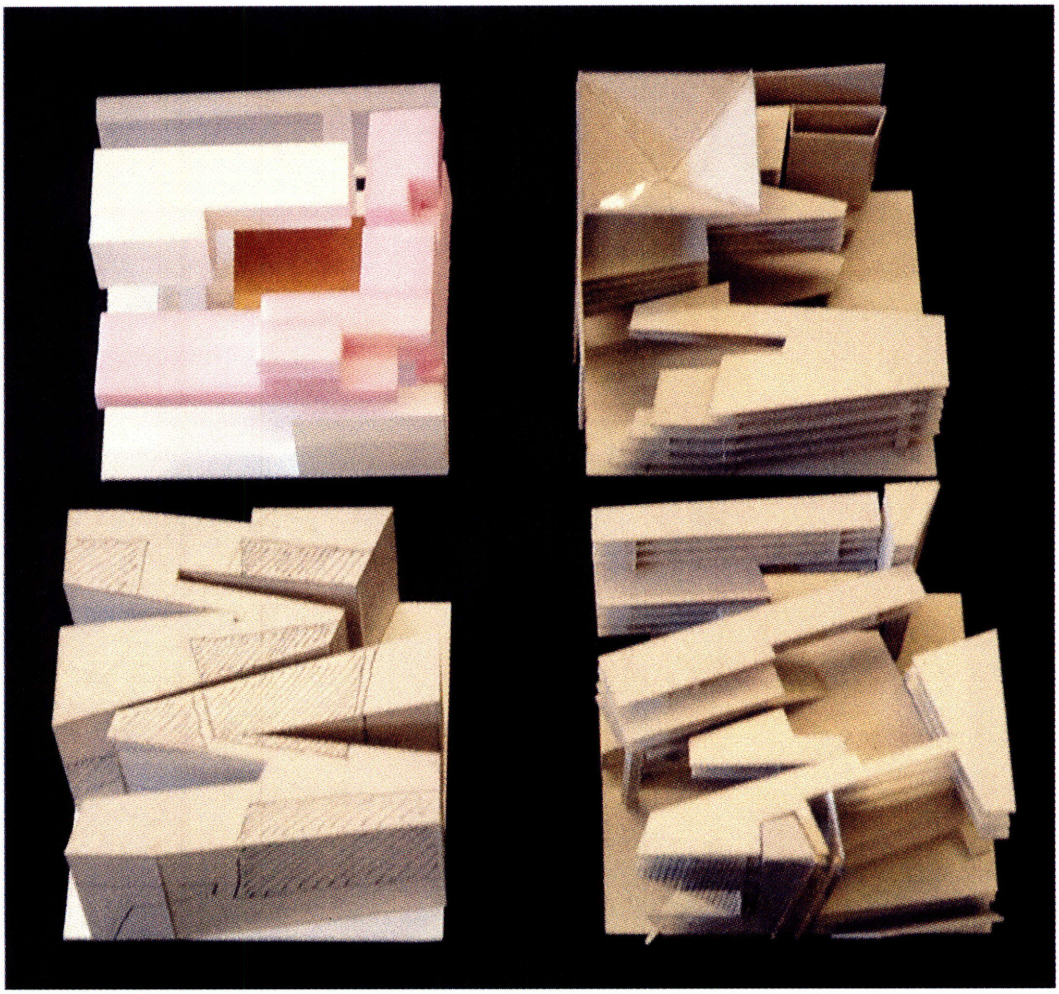
Model in site



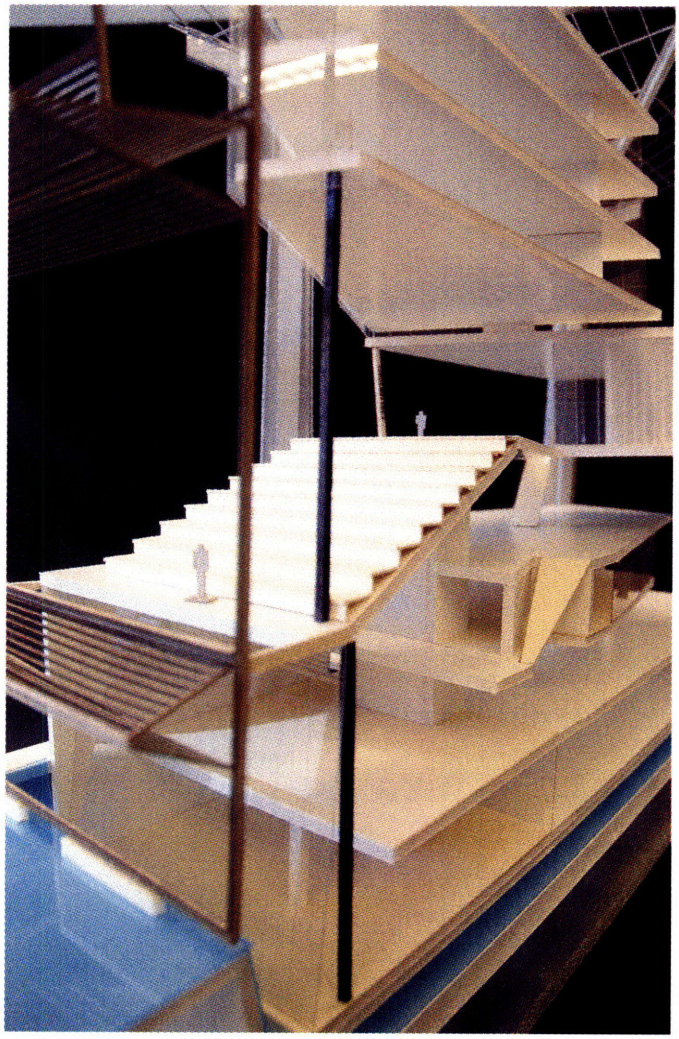
Model 1:200

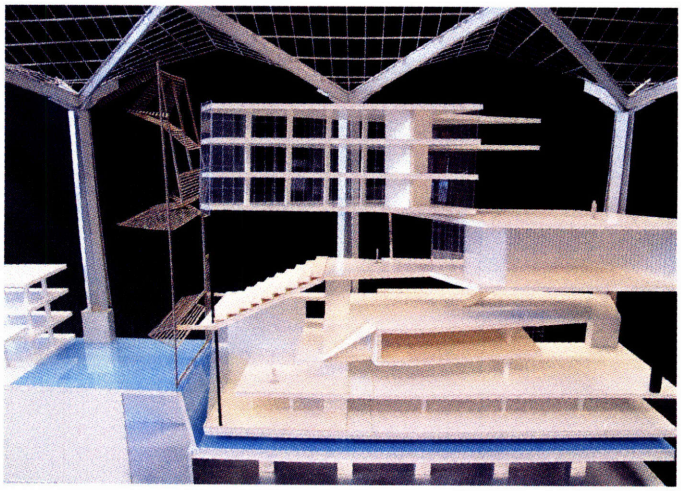


Model 1:200



Massing studies





Large scale sectional model.