

ABSTRACT

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Water is an element that is both essential to life and life threatening. The dual force within water "represents the essence of Yin and Yang where good cannot exist without evil." (Toy, 7) This thesis research will question the current proposed water protection plan in the historic neighborhood of Czech village in Cedar Rapids, Iowa. Instead of focusing on preventing the destructive nature of water as the only generator for the protection plan, the research will investigate and explore options where the protection methods could also create opportunities in which the water becomes an amenity; hence the development of the protection system in itself embody the dual force of water.

Perhaps the problem lies within our notion of natural disaster itself. Instead of viewing flood as a disaster that needs to be overcome, we should look at it as a

constant natural occurrence that we need to account for and live in harmony with and further celebrate. The investigation will manifest in three different scales; city scale, neighborhood scale, and building scale.

By critically examining current master plan and introducing opportunities where the built environment can work with water and use it as an amenity rather than fight against it, I intend to explore new ways of developing floodplain protection. The city of Cedar Rapids, Iowa suffers from repeated annual flood. The aftermath of the annual flood defers each year. In some cases, the public barely notice the rise in the water level but in other cases, the effect of water is felt by every organism inhabiting within the city boundaries. In June of 2008, Cedar Rapids endured an epic surge that paralyzed the city for well over six months and still counting as of June 2009.

By providing Cedar Rapids with a series of strategies that responds to the rising waters, I intend to explore new ways of developing floodplain properties in Cedar Rapids.

WATER AND ARCHITECTURE

By

Ray Allen Cho

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
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Advisory Committee:

Professor Peter Noonan, Chair
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Professor B.D. Wortham-Galvin, Ph. D

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Dedication

It is amazing to have the privilege to be able to write this portion of my thesis. First and foremost, I'd like to thank my parents, my two older sisters and also my girl friend for all the support. Without their support, I would have not been able to finish a master's thesis.

I would also like to thank my committee members; Isaac Williams for his insightful feedbacks, B.D. Wortham-Galvin for her energy, understanding student needs and support, and Peter Noonan, committee chair, for his time and willingness to assist my efforts. I would also like to thank my colleagues Joe Kunkel, Sara 'Goldfarb' Langmead, Katherine Solether, Kimberly Kramer & Rachel Simon for numerous assistances during the past three and half years. It has been quite a journey.

Lastly, I would like to dedicate this thesis to all the people who suffered from the flood of 2008 in Cedar Rapids, Iowa. Hopefully there will be more people involved in the recovery process from all disciplines.

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Chapter one: The Human Perception of Water

Section1: Water as the Creator

Water is an essential element to all living organisms on planet earth. Water is the very element that makes life possible on this planet. It essentially is what distinguishes this planet from any others and could be the one most important element that characterizes earth. Seventy percent of the earth's surface is covered with water and this surface water acts as the cooling and heating system for the planet. By changing its state from solid to liquid to vapor, water stabilizes the temperature for the planet, hence making it possible for mankind to survive the heat wave constantly being generated by the sun.



Fig. 1_1: Globe on hands _ source: www.casifoundation.org

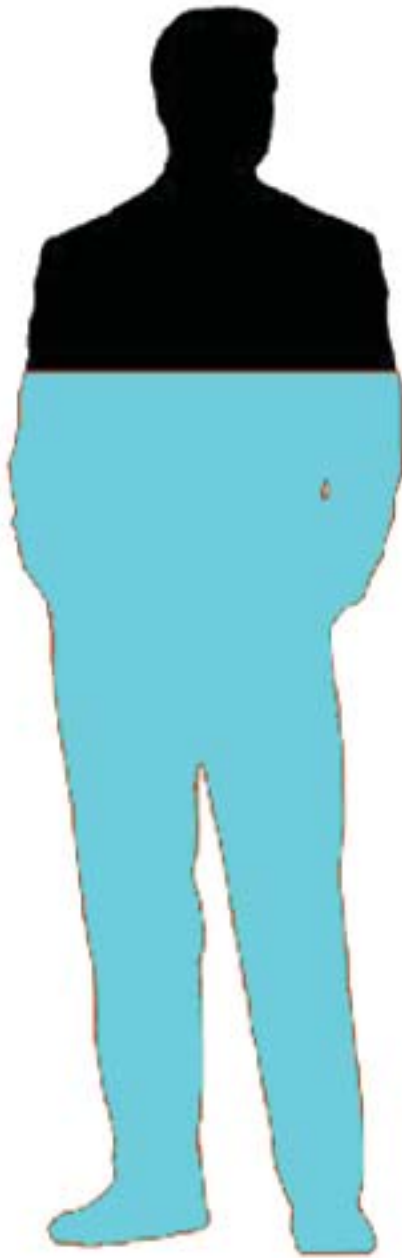


Fig. 1_2: human water content ratio (by author)

Water is not only crucial on creating a viable living condition for living organisms but also directly crucial on the existence of the living organisms themselves. Human beings are consisted of around seventy five percent water. Twenty five percent of the human body is solid matter and seventy five percent is water states. (Batmanghelidj, 8) The brain is said to be eighty five percent water. Human blood is ninety percent water, muscles are seventy five percent water, the liver is eighty two percent water and our bones are twenty two percent water¹.

Every part of the human body is dependent on water. Water is the creator for all living organisms on our planet. Water is what creates life on this planet and what separates this planet from any other planets on this solar system.

1. F. Batmanghelidj, MD, Your Body's Many Cries For Water, 1998

Section2:
Water as the Destroyer



Fig.1_3: Biblical Noah's Ark1

Water gives life but also claims life. The destructive power of water has always been part of the human history and as long as the planet exists, it will always be a part of our history. The destructive power of running water can be described by explaining how river comes to exist. What starts off as a single stream of water dripping from high ground to low ground eventually joins other streams and by using gravitational force, forms the river.

Although river provided life line for many habitats along its path, the river also has claimed many lives and will continue to do so.

Running water's destructive power is fast and quick washing away everything in its path. But standing water's destructive power can be just as devastating as running water in a very different way. With time, water has the power to dissolve hence destroy anything.

By decaying and destroying existing object, water also creates bacteria and fungi. In essence, there is nothing wrong with this duality of the nature of water, for one to live eventually imply one that would die. Water is the ultimate agent that completes the circle of life. One cannot exist without the other. While being an agent of destruction, water also provides life.

Fig.1_4: Flood in Cedar Rapids2





Fig.1_5: Muir and Riggs Glacier1

The temperature rise and global warming is not just a theory. The upper Muir Inlet in the east arm of Glacier Bay has been completely transformed in 60 years. In 1941 the ice was about 3000 feet deep, and 1.8 miles wide. Muir Glacier has retreated 12 miles between 1941 and 2004, and 28 miles since 1899. Riggs Glacier, which ran into Muir Glacier in 1941, has been severely reduced and terminates at Muir Inlet. Significant changes in vegetation accompanied the altered landscape, with immediate growth into the bare ground left by the retreating ice.

From the cases of Muir and Riggs glaciers, it is evident that temperature has been and still is raising causing earth's fresh water depository to melt and increasing the water level throughout many different regions.

Chapter two: Cedar Rapids Floodplain

Section 1: Cedar River



Fig.2_1: Cedar River Valley1 (by author)

Cedar River valley is created by the two rivers: Cedar River and Iowa River. These two rivers eventually join the Mississippi River and becomes one of many feeders for the Mississippi River valley.

Cedar Rapids is located at the southern edge of Cedar River before Cedar River joins the Iowa River. The river passes through Austin, Minnesota and Charles City, Cedar Falls, Waterloo and Cedar Rapids, Iowa. Its principal tributaries are the Little Cedar and the Shell Rock rivers. The river is named for the stands of red cedar along its lower course. Over the river's 329-mile course, it descends 740 feet.

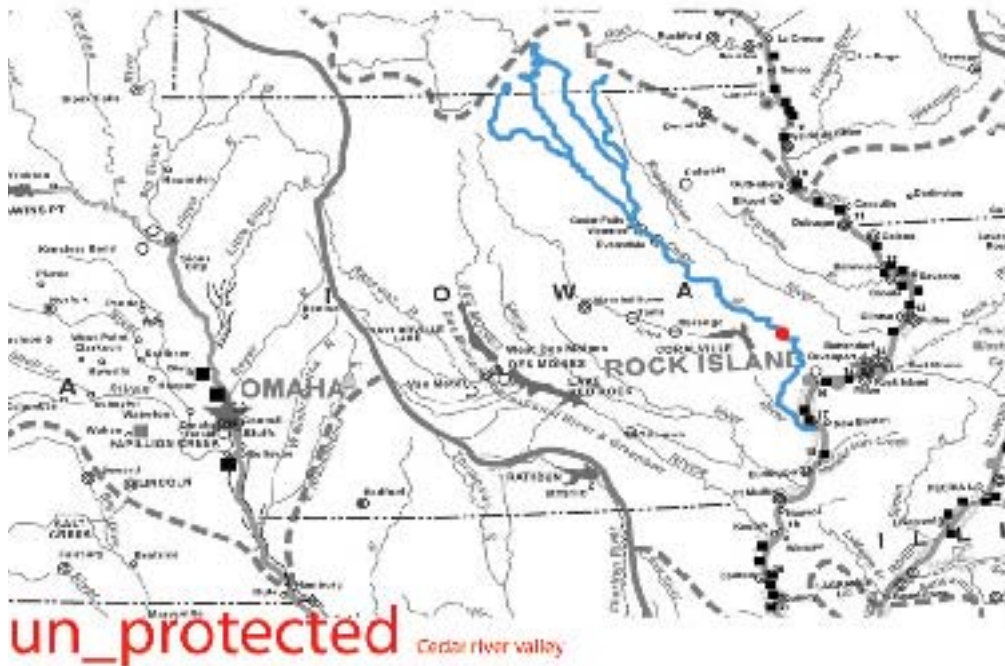


Fig.2_2: Cedar River flood protection map1 (modified by author)

The Cedar River's 7,819-square-mile drainage basin is mostly fertile farmland. There are several small hydroelectric dams on the river in the northern cities of Cedar Falls, Waterloo and Evansdale. According to the record indicated by United States Army Corps of Engineers, only a portion in the northern cities of Cedar Falls, Waterloo and Evansdale have flood control capability at a local scale.

Cedar River in its entirety is not regulated by the Army Corps of Engineers. The federal flood protection plan only begins where the Cedar River meets the Mississippi River Valley. The region where Cedar River enters The Mississippi is protected with sufficient levees. However, for the city of Cedar Rapids, and any cities south of Evansdale along the Cedar River corridor are unprotected from the annual inundation of the Cedar River.

1. Flood protection map indicates localized protection, dams, in Cedar Falls, Waterloo and Evansdale but nothing south of those cities. Source: US Army Corps of Engineers

Cedar River floods annually. The flood typically occurs between late spring and summer. It starts to threaten the city in the late spring when the snowfall from the winter starts to melt. The flood season lasts throughout the entire summer when prolonged heavy rain can overflow the river basin.

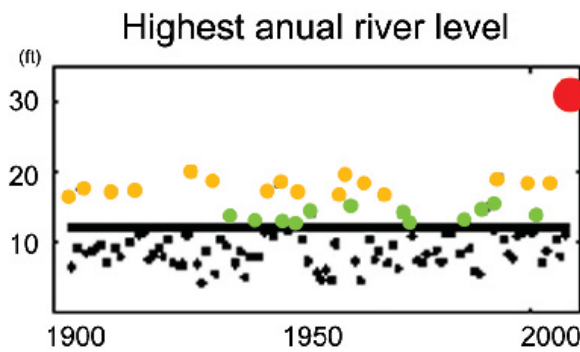


Fig. 2_2.5: Flood record from 1900 to current (modified by author)

Since the settlement in 1842, for the past one hundred fifty years, there have been numerous floods at various severities and almost in every ten year intervals; there has been a disastrous flood that claimed many lives and resources. It only seems fitting that the first bridge ever to be erected across the Cedar River in 1856 was washed away during the spring flood the following year. Yet people have settled along the Cedar River, constantly battling against the River.



Fig. 2_3: Historic flood of Cedar Rapids, Iowa

In recent years, the city of Cedar Rapids has continually raised the levees to fight off the Cedar River's rising waters. The current system is capable of containing up to 20 feet of water above sea level. The city successfully defended the flood in 1999 and 2004 where the water levels were 18.31 feet and 18.3 feet, respectively.

However, in 2008, the unprecedented flood tore through Cedar Rapids. In the following section, I will discuss some of the historic floods in Cedar Rapids.

1. Historic floods of Cedar Rapids in relation to the river water level. Color chart also indicates the severity of each flood in relation to other floods.

Section 3:
Historic Floods

Sub_section 1:
Flood of 1929



Fig. 2_4



Fig. 2_5



Fig. 2_6



Fig. 2_7

*Sub_section 2:
Flood of 1961*



Fig. 2_8



Fig. 2_9

*Sub_section 3:
Flood of 1993*



Fig. 2_12



Fig. 2_13

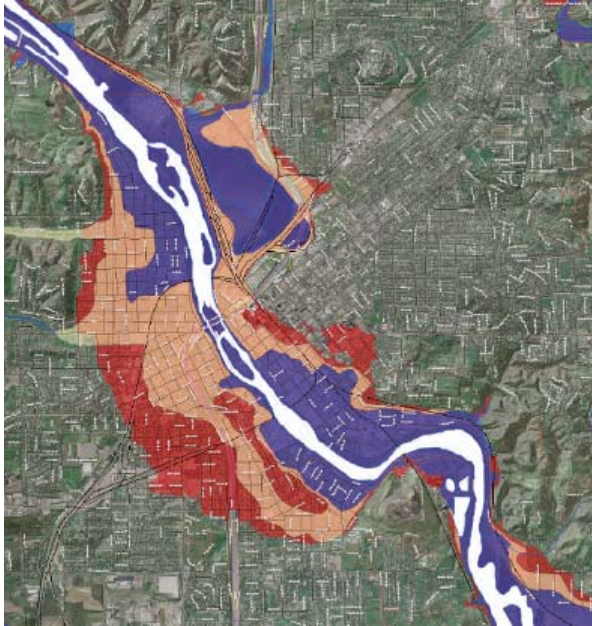


Fig. 2_14: Extent of flood and floodplain boundaries¹ (modified by author)

The historic flood of Cedar Rapids occurred in June of 2008. As shown in figure, the flood not only went past the 100 year floodplain but also went past the 500 year floodplain. The water level went 30 feet above sea level, making this the largest flood disaster in Cedar Rapids history.

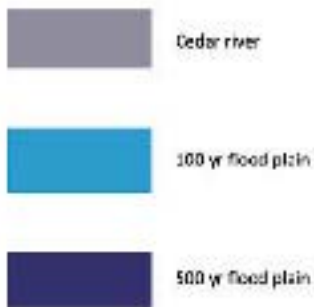
This flood came only after 15 years from the last flood in 1993 in which the water level was 20 feet above sea level, also exceeding the 100 year floodplain and till than the most devastating flood Cedar Rapids had seen. Most of the historical Cedar Rapids is developed along the Cedar River to take advantage of the river for various reasons. As the result, the flood affected almost all of the historic Cedar Rapids establishments.

1. Flood of 2008 in Cedar Rapids. White indicates the river, purple: 100 yr floodplain, beige: 500 yr floodplain and red: actual flooded area. Source: www.geog.ucsb.edu

Although the flood did not claim any lives, it affected 5,390 residential parcels, 1,049 commercial parcels, 84 industrial parcels, and 51 agricultural parcels amounting to over 7 billion on losses.

The flood also damaged a number of cultural assets.

Mother Mosque of America, Czech and Slovak National Museum and Library, African American Historical Museum and Cultural Center, Theatre of Cedar Rapids, Paramount Theatre, and Legion Arts were all heavily damaged by the flood. The flood also affected the fresh water resource of the region. 3 of 4 collector wells and 29 of 46 vertical wells were disabled, thus making the production reduced to less than 75% capacity¹.



Cedar Rapids flood of 2008 exceeded beyond not only the 100 year flood plain but also the 500 year flood plain



Fig. 2_15: Aerial view of flooded Cedar Rapids¹ (modified by author)

1. Flood of 2008 in Cedar Rapids. Blue indicates 100 yr floodplain, and purple indicates 500 yr floodplain. Source: www.geog.ucsb.edu

The repeated threat of the flood has always been part of Cedar Rapids history. Perhaps it is time to consider alternate ways of developing the floodplain in more drastic fashion. The next chapter will focus on studying precedents of how people cross culturally have dealt with the issue of rising waters.



Fig. 2_16: Aerial view of flooded Cedar Rapids1



Fig. 2_17: Flooded streets in Cedar Rapids

1. Statistics of the flood of 2008 in Cedar Rapids. Source: city of Cedar Rapids _ www.cedar-rapids.org

Chapter three: Case Studies

Section 1: Floating Villages

Sub_section 1: Tonle Sap Lake Village

The Mekong starts its journey in the Himalayas, flowing through China, Laos and Cambodia before discharging into the sea at its delta in South Vietnam. The Mekong Delta cannot absorb all the river water. So in May, the river reverses its normal seaward flow and begins to flow back up the Tonle Sap River. The 160km long lake fills with water and, expands to 250kms long by up to 100kms wide over a period of 3 months. The lake rises and progressively floods the surrounding forests and rice fields.

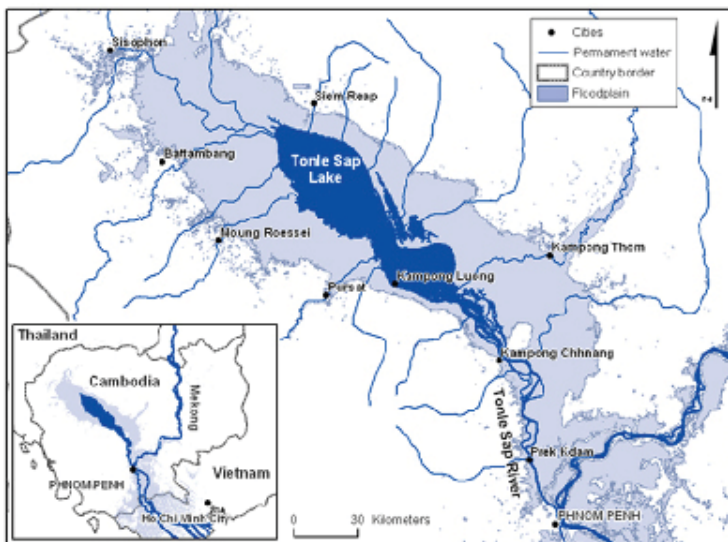


Fig.3_1: Tonle Sap River/Lake boundaries by seasons 1

1. Tonle Sap river/lake boundaries by the season. Dark blue is dry season and the light blue is lake boundary for the monsoon season. Source: http://en.wikipedia.org/wiki/Tonle_Sap

The people who live along the causeways and rivers move up towards the shore. As the water retreats and the rainy season approaches, the floating villages move inland to take shelter along the river banks. The community was developed by the villagers to create dwelling units flexible enough to accommodate the great fluctuation of the lake boundaries by the seasons thus developing and living along nature, not against nature. There are two types of dwellings. Ones that float on the river, essentially boat houses, and ones built on stilts. The image (next page) shows an example of a house on stilts and how living conditions vary by the seasons.



Fig. 3_2: Satellite image of the Tonle Sap Lake

1. Tonle Sap lake image during dry season.
Source: http://en.wikipedia.org/wiki/Tonle_Sap

The permanent structure / living quarters are raised above the water level and accessible with ladders during the dry season but during the wet season become the ground/water level entry point. Temporary movable structure is used during the dry season on the ground level to utilize the hollow space created by the stilts.

One could imagine depending on the complexity and design of the stilt structure itself, there could be a number of programs that could fit in the hollow space underneath. Although the nature of the flooding is a little different than that of Cedar Rapids, Tonle Sap lake floating village questions the development of a conventional floodplain urban development in the United States.



Fig. 3_3: House on stilts on Tonle Sap River/Lake1



Fig. 3_4: House on stilts on Tonle Sap River/Lake1

1. House on stilts in Tonle Sap lake village. Top: Dry season. Bottom: Monsoon season
Source: http://en.wikipedia.org/wiki/Tonle_Sap

Boat house community also provides a fresh way of looking at new possibilities involving floodplain development. Perhaps the most well known and prominent boat house community in the United States is the Seattle boat house community. Seattle boat house community is a little different in nature than that of the Tonle Sap lake village community. The boat houses along the water edge are more of a house than a boat. They are built on rafts and although they float on water, the units are connected to city water, sewage and electricity. As shown on the illustration, the boat house community is a direct extension of the city grid. The extension of existing city grid translates into easier integration of city amenities into these anomaly housing units. Hence although they are indeed floating on the water, they act almost as any other houses in the community. Instead of the backyard is the back-water, per-se. Also these boat houses are situated on the inner bay harbor and not lakes. Hence, the inland bay provides a more stable environment than that of a river stream.



Fig. 3_5: Seattle boat community1 (modified by author)

1. Seattle boat house community photo and satellite image.
Source: <http://local.live.com> (modified by author)

Perhaps the one most significant country in developing living conditions that are connected to water is the Netherlands. Much of the country, especially on the coastal area, is below sea level. Hollanders use a combination of dams, dykes along with a creative ways of looking at housing solutions to deal with their hydro-geological situation. Similar to the floating communities in the United States and Tonle Sap lake village, many architects explore new ways of developing dwelling units in the unique environment.

A Dutch architecture company, 'water studio' has exclusively been developing a housing type called, 'amphibian house.' A typical prototype of the amphibian house is situated on the water edge to connect and respond to both land and water condition. The amphibian house is a marriage between the boat and a house. It has the capacity and rigidness to accommodate comfortable living conditions and also has the ability to float away if desired.



Fig. 3_8: Water studio's 'amphibian house' - Holland

1. Aerial image of the Netherlands near Amsterdam
Source: <http://www.flickr.com>

Another way to deal with the rising water level is to simply live above the water line. Similar to the stilts housing in Tonle Sap lake village, many housing types developed for New Orleans as the result of hurricane Katrina uses the concept of stilts housing. Kieran and Timberlake architects were commissioned by actor Brad Pitt to design an affordable housing type for the lower ninth ward of New Orleans, the poorest area in New Orleans. Aside from the stilt concept, the project was developed with affordability and sustainability as the other driving force. The project suggests achieving affordability through utilizing local off site fabrication and assembling instead of the usual stick built construction type. Also the house has a construction document as well as deconstruction documents so that the house can be completely disassembled for recycling materials. After investigating floating houses and stilts houses, the next chapter will focus on applying these principles to Cedar Rapids as well as studying the historic development of the city and building types in Cedar Rapids.



Fig.3_9: Make it right house _
source: KieranTimberlake.com1

Chapter four: Analysis of Cedar Rapids

Section1: Historic Urban Development

The city of Cedar Rapids grew in a very conventional way of a Midwestern city: first settlement along the river, then the railroad oriented development, then the highways driven development. People first made settlements along the river for the river transportation and fertile lands in the late 1830's. With the population of eight in 1842, Cedar Rapids grew rapidly and by 1847, the first school building, post office, and hotel were built. Cedar Rapids was incorporated by the legislature on January 15th, 1849. The introduction of railway made the city grow even more rapidly and by 1906, along with the U.S. grid implementation, the city blocks started to resemble those of today's Cedar Rapids.



Fig.4_1: 1875 aerial rendering of Cedar Rapids1



Fig.4_2: 1906 map of Cedar Rapids2

1. Cedar Rapids (1875) Source: www.davidrumsey.com
2. Cedar Rapids (1906) Source: www.nsp.gov

Section2:
The City

Sub_section 1:
Sided City

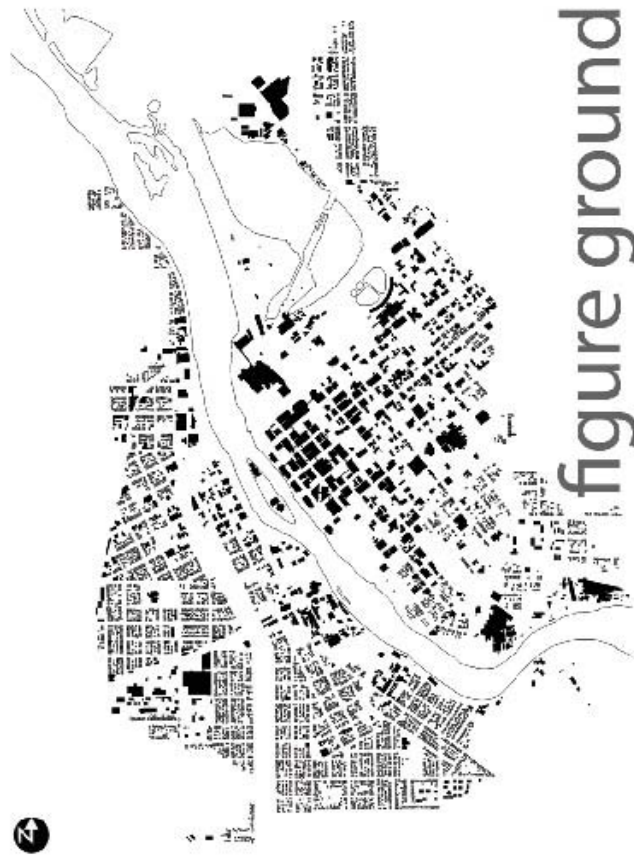


Fig.4_3: figure ground illustration (by author)1

Looking at the figure ground of the city, one could quickly see the sided nature of the city development. More robust and large scale foot-printed buildings are situated along the east bank of the river and to the west seems more smaller scale buildings and primarily residential scale buildings. Aside from the void of the Cedar River, the void of the interstate highway is also notable to the west bank. The central location of May's island acts as the mediator of the two distinctive sides and becomes the symbolic heart of the city.

1. figure ground illustration generated by author using satellite image from google earth

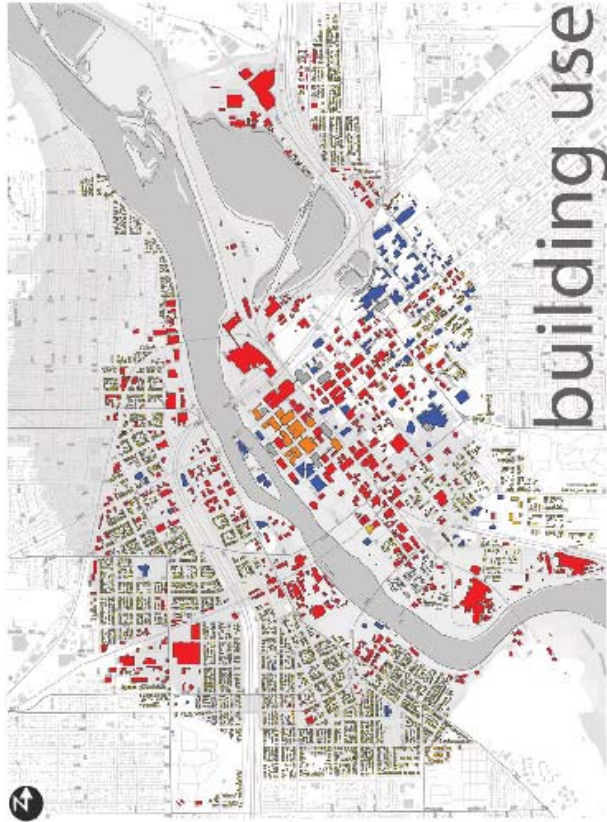


Fig.4_4: building use illustration (by author)¹

Cedar Rapids provides a rich contextual experience for its seamless connection between the core city fabric and surrounding neighborhood residential fabric due to the compact nature of the city development. The proximity of tall buildings of the commercial core, the mid rise buildings of colleges and high density residential units, and the single family house neighborhood provides an opportunity for experiencing the city with multiple senses.

On describing the area surrounding the Quaker Oats Mill and office, a local resident describes, “on Thursday it smelled like Crunch Berries. Most other days it smelled of burnt oatmeal.”² Being able to see the mixed city fabric in one sight combined with the permeating smell of Quaker Oats, the sound of railway and the Cedar River gives the city a unique character .

1. building use illustration generated by author using map of Cedar Rapids
2. Based on a web interview with a local resident, Anton Olsen conducted by author



Fig.4_5: green space illustration (by author)¹

The green space in Cedar Rapids are very scattered and the implementation of the space seems like an afterthought. Much of the downtown Cedar Rapids falls in the floodplain, hence before the settlement, much of the area were cover with greenery. Without the two cemeteries (Oak Hill to the east and Linwood to the west) the city seems to be in dire need for public green space. Exploring with a linear urban park that gets developed

alongside the river, hence both giving public outdoor space to the city as well as providing a buffer zone in case of the flood seems like an intriguing approach. I will explore many different approaches in the following chapter to utilize the lack of public park space and implement green space in such a way that ithe park becomes both civic amenity and a device to address flooding.

1. green space illustration generated by author using map of Cedar Rapids
2. satellite image of green square park. source: local.live.com

Section 3: Topography

The current downtown Cedar Rapids is developed around the May's island. May's island houses the court house building and is a symbolic center of the city. It is natural that the city developed in the flat lands around the river for its easy implementation of buildings. Although the major developed areas are in the flat lands, Cedar Rapids also possesses reasonably low bluffs that are mainly developed with residential neighborhood.

One strategy might explore the reversal of civic and more permanent buildings with the existing residential buildings in these high grounds.

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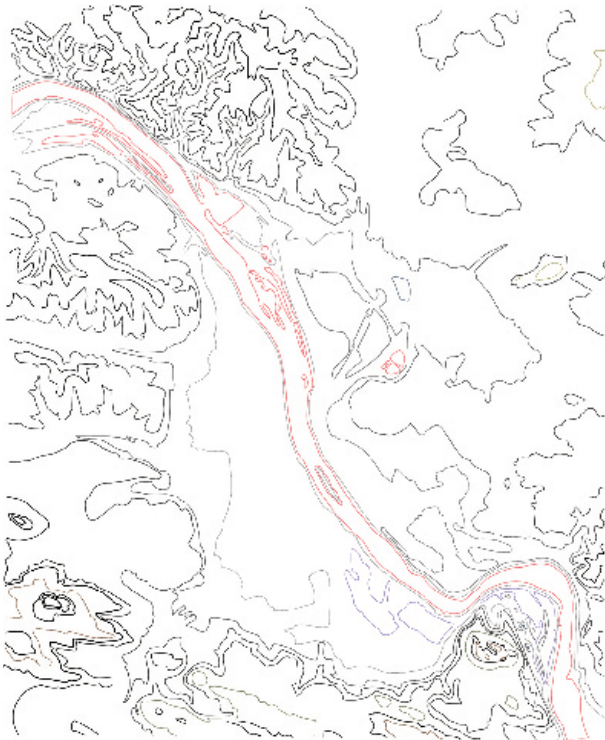


Fig.4_7: Cedar Rapids topography illustration (by author)1



Fig.4_8: terrain map of Cedar Rapids (modified by author)2

1. Cedar Rapids topography illustration generated by author using USGS topo map
2. source: maps.google.com

Section 4:
The River

Sub_section 1:
Level one

Level one indicates water level below 10 ft. The illustration indicates in level one, the water is contained by the boundaries of the river. The current fema instructions



Fig.4_9: Cedar River stage 1 illustration (by author)1

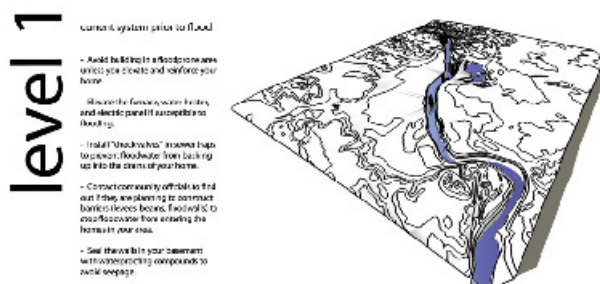


Fig.4_10: current fema guidance for prior to flooding (by author)2

- for before flood stage are:
- * Avoid building in a flood-prone area unless you elevate and reinforce your home.
 - * Elevate the furnace, water heater, and electric panel if susceptible to flooding.
 - * Install "check valves" in sewer traps to prevent floodwater from backing up into the drains of your home.
 - * Contact community officials to find out if they are planning to construct barriers (levees, beams, floodwalls) to stop floodwater from entering the homes in your area.
 - * Seal the walls in your basement with waterproofing compounds to avoid seepage.

1. level one indicates water level below 10 feet
2. information source: www.fema.gov illustration by author

Level two indicates water level between 10 feet and 20 feet. The illustration indicates in level two, the water starts to inundate. However, with the current protection system (mainly raised levees and temporary sandbags) the city was able to succeddfully fight off water level upto 20 feet. The current fema instructions for

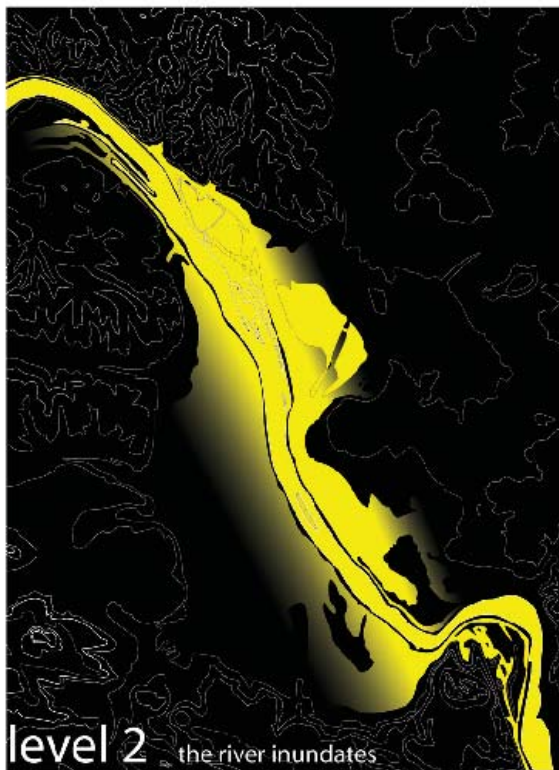


Fig.4_11: Cedar River stage 2 illustration (by author)1

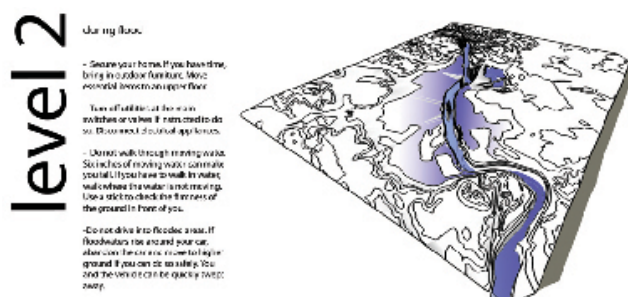


Fig.4_12: current fema guidance for during flooding(by author)2

during flood stage are:

* Do not walk through moving water. Six inches of moving water can make you fall. If you have to walk in water, walk where the water is not moving.

* Do not drive into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground if you can do so safely. You and the vehicle can be quickly swept away.

*Turn off utilities at the main switches or valves if instructed to do so. Disconnect electrical appliances. Do not touch electrical equipment if you are wet or standing in water.

1. level two indicates water level between 10 feet and 20 feet
2. information source: www.fema.gov illustration by author

Level three indicates water level over 20 feet. The illustration indicates in level three, all of downtown and surrounding flat lands are completely under water. The current fema instructions for after the flood stage are:

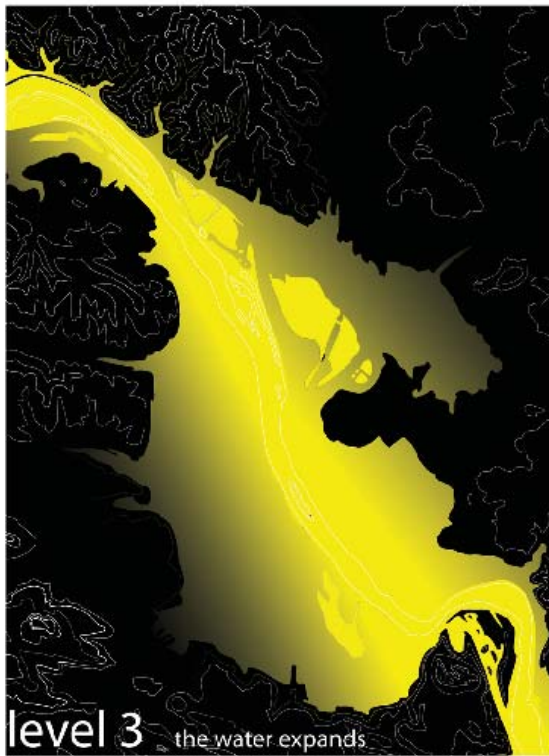


Fig.4_13: Cedar River stage 3 illustration (by author)1

- * Be aware of areas where floodwaters have receded. Roads may have weakened and could collapse under the weight of a car.
- *Stay away from downed power lines, and report them to the power company.
- *Return home only when authorities indicate it is safe.
- *Stay out of any building if it is surrounded by floodwaters.

The next chapter will use research and analyses conducted in this chapter to explore some innovative ways of rethinking the floodplain development in Cedar Rapids in its urban context.

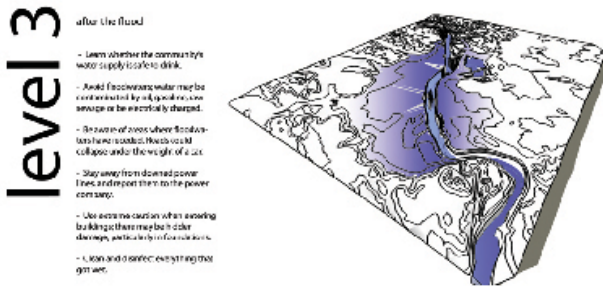


Fig.4_14: current fema guidance for after the flooding(by author)2

1. level three indicates water level over 20 feet
2. information source: www.fema.gov illustration by author

Chapter five: Urban Plan for the Future

Section 1: Exiting Temporary Plan

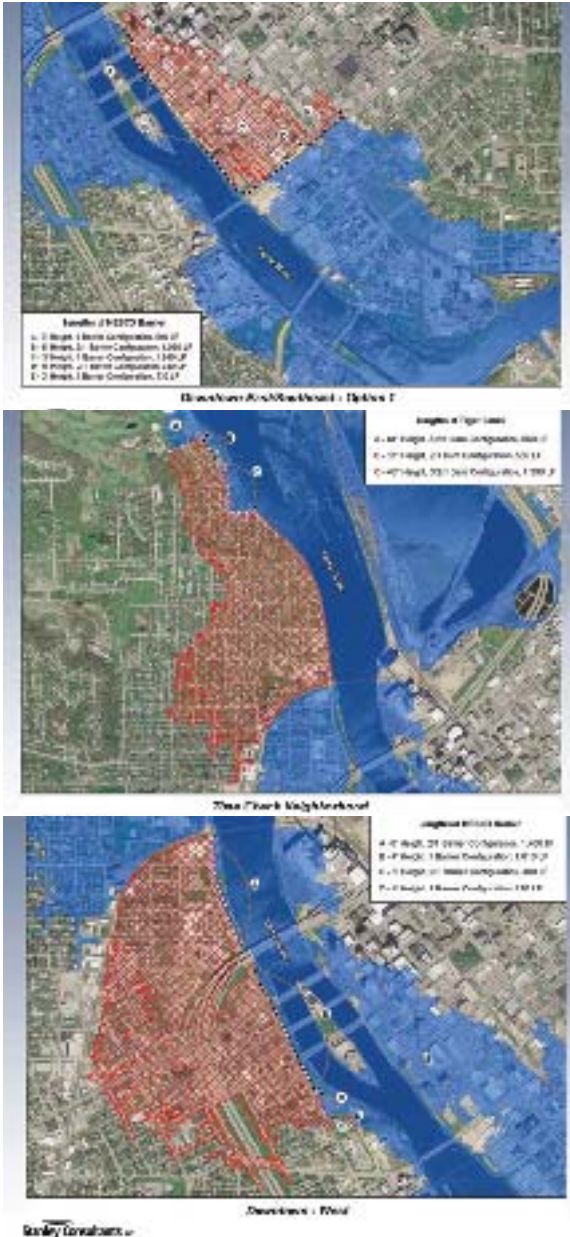


Fig.5_1: current temporary flood protection plan1

The current temporary strategy for upcoming seasons, until the more permanent plan implementation, is to raise the levees around major places of interests. The plan focuses on four different areas of east and west downtowns, time check neighborhood (northwest Cedar Rapids) and also the historic Czech neighborhood (Southwest Cedar Rapids). Although this is meant to be a temporary solution, these temporary walls may linger around if they seem sufficient. The worst fear is that the city may hold off developing the more permanent solution in short sight of the levees holding off

In the wake of the unprecedented 2008 Flood, the City initiated a planning process to provide improved flood management to better protect the homes and businesses of Cedar Rapids.

3 goals

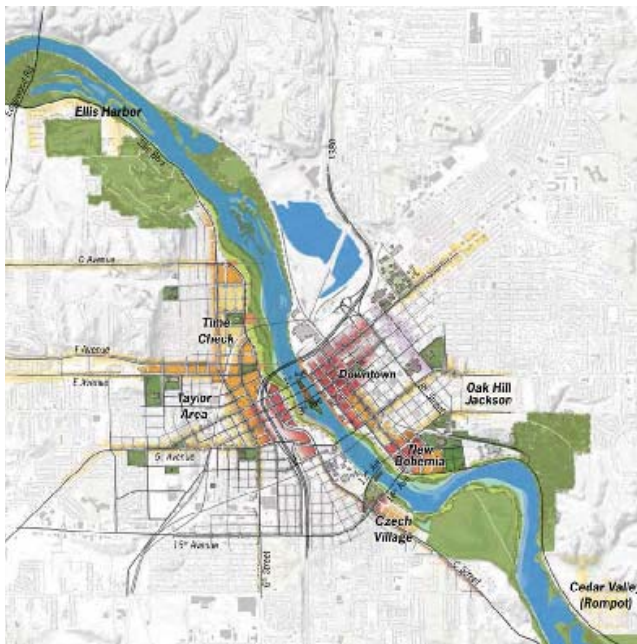


Fig.5_2: future long-term schematic plan proposal1

1. Flood Management Plan:
Provide increased protection against future floods and leverage the flood management strategy to create a Riverfront Park.

2. Connectivity:
Knitting together the City and its neighborhoods via transportation improvements to public transit, trail systems, the street grid system, rail operations, and specific streetscapes.

3. Sustainable Neighborhoods:

Targeted areas within the City serve as opportunities to reinvest and redevelop to provide housing, strengthen neighborhoods, enhance the downtown business and arts communities, and improve public facilities.²

1. source: www.cedar-rapids.org
2. information source: www.corridorrecovery.org

Principles for the proposed plan are

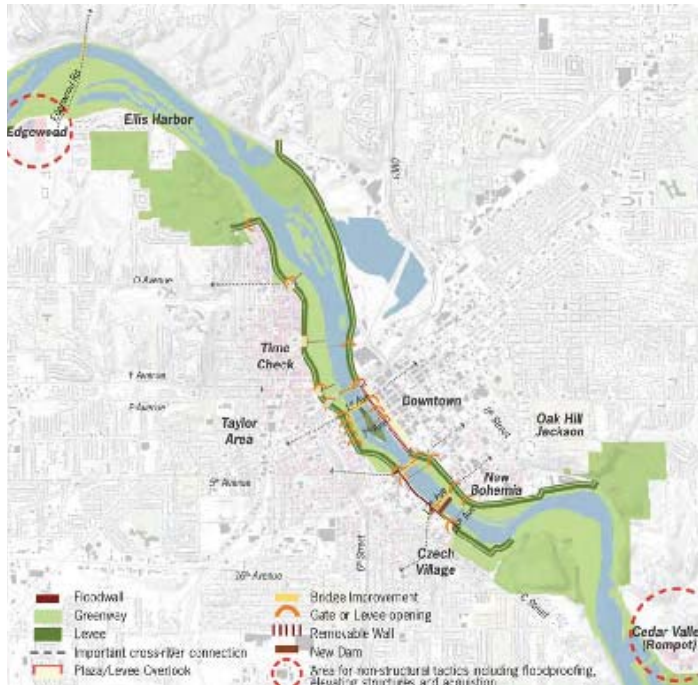


Fig.5_3: flood management plan1



Fig.5_4: section through the river at east downtown area1

-Uses levees more often than vertical floodwalls. (current proposal indicates east downtown area as the only area with vertical flood-wall use)

-Maximizes open space while preserving existing neighborhoods as much as possible.

-Preserve critical cultural and economic assets, including Czech Village/New Bohemia, Downtown, Quaker, and Cargill.

-Address non-structural issues such as flood warning systems, watershed management, and land use/zoning practices.

-Prioritize maintaining evacuation capability via bridge(s) in case of floods.2

1. source: www.cedar-rapids.org
 2. information source: www.corridorrecovery.org

Fig.5_5: future long-term plan_west bank section1



- Use of open space
- Leverage flood management measures to maximize open space
- Keep the riverfront open to the public
- Develop pedestrian and bike trails along greenway corridor connecting downtown to the neighborhoods
- Use the riverfront for parks, high-quality mixed-use development, or public uses
- Implement desired greenway program including an expanded farmer's market, trails, a dog park, gardens, an amphitheater, wetlands and interpretive flood education.
- Maintain views to the river

Another approach is to implement the green open space in a larger scale. The proposed landscape plan still is an afterthought of what seems to be motivated by protecting existing city fabric that is built in the heart of Cedar Rapids.



"To build in-the-heart-of something means to be inscribed in that something. To be inscribed in is much more than being alongside. ...It's a way of pacifying the side inside so that hostilities end with the side outside. In fact, for the differential not to be conflict consist in precisely that; that there are gradient without hostility." (Folch, 7)¹

Fig.5_6: park city scheme illustration (by author)

The park city plan's goal is to provide the city with the 'gradient without hostility' element that the city has lost ever since the settlement. Still, recognizing the sidedness nature of the city fabric, the approach is to dedicate a large portion of green space as the mediator between the city and the river on the west bank of the river.

1. Folch, Ramon - in foreword to the book, *Al Lado De* - see bibliography for detail

The mediating green space in the proposed large scale offers many opportunities for multiple programs to co-exist. The side to the river will be utilized as a riverfront park similar to the previous plan. However, the riverfront park will be designed with the attention to dry weather as well as the situation when the river expands. An active agriculture field will also be implemented to the city side.

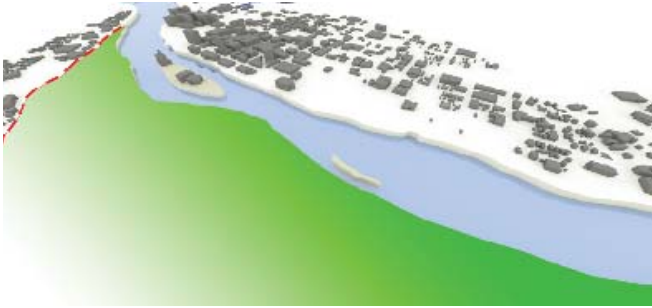


Fig.5_7: park city scheme illustration (by author)



Fig.5_8: park city scheme illustration (by author)



Fig.5_9: urban farm - community supported agriculture1

From this point out, the term 'flood' will be re-defined as 'river expansion' in order to suggest a change in attitude. River expansion is a natural occurrence and not a disaster. Building a riverfront park along side the river will take an attitude of accommodating the river as well as the people.

The next approach will explore a possibility of implementing the mediating element while preserving the existing context.

Is there a way to co-exist along with the river? The experimental river city scheme challenges the current floodplain development of Cedar Rapids with a different way of thinking about existing floodplain developed area.

The current city was developed with an attitude towards the river that thinks the river as an element that needs to be controlled. The western way of trying to control the environment for the betterment of human life is precisely the notion the river city scheme questions. The approach is similar to the previous park city approach where there is a mediating element that allows seamless transition between the river and the city. However the river city approach differs from park city and allows existing buildings to continue as part of the urban fabric.

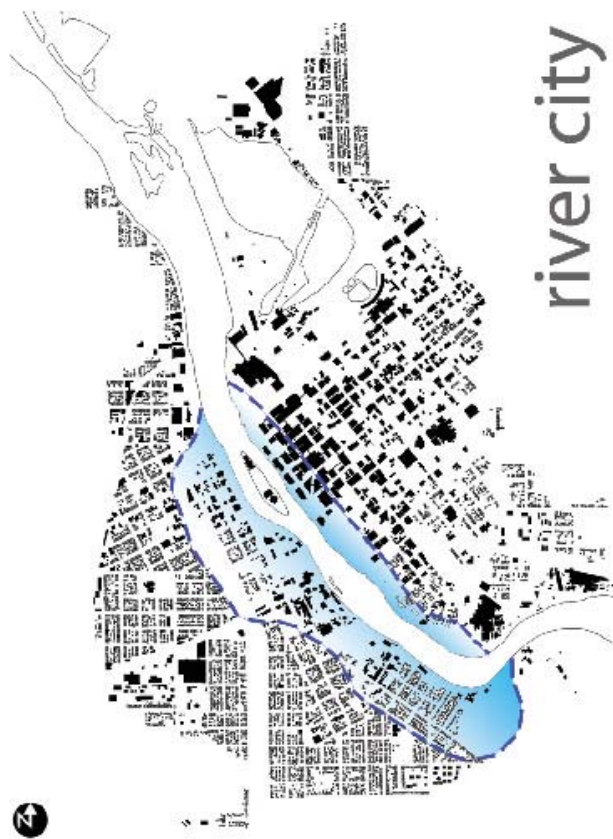


Fig.5_10: river city scheme illustration (by author)1

The idea is to have the landscape interweave with the existing architecture. All buildings in the indicated area have been damaged from the 2008 flood. Most of the larger scale buildings were damaged on the ground floor but the second story up were in good condition. Redevelopment of the ground floor the same way as before would be a loss of opportunity.

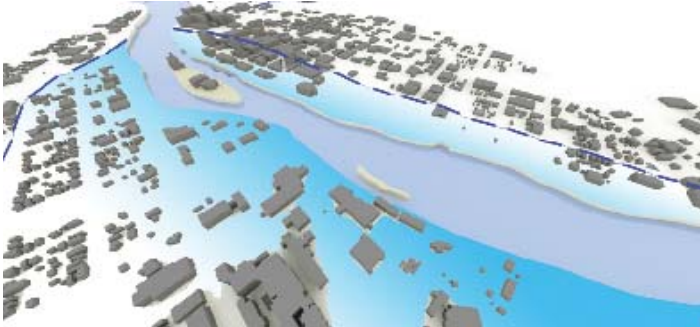


Fig.5_11: river city scheme illustration (by author)

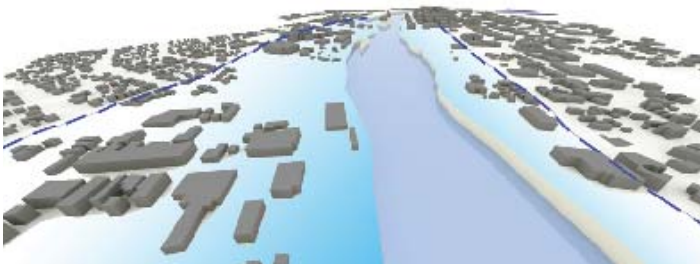


Fig.5_12: river city scheme illustration (by author)



Fig.5_13: floating community sketch1

While some larger scale buildings could be saved, most of the residential buildings were damaged beyond repair. Big portions of historic time check neighborhood and Czech village exist today with damaged vacant houses. In the following Chapter, the investigation will shift from urban scale to a building scale. How might the ground floor program change for the existing large scale buildings? How may one build a single family house in a river expansion area that is also historic neighborhood?

Chapter six: Design Proposal

Section1: Initial Proposal

Sub_section 1: Community_Water as Unifier

The Cedar River has always acted as a 'divider' for the two communities of Czech Village and New Bohemia. Although Czech Village has a historic main street commercial area, the two neighborhoods have been divided primarily in terms of zoning ordinances.

While Czech Village is primarily a single family residential neighborhood, New Bohemis is more of a commercial / office area with some single family housing as well as much denser mid-rise condominiums. Also the remnants of the dominant presense of SinClair / Wilson meat packing factory begged for a need for revitalization of these two areas.

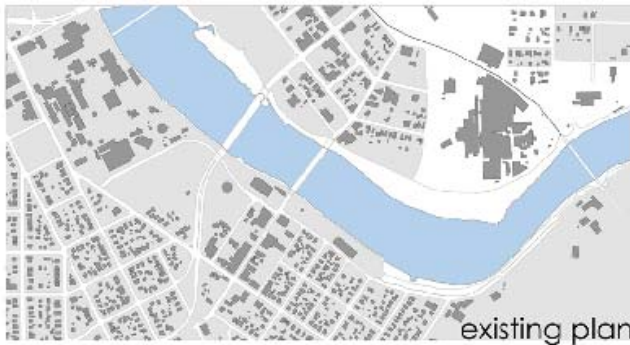


Fig.6_1: existing plan of Czech Village _ New Bohemia



Fig.6_2: smoke stack of SinClair / Wilson meat packing factory

Sinclair / Wilson meat packing factory had been in operation from 1875 to 1990. It has been part of the city fabric of Cedar Rapids for well over 100 years. One could say that the factory is what defines New Bohemia neighborhood of Czech Village.

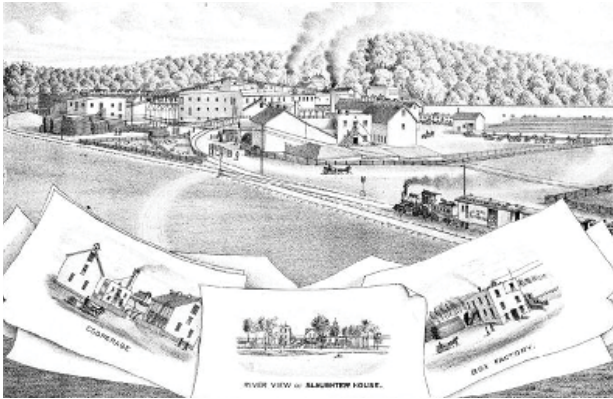


Fig.6_3: Sinclair / Wilson meat packing factory (1875)



Fig.6_4: smoke stack of Sinclair / Wilson meat packing factory



Fig.6_5: Sinclair / Wilson meat packing factory

The city purchased the factory in recent years and was looking for in ways to revitalize the neighborhood by either adaptively reusing the factory building or razing the building and having new mixed-use developments. Due to the asbestos contamination, the building was deemed hazardous for any type of occupation.

My proposal is to keep the symbolic / iconic smoke stack and the portion of the building as a monument and adaptively reuse the 'material' of the building rather than trying to use the hazardous building itself. By using the brick as pavement material for the sidewalks of New Bohemia, the memories of this old building will continue to be part of the history of Cedar Rapids, Iowa.

The master plan focuses on connecting the two neighborhoods by using the river as the agent for connection. Two connections are modified. First modification is to convert the main street bridge into a pedestrian / bike bridge. Most vehicular traffic already is concentrated on the bridge to the north. Converting the main street bridge into a pedestrian bridge will add to the character of the neighborhoods. The second connection is the abandoned railroad bridge to the east. Reusing this bridge as a pedestrian / bike bridge will allow circular movement, and create a desirable bike trail route for the residents. Coupled with park space on the New Bohemia side along with the new public promenade on the Czech village side, the river will promote connectivity between the two communities.



(re)vitalize

Fig.6_6: neighborhood connection diagram
 _ dry stage(top) _ flood stage(bottom)

Recognizing the sidedness of the two neighborhoods, the water protection plans also tried to utilize the geographical uniqueness of both sides as opportunities rather than obstacles. To the New Bohemia side, levee system along with greenway park that allows flooding was implemented. The neighborhood master plan was devised by extending the existing urban grid and restitching the east side to the west side. Abandoned railroad line was converted into a linear park element that defined the boundary for the new development of the New Bohemia. Linear park also gave a smoother connection between New Bohemia to the northern neighborhood of Oak Hill Jackson. To the Czech Village side, a series of river wall was proposed to create public space along the waterfront. I will discuss in detail about the public space created by the river wall in detail in the next sub-chapter.



Fig.6_7: proposed neighborhood master plan _
dry stage(top) _ flood stage(bottom)

*Sub_section 2:
Public Space_Water
as Amenity*



Fig.6_8 : proposed removable flood wall @ Czech village



Fig.6_9 : permanent floodwall @ parkersburg, WV



Fig.6_10: seawall @ New Orleans

The current proposed water protection plan for the Czech village side is a removable engineered flood wall that can be installed during flood stage and disassembled during dry season. The other extreme with be to have a permanent flood walls similar to those of Parkersburg and New Orleans. Having the temporary removable flood wall may be economically viable and it does have the minimal impact in terms of impeding on the existing fabric. The question of installing a flood wall raised another fundamental question; Can a flood wall be more than a flood wall? Could it be an occupiable space?

The wall condition, by default, creates 3 occupiable spaces; both sides of the wall and the space on top of the wall. In the case of Czech village, having the flood wall meant having a public walk along the village side, along the river and also on top of the flood wall itself, in the case the wall becomes more than just a flood wall. Access to and from the wall becomes an issue / opportunity in this case. A series of access study was done to see all possible ways in which people would access the wall walk. In order to protect the village from the 500 year flood, the wall height had to be considerably high (approx. 16 feet high) The ramp access became tricky to solve. The height of the wall itself became the generator on dividing the wall walk into two accessible walks later on.

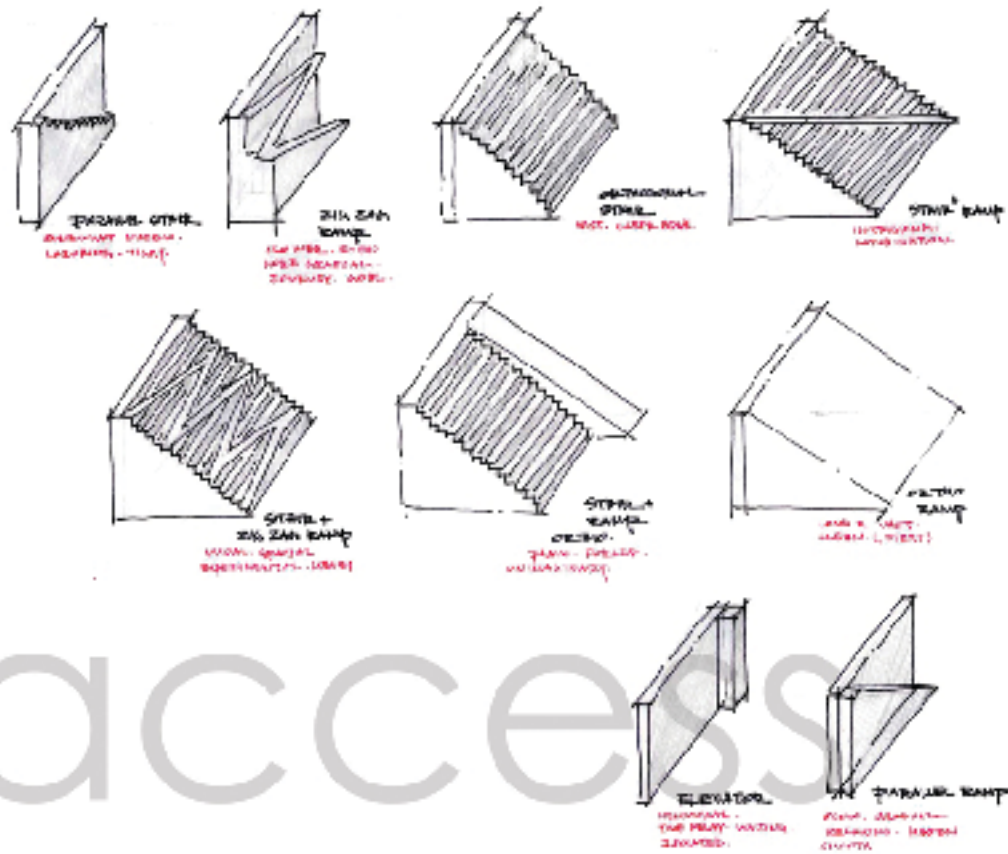
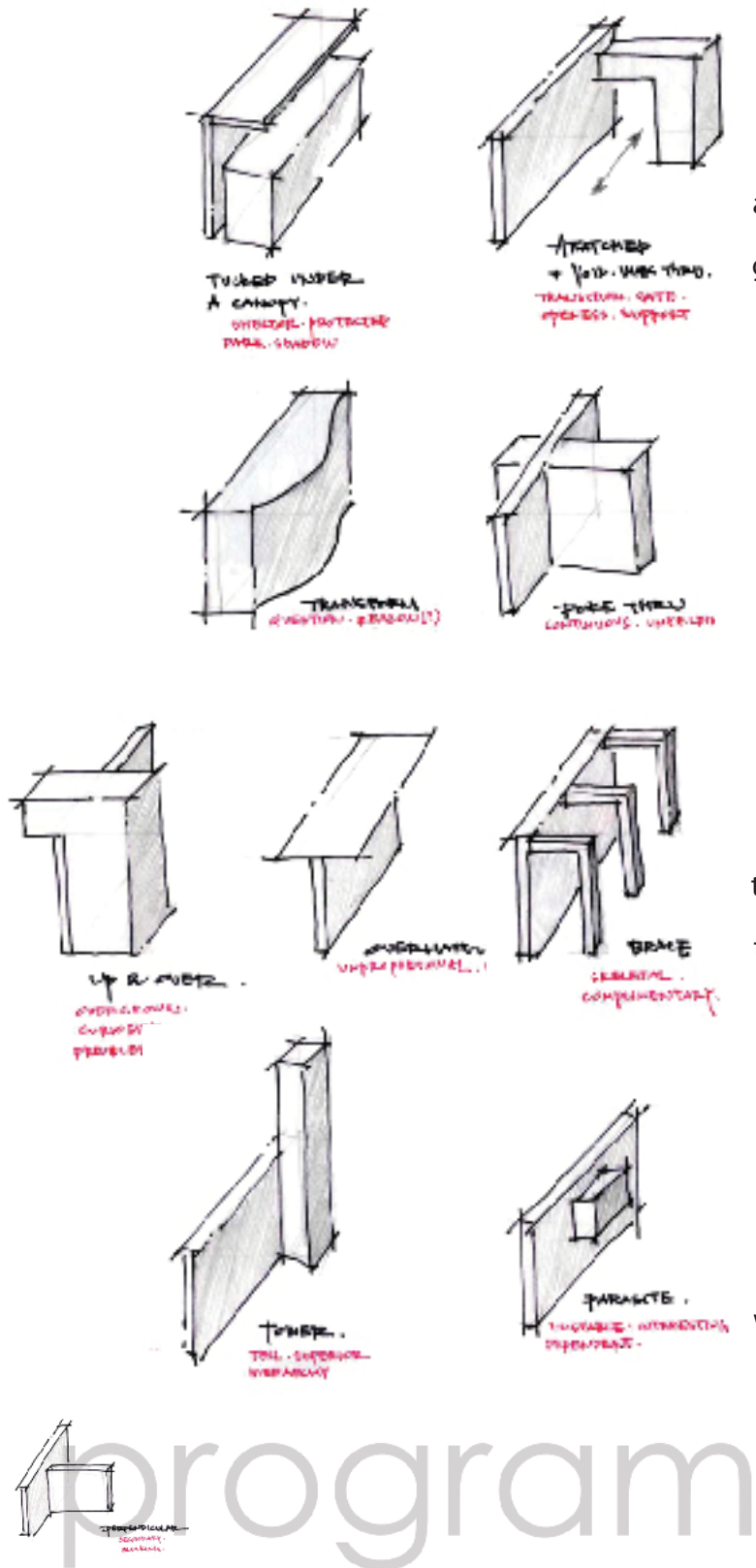


Fig.6_11: wall access diagrams



Installment of the flood wall meant protection from the water. This allows architectural programming to occur on the village side of the wall.

A series of program diagrammings were done to study how the architectural component would complement the wall walk. Also the transformation of the wall itself was studied to experiment with multiple possibilities to give hierarchy on the public wall walk space being created. Also in terms of structural integrity, the program element would reinforce the wall structure from water pressure during the flood.

Fig.6_12: wall program diagrams



Fig.6_12(1): aerial perspective _ massing study _existing condition

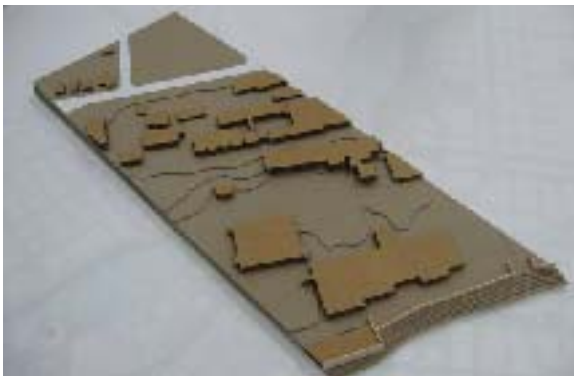


Fig.6_12(2) : wall condition @ penford factory area



Fig.6_12(3) : wall condition @ national czech & slovak museum



Fig.6_12(4) : wall condition @ single family residential blocks

The 6 block stretch in Czech village where the wall development would occur has 3 typical urban conditions. Beyond the initial block, is the penford factory area where permanent flood wall is planned to be installed. The transition from this permanent wall to the wall walk lies the 12th avenue bridge. The initial block to the north, starts in a park area then transitions into National Czech and Slovak museum area where the urban fabric is more commercial driven than residential. Then the remaining areas are predominantly single family residential area.

The northern termination point of the wall walk was naturally at the National Czech and Slovak museum. The site already had a civic scale plaza with a symbolic clock tower. The plaza was also on the northeast side of the bridge connecting Czech village to New Bohemia and was the main entrance into Czech Village. Recognizing the character of the site, the approach was to have a civic scale monumental staircase, and allow access to the wall walk from the plaza level. Series of studies were done focusing on the material of the ground surface as well as types of access. The space under the stair case and allowing direct access point from the wall walk to the museum also came in question.

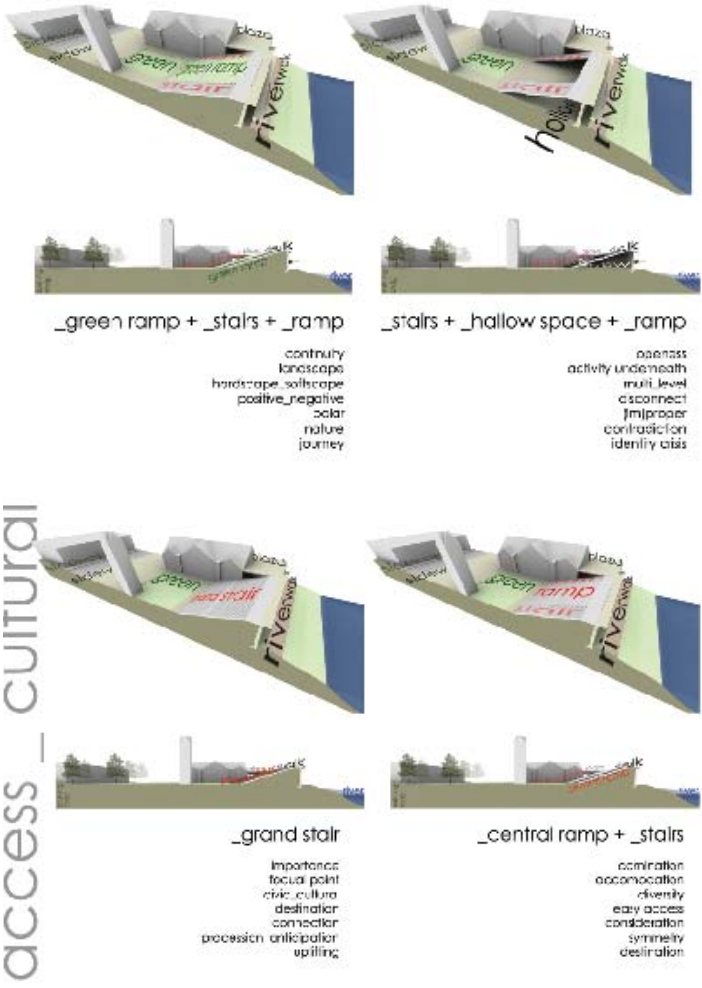


Fig.6_13: access diagrams @ national czech & slovak museum

The program massing studies were done with 3 focal points; promoting mixed use, creating public wall walk space, and access from the wall walk to the ground plain. Initial approach was to have commercial retail use on the village side ground floor and have office / light retail on the wall walk level. Housing would be situated on top of the wall walk space, hence separating the private from the public space. Access to the wall from each side were also studied. Due to the limited topography, from the river side, the access was along the river. From the village side, access was perpendicular to the wall and connected the wall directly from the existing urban pedestrian movements.

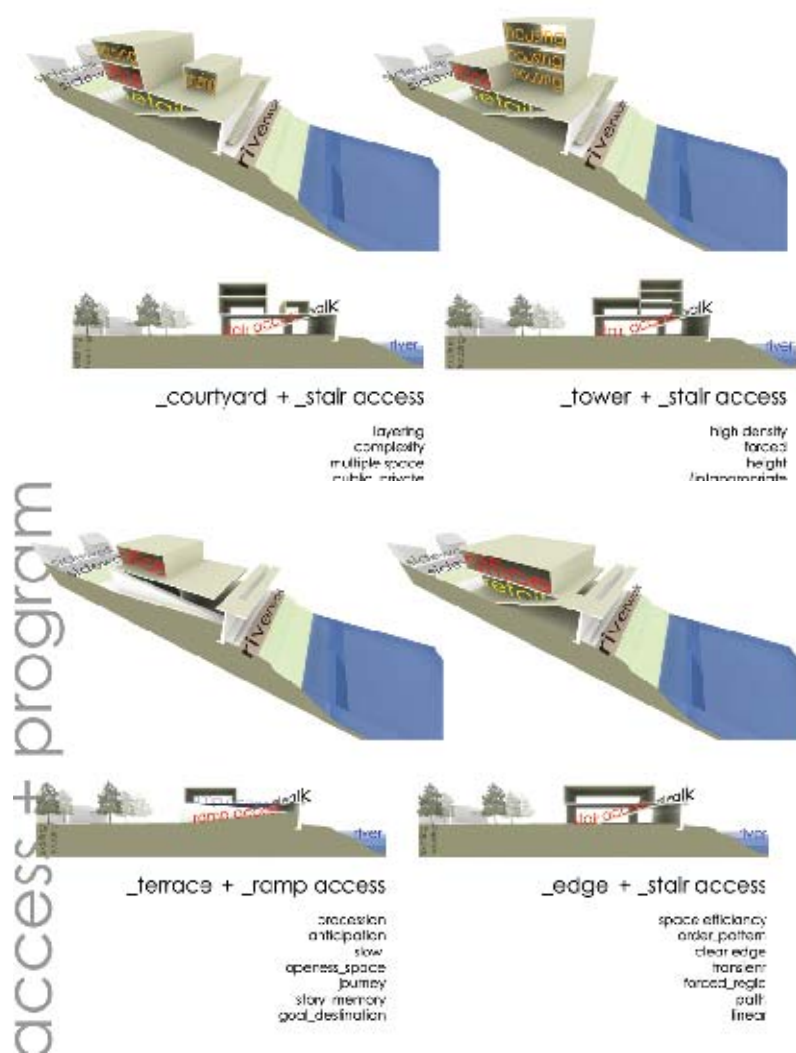


Fig.6_14: access + program diagrams

The design approach of creating the wall walk as a viable habitable public space relied heavily on its connection from the village to the wall to the river. Village walk connects the village fabric to the high wall walk by creating a commercial retail promenade on the ground level on the Czech village side. Also the residential units above the wall walk development is accessible from the village walk level. The circulation space between village walk and high wall walk becomes not only the access points but also a civic gathering space where people can sit, relax and enjoy.



Fig.6_15: village walk _ high wall walk perspective

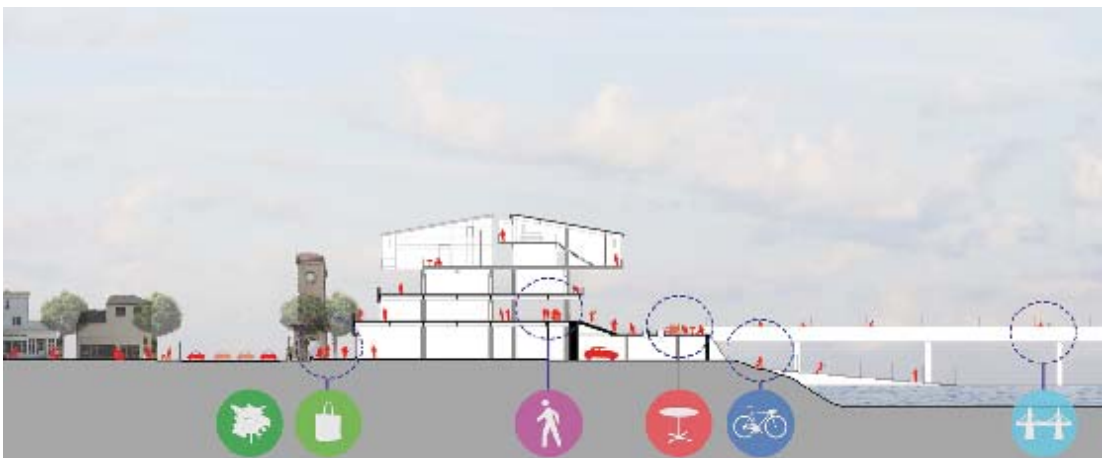


Fig.6_16: section thru clock tower block

The northern termination point is the Czech and Slovak museum, and the southern termination point is the park walk. Park walk transitions from the village to the low wall walk through a park area and a series of green terraces. The approach is to create 'an active park' with playground to activate the green space. The presence of the wall and the level change needed to transition from the park to the wall walk creates space where parking can be introduced.



Fig.6_17: park walk _ low wall walk perspective



Fig.6_18: section thru park walk

The high wall walk and low wall walk together creates the public promenade on top of the flood wall structure.

While high wall walk is intended for semi-public space that caters the need for the office space located on the 2nd floor level, the low wall walk is intended as a civic space where people can gather, walk by and enjoy. Also to the north side where the low wall walk widens considerably, commercial tenants can utilize the outdoor seating to create a desirable outdoor dining experience.



Fig.6_19: high wall walk _ low wall walk perspective



Fig.6_20: section thru main stair

The high wall walk and low wall walk complements each other. High wall walk responds to the village grid and the wall itself is formed on a rigid linear stripes. The low wall walk responds to the river and the form itself is more free form and the form also responds to the existing topography. In terms of the material, high wall walk is concrete while low wall walk takes the form similar to riprap wall. Having more of an organic material for the low wall helps to establish the river walk's character.



Fig.6_21: river walk _ bridge walk perspective

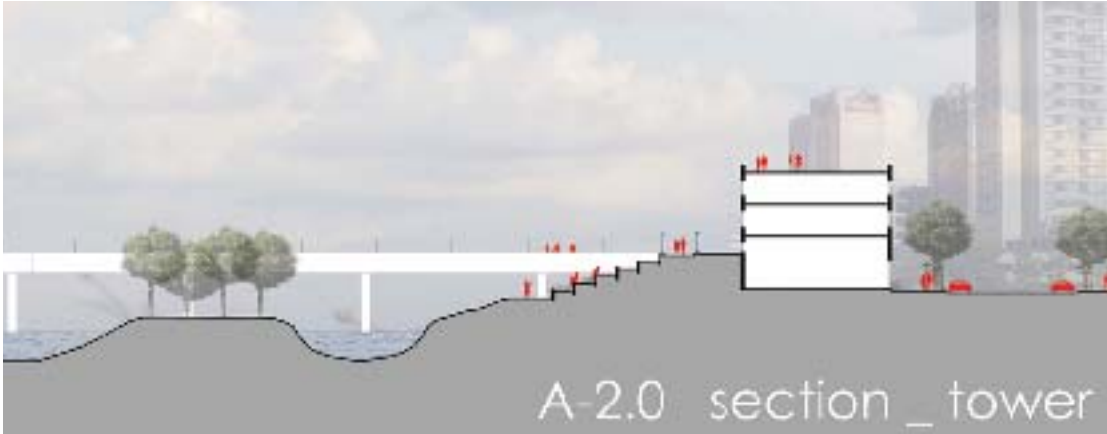


Fig.6_22: section thru clock tower block

The overall block plan puts emphasis on the public space being created. On the 3rd level and 4th level are variety of housing options. On the 3rd floor are flat units. Flats are available from 1 bedroom units upto 3 bedroom units. Much like the public space , the housing options also are similar in spirit for its emphasis on outdoor terrace space. Each unit offers either village view or river view and most of the units have generous outdoor courtyard space.

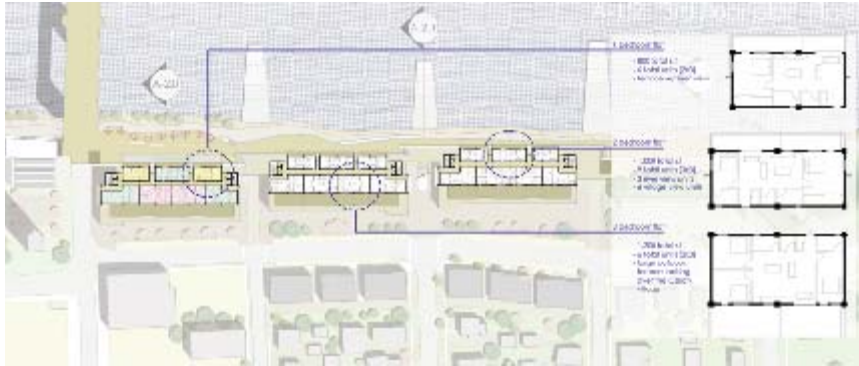


Fig.6_23: 3rd floor plan _ flats level



Fig.6_24: 2nd floor plan _ wall walk plan



Fig.6_25: ground floor plan



Fig.6_27:
4 units per
block



Fig.6_28:
6 units per
block



Fig.6_29: 8 units per block

The loft units were developed with 2 main principles. First, like other units and the public space schemes, the loft units were developed around the outdoor courtyard space. The second principle was to form the cluster of loft units appropriate to the surrounding context of the residential Czech village. Rather than having a continuous high rise flat units that sores out of the ground, the loft units were meant to cap off the height of the development more responsive to the surrounding neighborhood.

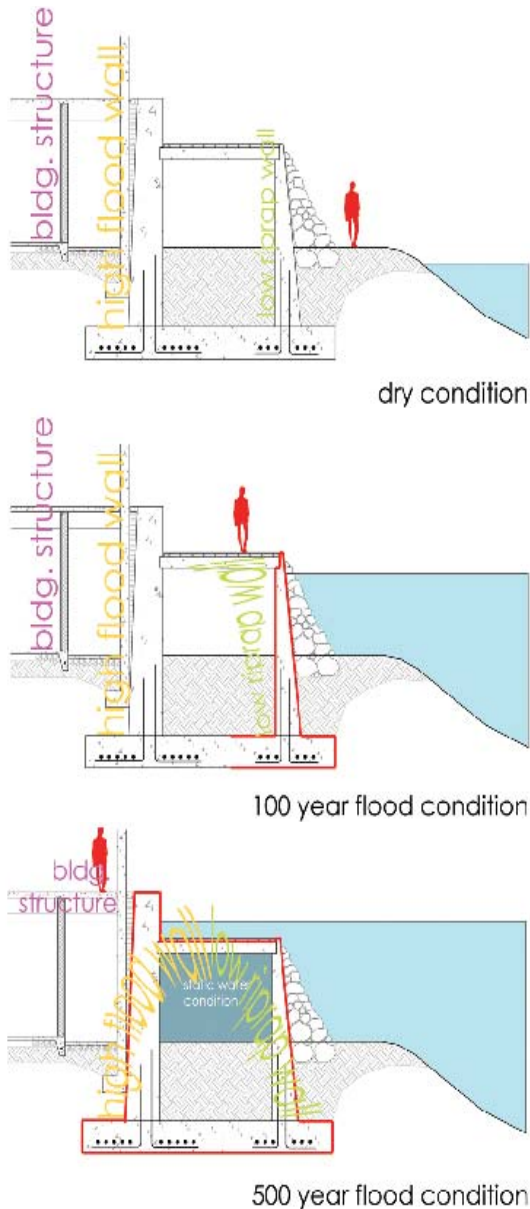


Fig.5_32: static water condition
diagram _ water as structure

The structure of the wall walk consists of the high wall and the low wall. Both are concrete structures, although the lower walk has natural stone appearance to create more of a riprap condition on the river walk. During the dry condition, the structure acts as two walls. Even during the 100 year flood stage, the low wall is the structure holding the water. Although the two walls are joined down at the foundation, the 100 year flood condition puts pressure primarily on the low wall.

The condition becomes much more stable during the 500 year flood. When the flood exceeds the 100 year flood and hollow space between the two walls gets filled with the flood water, the water gets trapped in the space.

This creates a static water condition and water acts as a structural stabilizer.

The two walls become one with the help of water.

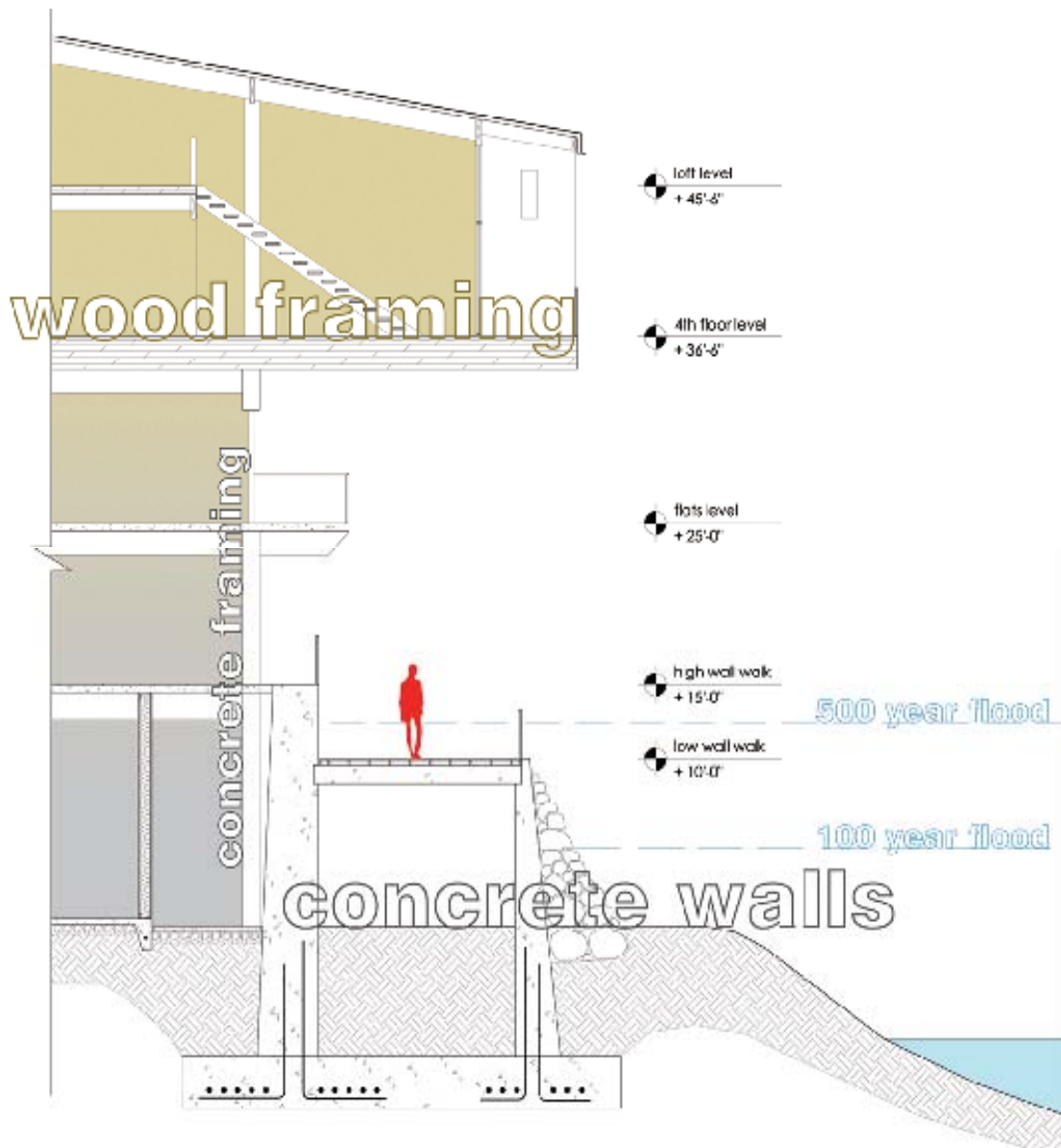


Fig.5_33: wall section

Section2:
Public Review Critique
& Responses

*Sub_section 1:
Design Approach*

Q1: Some of the diagrams suggest much more innovative solutions than an expensive flood wall, why not push the architecture to respond to the water? Have you considered letting the water in, instead of blocking it completely?

A1: The initial research was focused very much on letting the architecture respond to the condition of flood directly. Precedents were studied for possible application of floating housing or housing on stilts to the region. However, after visiting the site and seeing peoples attitude towards the river, it seemed inappropriate to suggest recent flood victims to buy into the idea of living on floating houses. I was interested in pushing the sideness of the site directly into the design approach. Recognizing the Czech village side's limitations in topography and available land, the approach was to have a clear datum that protects the village and at the same time create public amenity. The north side of the site, in New Bohemia, water is allowed with breathing room where the riverfront park element accomodates flood condition.

Q2: Are there any apertures on the wall? The flood only affects a few days each year, why not provide some direct connection to the water from the city?

A2: The earlier schemes did allow direct access to the water. The thought behind closing off the wall was to suggest that in fact this was 'the wall' that protects the village from the flood. Punching holes into the wall seemed counter intuitive as a design method. I wanted to make a bold statement that on the Czech village side, the wall is the protecting element. Perhaps the statement was too bold. It may be appropriate to connect the city directly to the water.



Fig.6_33: public review @ the university of maryland (11/16/09)

Q1: How does one access the public 'wall walk?' What is the nature of this public space? Does it make sense to have office space on the plaza level?

A1: There are 3 main entry points from the village to the wall. First is the tower plaza point, second is the park point at the other end, and the last is the main entry point in the center of the complex. The public space is meant to be used by everyone visiting the site. The high wall walk is geared for the use of residents of the complex and people visiting the retail and office tenents. The low wall walk is meant to be a public space where everyone can use. Although there are no clear boundaries to enforce such separation in use, the level change along with canopy coverage on the high wall walk does give a different atmosphere between the two wall walk conditions. The suggestion of retail space on the plaza level instead of office space does seem more appropriate given the civic nature of the wall walk space.

Q2: Is the development too low density for its 'expensive foundation?' Could you benefit from providing more density and height to the project? Or on the other hand, could you eliminate the housing program all together and make the development purely a civic space and suggest higher density development on the village side?

A2: One of the main concerns of the development of the wall complex was the height and presence of the new, imposing upon the historic neighborhood. Perhaps contrasting the two by allowing drastic differences of the two is another approach. It would certainly be more of a viable option in terms of economic concerns. The other approach of complete elimination of the housing program also is an interesting design concept. In a way, the initial design proposal along with the higher density and elimination of housing scheme could be a phasing option for the overall development of the complex. I intend to explore these two options as generators for alternate development schemes in the following section.



Fig.6_34: public review @ the university of maryland (11/16/09)

Section 3: Alternate Proposals

Sub_section 1 Eliminating Housing

Elimination of the housing on the complex strengthens the idea that this truly is a public civic space. The separation between high wall walk and low wall walk is lessened as well.

The implementation of the plaza level retail activates the wall walk further more than the previous scheme. The office space is moved up to the third level and capitalizes similar views that the previous flat units had.

Also limiting the height of the development to 3 story high, the complex seems more responsive to the historic fabric of the Czech village neighborhood.

Higher and more concentrated density on the clock tower block benefits the development in multiple ways.

The first is the economic viability. Also by concentrating the housing units on one block instead of spreading out to all three blocks, eliminates multiple circulation stair cases and elevators on the complex. Also the tower element becomes the new symbolic entry element that defines the neighborhood. The residential high rise tower creates a gateway along with the existing iconic clock tower on the other side of the pedestrian bridge.

On the ground floor, openings are provided to make direct connection to the river from the village. This allows multiple access to both wall walks and also the river walk.



Fig.6_36: plan diagram



Fig.6_37: revised ground floor plan



Fig.6_38: low rise section_phase I



Fig.6_39: high rise section_phase III



Fig.6_40: aerial site model_phase II

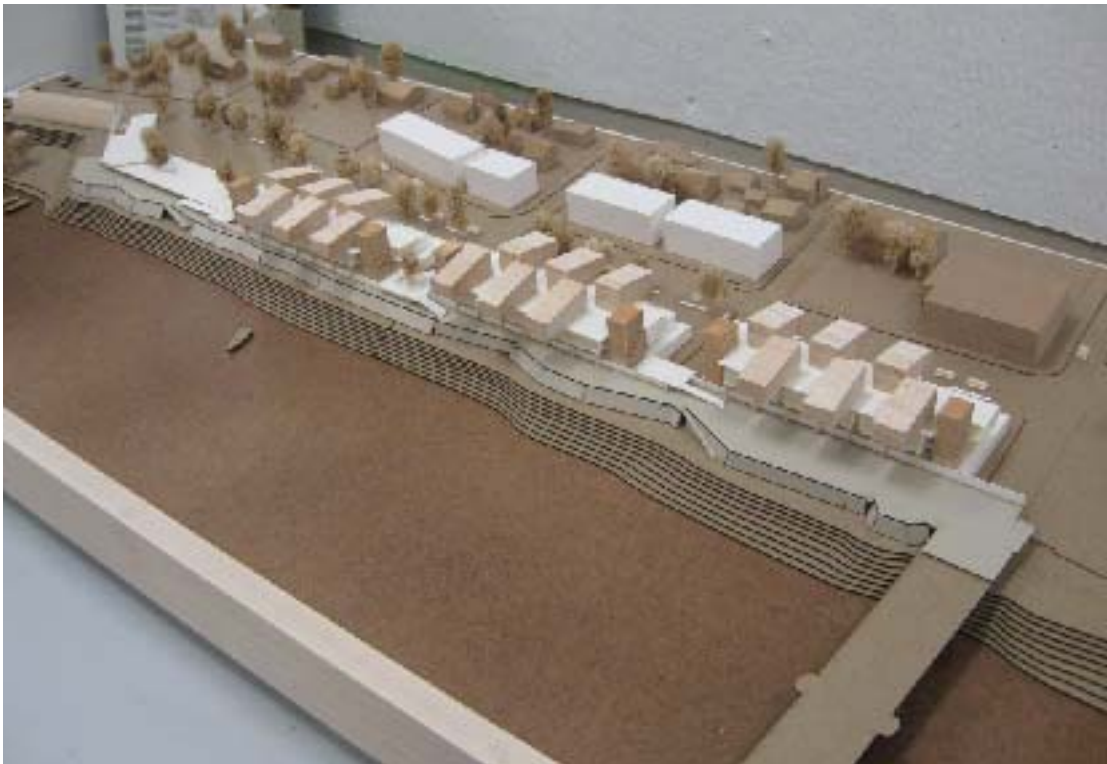


Fig.6_41: aerial site model_phase II

As evident from the research conducted and precedent studies done, this thesis has taken many different turns during the course of the research. I can truly say that I have discovered my thesis from researching how to account for the issue of rising waters. Flood, like any other natural disasters, affects us all, in one way or another.

This thesis questions the current practice of civil works implementation. Just like the current proposed plan of removable wall structure being installed in Czech village area, in most cases, civil works are being viewed simply as problem solving process that satisfies the status quo. This thesis challenges the idea of using civil works to improve and revitalize our environment and improve the quality of living at the same time while solving the problem at hand.

After all, we as architects have social responsibilities to design for the betterment of all humanity. By using civil works opportunities and implementing public space realm that serves everyone in the community, I intend to solve the problem of the rising waters and improve the quality of life for everyone in Czech village / New Bohemia area in Cedar Rapids, Iowa.

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