



# *Re-design of Toledo Riverfront*

*- from industrial past to sustainable biodiverse future*



Sveriges lantbruksuniversitet  
Swedish University of Agricultural Sciences

Department of Urban  
and Rural Development

SARA HENRIKSSON

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Swedish University of Agricultural Sciences  
Faculty of Natural Resources and Agricultural Sciences  
Department of Urban and Rural Development, Division of Landscape Architecture, Uppsala  
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© 2014 Sara Henriksson, e-post: [sara\\_hen4@hotmail.com](mailto:sara_hen4@hotmail.com)

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Supervisor: Maria Ignatieva, SLU, Department of Urban and Rural Development

Examiner: Camilo Calderon, SLU, Department of Urban and Rural Development

Assistant examiner: Tuula Eriksson, SLU, Department of Urban and Rural Development

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## *Preface*

Landscape architects and ecologists worry about the environmental issues on earth, emissions of greenhouse gases affecting the environmental conditions and causing global warming. We have questions like how will future be and how many species on earth will extinct? Can cities be sustainable and in harmony with nature? Further I thought, can we as landscape architects do something about this? Can we implement better design which can mitigate existing conflict between man and nature? This is the reason why I wanted to work with ecological design. The design competition in US gave me the opportunity to implement ecological design principles and theoretical approach in a proposal for Toledo city which has problem with abandoned industrial areas, so called brownfields, along their riverfront.

## *Acknowledgement*

During the spring semester of year 2014 I wrote my master thesis which also meant to participate in the design competition North Coast Design Competition in the U.S. I would like to give big thanks to my supervisor Professor Maria Ignatieva, Swedish University of Agricultural Science. Thanks for all motivating meetings, coaching and inspiration. I would also like to thank Assistant Professor of Landscape and Urban Design Sean Burkholder, University of Buffalo School of Architecture and Planning, for all help in finding the references of the competitions photographs and maps.

# ABSTRACT



Figure 1. Aerial photograph over Toledo Riverfront. Photo: © Marge Beaver 2008.

Effects of climate change, urbanization and global homogenization are resulted in the degradation of land and losses of natural habitats. Ecological design integrates nature into urban environment by respecting natural ecological principles and processes and creating resilient urban biotopes which also can be used by local urban communities. The aim of the thesis is to answer the research questions: *How ecological design principles can be applied for re-design of Toledo Riverfront (with requirements of the design competition)?* and *What is the ecological design in landscape architecture?* I participated in the USA design competition with the aim to create a vision and redesign of Toledo Riverfront in Ohio State, USA. The site is located in the south point of

Lake Erie. As a result of a long industrial activity, riverfront of Toledo had been transformed into inaccessible and abandoned brownfields. In my proposal I applied ecological design principles on three scales: the city of Toledo by reinforcing of ecological connection and creating green corridors along the river; the intermediate scale by suggesting public parks along the river front and on the fine level by proposing detailed design including remediation of the site and use of dredged material. One of the key suggestions was to recreate native ecosystems which are typical for Toledo and Ohio State. The inspiration of my design came from successful case studies in Germany, USA and China.

Key words: Ecological Design, Ecological Principles and Processes, Landscape Architecture, Redesign of Toledo Riverfront, Redevelopment of Brownfields.

# SAMMANFATTNING

På grund av klimatförändringens negativa effekter, urbanisering och den globala homogeniseringen försvinner och skadas lokala habitat i vår värld. Dessa globala problem är till största delen orsakade av människan. När våra lokala habitat utrotas är det inte bara människan som blir av med värdefull natur utan också många djur och växter som förlorar sina livsmiljöer. De utsätts då för en större risk att utrotas eftersom deras habitat minskas.

Ekologisk design integrerar naturen i den urbana miljön samtidigt som den respekterar de naturliga ekologiska processer och skapar motståndskraftiga urbana biotoper. Syftet med uppsatsen är att svara på frågeställningarna *Hur kan ekologiska designprinciper appliceras i en omgestaltning av Toledo Riverfront (utifrån designtävlingens krav)?* För att undersöka detta deltog jag i en designtävling med huvudsyftet att skapa en ny vision och omgestaltning för Toledo som är belägen i staten Ohio i USA. Toledo ligger vid södra spetsen av Lake Erie i norra central-USA. Toledos centrala flodområde har genom historien omvandlats från naturliga grönområden till otillgängliga industriella ytor där industrierna successivt har lagts ner och övergivits. För att kunna applicera ekologiska design principer i gestaltningsförslaget för Toledo har jag också genom en litteraturstudie undersökt *Vad är ekologisk design inom landskapsarkitektur?*

I mitt gestaltningsförslag applicerade jag ekologiska designprinciper i tre skalor: den övergripande stadsskalan för att återinföra ekologiska kopplingar och skapa gröna korridorer längs floden; mellanskalan föreslår nya allmänna parker längs floden och i den mer detaljerad skala visas omgestaltning av utvalda områden längs floden och användning av muddermassor i designen. Ett av huvudförslagen var att återskapa lokala ekosystem för Toledo och Ohio. Inspirationen till mitt designförslag kom från välkända fallstudier i Tyskland, USA och Kina.

## Metod

Arbetet är genomfört i två delar där första delen innebar att delta i en designtävling i USA och producera en vision och ett gestaltningsförslag för Toledos flodområde där jag applicerat ekologiska designprinciper. Designprocessen började med inventering och analys av platserna, eftersom jag inte haft möjlighet att besöka platsen har detta gjorts utifrån Google Streetview samt flygfoton från platserna. Andra delen av arbetet innebar en litteraturstudie för att reda ut vad ekologisk design är samt hur man kan applicera ekologisk design i ett gestaltningsförslag. Litteraturstudien pågick parallellt med design processen. Under arbetets gång genomfördes även en fallstudie där jag undersökte två projekt

där man använt sig av ekologisk design i gestaltningen. Fallstudierna samt litteraturstudierna gav mig värdefull information om hur ekologiska designprinciper kan appliceras i gestaltningen. Dessa tog jag med mig som designmål in i min gestaltning av Toledos flodområde. Gestaltningsprocessen resulterade i 3 posters som presenterar tävlingsförslaget (finns med som bilagor i slutet av uppsatsen). I uppsatsen ligger tävlingsförslaget till grund för undersökningen hur man kan applicera ekologiska designprinciper i en gestaltning.

## Tävlingen:

Tävlingen *“The North Coast Design Competition – 2014: Designing Dredge - Re-Envisioning the Toledo Riverfront in Ohio, USA”* som jag



Figur 2. Map of the competition areas of Toledo Riverfront. © Courtesy of North Coast Design Competition.

deltog i grundades av biträdande professorn Sean Burkholder, anställd vid University at Buffalo School of Architecture and Planning, New York. Tävligen efterfrågade en omgestaltning av utvalda områden vid flodområdet, då Toledo är beläget på båda sidorna om Maumeefloden. Fem områden var utvalda och det var upp till deltagaren att avgöra hur många och hur detaljerat man ville gestalta dessa. Platserna var Penn 7, Penn 8, Riverside, Edison Park samt International Park. Penn 7, 8 och

# SAMMANFATTNING

International Park var nedlagda dumpningsområden för muddermaterial från flodens botten medan International Park är en befintlig park och Edison Park är en före detta soptipp. Toledos hamn är den sjunde största i Great Lakes-regionen varför hamnen etableras av industrier. Tävlings huvudsyfte var därmed med gestaltningen att skapa en ny vision för Toledos flodområde. Att använda muddringsmassorna från floden är ett krav från tävlingskommittén.

## Bakgrund

Ur det ökade intresset av att de lokala och globala miljöförhållandena har försämrats har ekologisk design uppkommit (Rottle & Yocom 2010). På grund av människans handlingar försämrats våra miljöer och grönområden fragmenteras allt mer. Det finns ett intresse i att bryta denna trend och Baschak och Brown (1995) menar att genom att tillämpa ekologiska designprinciper i gestaltning av våra urbana miljöer kan detta mönster förändras.

## Ekologisk design

Ekologisk design integrerar naturen, ökar den biologiska mångfalden och skapar därför bättre förutsättningar för habitatet att återhämta sig vid förändringar som till exempel klimatförändringar (Ignatieva 2012). Genom att förstå de ekosystem som finns i vår miljö kan vi förstärka dessa och samtidigt skapa en bra miljö för människan. Ekologisk design skapar lämpliga miljöer för både människor och övriga arter i habitatet (Rottle & Yocom 2010, p.13). Miljöer som grundats på ekologisk design minimerar de negativa effekterna av klimatförändringen genom mindre utsläpp av växthusgaser och skapar därför en bättre plats för våra framtida generationer (Yeang 2006, p.44). Uppsatsen undersöker två fall inom landskapsarkitektur där man har



Figur 3. Gas Works Park. Photo © "Gas Works Park Seattle" by Hairyegg (CC BY-SA 2.0)



Figur 4. Duisburg Nord. Photo: © "Landschaftspark Duisburg-Nord" by Antonio Gallud, (CC BY-SA 2.0)



Figur 5. Toledo beläget i norra USA. © Sara Henriksson



Figure 6. Toledo ligger i staten Ohio och precis intill Lake Erie. © Sara Henriksson

använt sig av ekologiska designprinciper när man skapat parkerna.

## Urban Grönstruktur

Urban grönstruktur är ett verktyg för att gestalta ekologisk design i den stora skalan i staden. Ökad grönstruktur i städerna har positiva effekter på våra miljöer genom att anpassning och mildring av den globala klimatförändringen (Rottle 2013). Urban grönstruktur skapar därav hälsosamma och ekologiska städer.

## Brownfields

Brownfield är ett nedlagt industriellt och övergivet område som eventuellt är förorenat (Gold, Hollander & Kirkwood 2010, p.72). Dessa områden förknippas med lägre säkerhet, försämrar kopplingar i staden och kan sprida föroreningar till grundvattnet (U.S. Environmental Protection Agency 2012c). Genom att applicera ekologisk design på dessa områden kan städer på ett effektivt sätt höja kvaliteten på miljön genom att skapa grönområden samt undvika att städer expanderar utåt och exploateras på orörd natur (Cizler 2013). I uppsatsen ges Duisburg Nord i Tyskland och Gas Works Park i Seattle som två exempel på brownfields som gjorts om till parker.

## Toledo

I uppsatsens resultatdel beskrivs visionen och gestaltningen av Toledos flodområde där jag har använt mig av ekologiska designprinciper. Toledo ligger vid södra spetsen av Lake Erie i norra central-USA. Toledos centrala flodområde har genom historien omvandlats från naturligt område till otillgängliga industriella ytor där industrierna successivt har lagts ner och övergivits. Genom Toledos nya vision omvandlas flodområdet

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Figur 7. Toledo Riverfront and the sites along Maumee River. The basis of the aerial view is © Marge Beaver 2008.

till en grönkorridor där de gestaltade ödeområdena har ersatts med lokala habitat för att locka både människor och djurliv. Visionen har sammankopplats med de två projekt som fortskrider i Toledo. Dessa är Maumee River Trail Project som är ett rekreativstråk för gående och cyklister som binder ihop staden från norr till söder samt Green Corridor Project som länkar samman grönområdena i staden. *Toledo Riverfront – from industrail past to sustainable future* blir en del av den gröna korridoren och knyts samman med rekreativstråket samt skapar nya rekreativsmöjligheter.



Figur 8. Toledo invånarens tillgänglighet till floden i dagsläget. The basis of the aerial view is © Marge Beaver 2008.



Figur 9. Toledo invånarens tillgänglighet till floden enligt visionen. The basis of the aerial view is © Marge Beaver 2008.

Designprocessen började med valet av områden som skulle gestaltas. Mitt val föll på Penn 7, Penn 8 samt Riverside-området. Det beror på att dessa tre områden var helt otillgängliga för Toledos invånare på grund av de industrier som var etablerade mellan North Summit Street och tävlingsområdena. Platserna är belägna intill varandra vilket också gör det möjligt att skapa en koppling mellan dem, som en del av den gröna korridor visionen visar.

## Existerande situationen längs Toledo Riverfront

I dagsläget är tillgängligheten för invånarna i Toledo begränsad för att ta sig ner till floden. Detta beror på att industrier är etablerade längs floden. Bilden till vänster nedan visar i rött de otillgängliga delarna av floden medan det gröna illustrerar områden som nyligen är omgjorda och tillgängligheten till floden har ökat. Visionen kommer tillgängliggöra hela flodområdet vilket också kommer bli en del av den gröna korridor som växer fram i och med omgestaltningar.

I omgestaltningen av Toledos flodområde har målet varit att skapa tillgängliga parker med lokala habitat dit både människor och djurliv lockas. Fyra konceptprinciper utvecklades och följdes under gestaltningen.



Figur 10. Visionen för Toledo flodområde. Den rosa prickade linjen visar Maumee River Bike Trail. The basis of the aerial view © Marge Beaver 2008.

# SAMMANFATTNING

## Konceptprinciper

- Öka de sociala aktiviteterna genom att skapa tillgängliga parker som erbjuder rekreation och interaktion mellan människa och natur.
- Öka den biologiska mångfalden genom att skapa lokala habitat som attraherar djurliv.
- Omvandla industriella ödemarker till rekreations tillgängliga parker vid floden samt introducera ett gångstråksnätverk.
- Ta hänsyn till muddermassorna från floden vid gestaltning av topografin.

## Visionens mål

1. **En allmän tillgänglig riverfront**  
Omvandlas från en industriell och otillgänglig riverfront till tillgängliga och gävändliga ekologiska parker.
2. **Öka den gröna infrastrukturen och det sociala utomhusaktiviteterna**  
Parkerna längs floden är en del av den gröna infrastrukturen och sammankopplar grönområden i Toledo.
3. **Öka den biologiska mångfalden**  
Genom att gestalta parkerna med lokala växtarter kommer djurliv att lockas samt vegetationen frodas.
4. **Förbättra kopplingarna mellan Maumefloden och staden**  
Med ett förbättrat gång- och cykelnätverk kommer staden, floden och omgivningarna länkas samman.
5. **Ta hänsyn till muddermassorna från floden**  
Visionen visar hur man kan återanvända muddermassor genom att förändra topografin samt skapa nya lokala habitat.

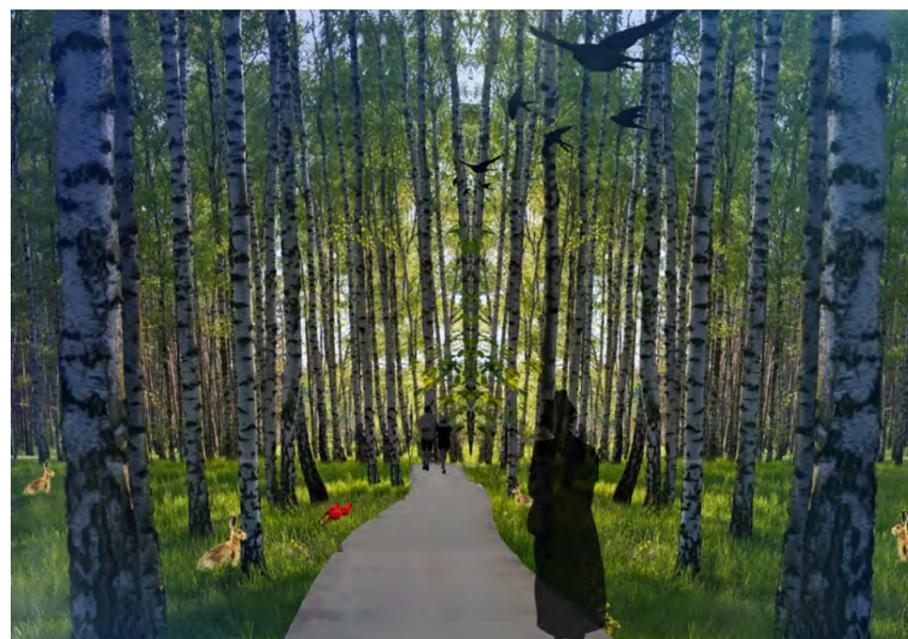
## Design

De tre områdena längs floden har omvandlats till grönområden tillgängliga för invånarna i Toledo. Områdena har olika attraktionsvärden där The Wetland Park erbjuder fågelskådning och kajakpaddling, Urban Ecological Park (Ekologiska stadsparken) erbjuder små botaniska trädgårdar och bryggor vid flodkanten samt Riverside Park som tillhandahåller besöks- och utbildningscentret med ett grönt tak och skogspromenads möjligheter.



Figur 11. Perspektivet visar våtmarkerna i Wetland Park. © Sara Henriksson.

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Figur 12. Perspektivet visar björkskogen i Ekologiska stadsparken, fd. Penn 8.

© Sara Henriksson. References picture built upon: "Another wet hare day" by Steven Ward (CC BY 2.0), "The Red Bird" by spisharam (CC BY-SA 2.0), "Birch-tree forest" by Arcadiuš (CC BY 2.0)

# SAMMANFATTNING



Figur 13. Perspektiv av Riverside Park. Till höger i bild syns besöks- och forskningsbyggnaden.  
© Sara Henriksson References picture built upon: "2010 June, Butterfly" by Lee Ruk (CC BY-SA 2.0), "Monarch butterfly" by Harald Hoyer (CC BY-SA 2.0), "Dickcissel (Spiza americana)" by Joshua Mayer (CC BY-SA 2.0), "Ruby-Throated Hummingbird" by thefixer (CC BY 2.0), "Elevator to Treetop Walk" by La Citta Vita (CC BY-SA 2.0), "Prairie" by Joshua Mayer (CC BY-SA 2.0)

## Användning av muddermassor

I resultatet redovisas också hur man på ett innovativt sätt kan arbeta med muddermassorna från floden för att skapa variation i topografin samt olika lokala habitat i parkerna. I våtmarksparken (Wetland Park) skapar den förändrade topografin kanaler med paddlingsmöjligheter medan den Ekologiska stadsparken har fått en stor kulle designad för att skapa olika typer av växtförutsättningar samt ge utsiktspunkter ut över floden och parken. I Riversideparken (Riverside Park) är ekskogen planterad på en ås som skapar ett dynamiskt landskap samtidigt som den ger skydd för vind. Massorna är ett bra växtmaterial men har på grund av de olika habitaterna blandats med grövre material så som sand för att uppfylla de specifika växtarternas önskemål.

### Parkerna Wetland Park, Urban Ecological Park and Riverside Park:

- Skapar habitat för människor, djur och natur
- Erbjuder nya aktiviteter med respekt för naturen
- Nyttjar platsens resurser hållbart
- Ger nya rekreativsmöjligheter utifrån önskemål om mer gångvägar och gröna ytor i Toledo
- Minskar de negativa effekterna av klimatförändringen genom hållbara ekosystem som absorberar och lagrar kol samt renar vattnet
- Skyddar de lokala habitaterna genom att introducera dem i parkerna
- Ökar den biologiska mångfalden samt attraherar djurliv
- Öka det sociala aktiviteterna och skapa möjlighet för en hälsosammare livsstil.



Figur 14. Sektionen visar ett exempel på hur muddermassorna har används i förändringen av topografin. Sektion F<sub>1</sub>-F<sub>2</sub> i Riverside Park planen. © Sara Henriksson

- Koppla samman floden med staden genom att öka tillgängligheten
- Skapa undervisningsmöjligheter om situationen i Toledo Riverfront i Besöks- och forskningscentret i Riverside Park.

## Diskussion

Ekologisk design kan mildra effekterna av människans handlingar så som global homogenisering i stadsplaneringen, stadsexpansioner som bidrar till att vi förlorar många av våra lokala habitat. Genom mitt gestaltningsförslag av Toledos flodområde har det bevisats att den biologiska mångfalden kan ökas och den vardagliga livskvaliteten stärkas genom att använda ekologisk design principer i urban planering. Ekologisk design är ännu inte ett utbrett ämne inom landskapsarkitektur, vilket är en av utmaningarna i min uppsats. Vissa argumenterar att ekologisk design måste synliggöras för att kunna bli allmänt vedertaget. Den här uppsatsen och dess publikation är mitt försök till att bidra till att begreppet ekologisk design sprids. Utan att det är allmänt känt så är det många av landskapsarkitekturens kunder som inte vet om ekologisk designs fördelar på lång sikt och tycker därför principerna verkar dyra och tidskrävande. Ser man till de fördelar som ekologisk design erbjuder kan vi skapa bättre miljöer och läka de brutna länkarna mellan människa och natur och skapa en hållbar framtid för båda kommande generationer. Ytterligare en utmaning inom ekologisk design är att det kräver en bredd av kunskap inom många olika ämnesområden. Detta gör att man bör arbeta tillsammans med andra professioner för att ha tillräckligt med expertis. Av denna anledning kan det bli svårare att arbeta med ekologisk design och var också något jag upplevde under arbetet med mitt förslag.

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# INTRODUCTION

Urbanization has major ecological consequences on the urban environment and its habitats (Baschak & Brown 1995). When cities are growing land and environmental conditions are transforming and changing, natural habitats are disappearing. This means changed life conditions of all species living there and that the quality of the natural environment on earth is getting declined (Yeang 2006, p.022). Urbanization has contributed to the global warming and creating more homogenized world. Global trends with similar urban planning, design and plant material are resulted in the loss of local habitats and finally in creating “placeness” landscapes (Ignatieva & Ahrne 2013).

A contemporary important issue is the complexity of creating sustainable urban environments where human and nature can coexist. Lan (2011) believes that ecological design has the potential to reverse the trend of humans negative effects on the environment. Ecological design can increase the resilience to the effects of climate change and create suitable environments (Cizler 2013).

Toledo Riverfront, Ohio, United States, has the past centuries lost local habitats such as grasslands and wetlands when transforming the riverfront from natural nature into an industrial and inaccessible riverfront for human. Toledo, such as many cities in the US, has been designed for cars and the city calles for designs which provides social areas and interactions. By implementing ecological design this thesis will find out how ecological design will contribute to better environments for both human and nature and enhance social life and green areas along the riverfront.

## Objective

The objective of this thesis is to answer the following research question; *How ecological design principles can be applied for re-design of Toledo Riverfront (with requirements of the design competition)?* To investigate this I participated in a design competition with the aim to create a vision and re-design of Toledo Riverfront in Ohio, United States of America, using ecological principles. The work was resulted in a submission of 3 posters (24x36 inches) for the competition and a master thesis to the Swedish University of Agricultural Sciences. To be able to create the vision and design with respect of ecological design principles I researched the question *What is the ecological design in landscape architecture?* and presented the answer in the theorectial background through a literature study.

## Research questions

The research questions of this thesis are:

1. How ecological design principles can be applied in the re-design of Toledo Riverfront (with requirements of the competition)?
2. What is the ecological design in landscape architecture?

## Methods and implementation

The work was implemented through two phases; a design process for the competition and theoretical foundation of using ecological approach for design. During the first phase I have searched information about Toledo city, have done an inventory and analyzed the information and maps of Toledo (see pp. 28-30 & 32-36) and finally designed a proposal for the competition. In the second part of the process I went deeply in literature study and provided a parallel with the design process and during the whole working process to gather necessary knowledge about ecological design. I have used several case studies for brownfield redevelopment (Duisburg Nord and Gas Works Park) and for ecological design (Red Ribbon Park and Blue Circle of Moscow). This information has also been used when designing with ecological approach and inspired my proposal and design.

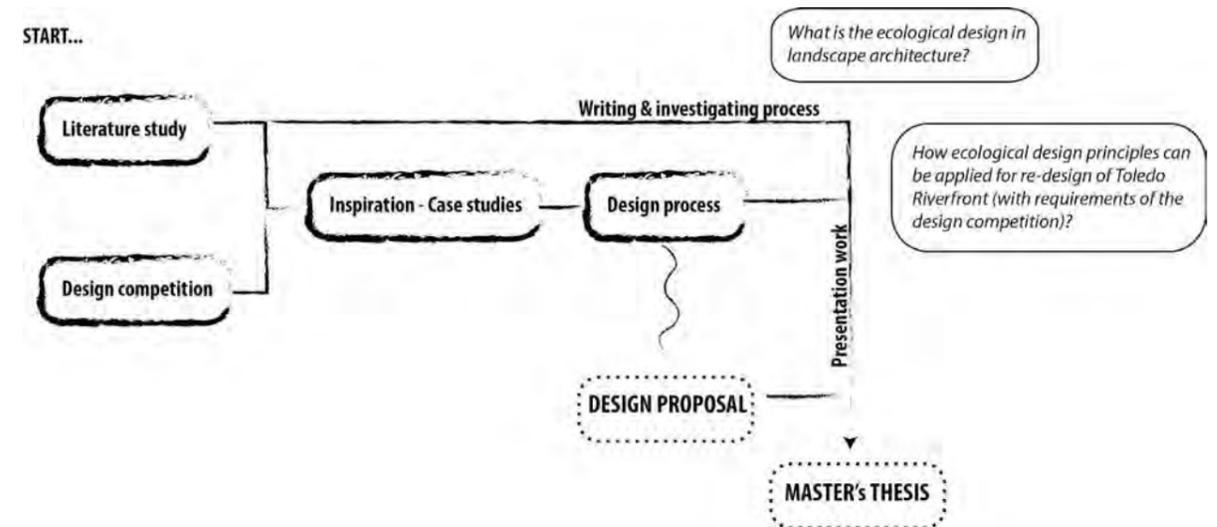


Figure 15. Picture of my working process. © Sara Henriksson

## Methods Design Process:

The design process was based on the competition “The North Coast Design Competition – 2014: Designing Dredge - Re-Envisioning the Toledo Riverfront in Ohio, USA”. I was participating in this competition. The following chapter presents the description of the competition and my design process.

## The competition

*“The North Coast Design Competition – 2014: Designing Dredge - Re-Envisioning the Toledo Riverfront in Ohio, USA”* is a competition founded by Sean Burkholder, Assistant Professor of Landscape and Urban Design at University at Buffalo School of Architecture and Planning, New York.

The aim of the competition is to create a vision for re-designing the riverfront of Toledo. The competition is based on the riverfront of the city where 5 specific areas have been chosen for further detailed design: Penn 7, Penn 8, Riverside, Edison Park and International Park (Figure 16). It was a free choice for a participant to decide which and how many of the sites to work with but the core agenda of the competition were to envisioning a transformed riverfront.

The port of Toledo is ranked as the 7<sup>th</sup> of the ports in the US Great Lakes area. Here the transportation by cargo vessels is common in Maumee River. Maumee River is kept deep enough for heavy cargo vessels by dredging of 1 million cubic yards of bottom material every year. The dredging is a big part of city’s economy and the employment of 7000 workers.

The dredging results in production of huge masses of dredged material. The biggest part of it is placed in open water of Lake Erie. Only uncontaminated dredged material with the same composition as the bottom material is approved for open water placement. Uncontaminated dredged materials are re-used on land in construction work or shoreline replacement. A small percentage of the dredged material is placed into the Confined Disposal Facility (CDF). The sites Penn 7, Penn 8 and Riverside along Toledo’s Riverfront are former CDF’s (see figure 16).

The open-water placement method has been less accepted in contemporary time and this method is requested to decrease. That is why the competition encourages participants to find solutions for more effective re-using of dredged material. When designing the competition the amount of available material should be considered as unlimited, uncontaminated and transported by truck from CDF#3 on the southeast part of Toledo and Maumee River.

According to the program of the competition the design and programming of the sites along Maumee River was quite open to the participant’s suggestions. The only requirements were the placement of a research center in Riverside, to work with dredged material in some capacity and to make the sites publically accessible. In my design I decided to focus on ecological design.



Figure 16. Map of the competition areas of Toledo Riverfront. © Courtesy of North Coast Design Competition.

The competition was open for designers, planners and students of all ages and abilities. Participants were encouraged to work with dredged material and take other projects of the city, like Maumee River Bike Trail, Renovations to Promenade Park, the Marina District and the Middlegrounds Metropark into consideration.

The competition *“calls for ideas that re-envision the role of the riverfront in Toledo and how this new role can embrace the realities of dredging while enhancing the overall quality of public space within the city”* (North Coast Design Competition 2014).

Summary of competition’s program:

- Design a vision for Toledo Riverfront
- In finer scale design chosen sites along Toledo Riverfront (1-5 sites)
- When designing consider dredged material from Maumee River, *possibly* use dredged material in the design.

- The vision should enhance the social life along the riverfront
- Conforming vision and design to research center which will be established in Riverside site.
- It is beneficial if the proposal takes other for the area planned projects into consideration, like the Maumee River Bike Trail and Green corridor etc.

### The Design Process

When inventorying and analyzing the riverfront and sites I used parts of LaGro's site analysis method. James A. LaGro Jr. (2001), a landscape architect and Associate Professor of Urban and Regional Planning at the University of Wisconsin-Madison, who developed the site analysis method as a guide to create better designs from inventory and site selections to concept development and final site design.

LaGro's method consists of site selection, programming, site inventory, site analysis, concept development, design development & implementation (LaGro 2001). LaGro argues that a proposal can be developed better when the area and its surroundings are properly analyzed.

### Site study – choosing sites in Toledo

In my project the sites were already given from the requirements of the competition. I had to decide which of the sites and how many of the five given sites I wanted to work with. I have chosen three sites: Penn 7, Penn 8 and Riverside because they are located next to each other. Edison Park and International Parks are already existing accessible green areas. Compare to them my selected sites are totally inaccessible for inhabitants of Toledo and former CDFs. In my opinion Penn 7, Penn 8 and Riverside is an ideal selection for creating good accessible parks next to Toledo riverfront.

### Programming of the chosen sites in Toledo:

By programming the selected sites one could see that the selected sites are suitable for the project, according to LaGro (2001). Though the city of Toledo is planned as a city for cars, like many other cities in US, I argue that Toledo needs more areas for pedestrians and bikers as well as an access to nature which also could enhance the social and ecological conditions within the city (improving health and urban environment). Programming the sites meant enhance local habitats which would attract citizens and wildlife to the contemporary inaccessible sites.

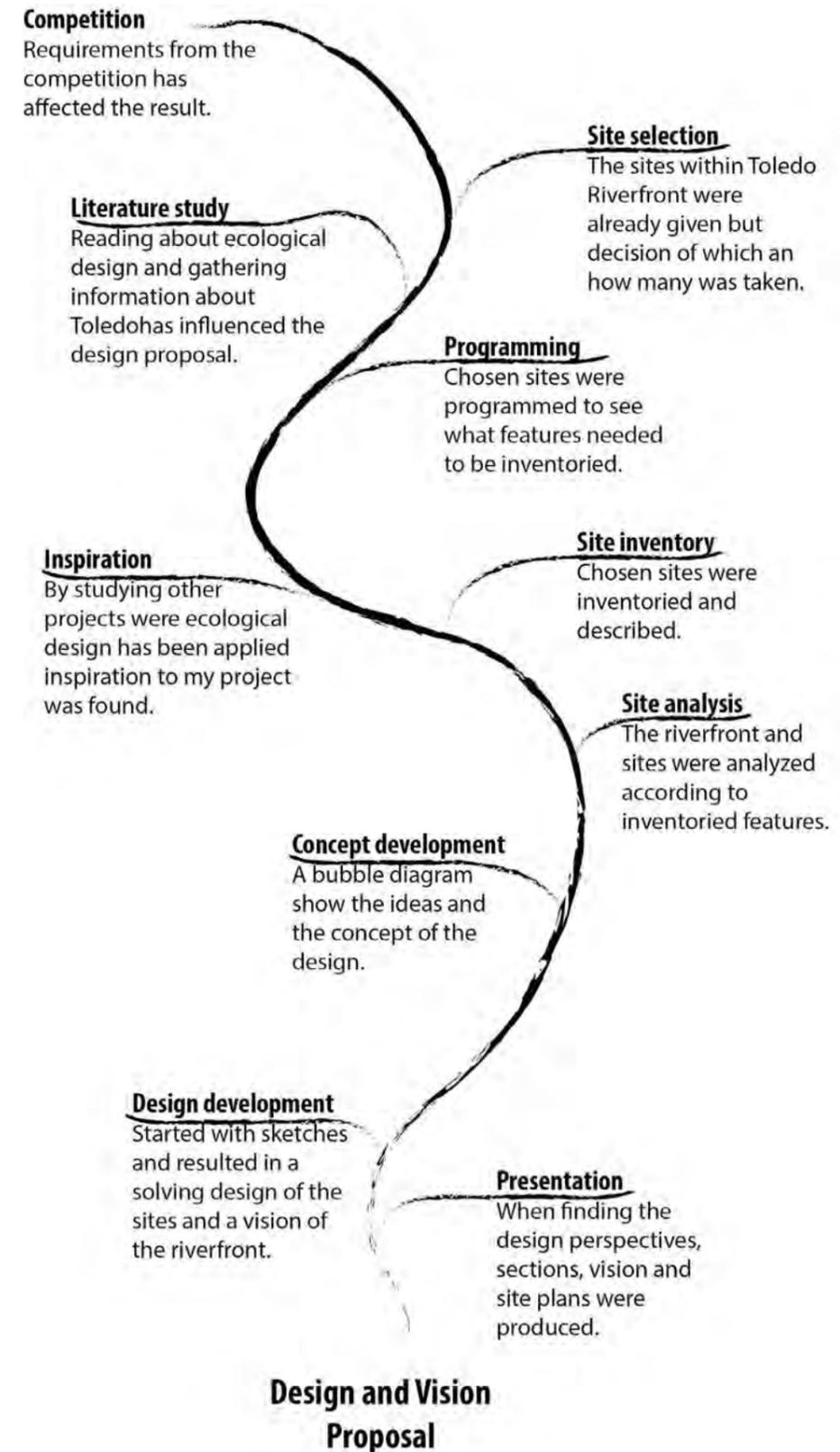


Figure 17. Picture of my design process. © Sara Henriksson

## **Site inventory of Penn 7, Penn 8 and Riverside:**

The inventory was started with gathering information about Toledo city and the riverfront. There was a lot of information from the competition such as information about dredging in Maumee River, statistics of the inhabitants of Toledo and maps of the Riverfront in different scales. This information could be found at the homepage<sup>1</sup> of the competition. I also made research of local birds and habitats of Toledo and Ohio State due to my focus of ecological design. When gathering this information I got inspiration to the design of my proposal. This data were found through search on Google using search words as "local habitats, Ohio, Toledo, birds, prairies and oak forest". Only information from trustworthy sources was used such as Department of Nature Resources – Division of wildlife, The Nature Conservancy, Northwest Ohio Nature, Great Lake Commission Dredging Team, U.S. Departments e.g. wildlife service and Toledo's official homepage.

The inventory of the sites included factors as:

Physical: topography, hydrology, climate.

Biological: vegetation and wildlife.

Cultural: land use, circulation, built structures.

The information of the attributes was found by searching in maps and internet sites at NOAA - National Climatic Data Center. Toledo has some ongoing or planned projects in the city (Green corridor Program and Maumee River Bike Trail) which were mentioned in the competition and information was found by searching at Google. The inventories gave me an overall understanding of Toledo as a city and of the Riverfront which I could use as foundation for designing.

## **Site Analysis of Toledo:**

The analysis of Toledo Riverfront and the specific sites can be read in the result-analysis part. Though I didn't have the opportunity to visit Toledo during my work I was quite limited when analyzing the sites. I used the maps and aerial photos from the competition and Google streetview which gave me a good appreciation of the riverfront. Analyzed factors were geology, topography, land use, connectivity, circulation and public and private areas and the accessibility of the riverfront. Analyzing was done in the overall scale as a riverfront (1:1000 feet) to get the big picture and context relationships and in the finer scale (scale 1:100 feet) to understand the sites. Though the sites haven't been accessible for citizens

<sup>1</sup> <http://northcoastdesigncompetition.com/current-competition/>

the big scale has been important to get the understanding of the riverfront.

## **Concept Development of Toledo's proposal:**

The concept development is to create a program of proposed ideas that is suitable for the specific site (LaGro 2001, p.14). When starting to work with the proposal of Toledo Riverfront I early realized the city was designed for cars. Another requirement of the competition was by the design enhance the social life within Toledo, why I decided to focus on social areas for pedestrians. Inventorying and analyzing Toledo Riverfront gave me an understanding of how the industries have established along the riverfront and restricted the accessibility for humans. The industries resulted in losses of local natural habitats which encouraged me to design wetlands. Reading information about Toledo and ecological design focused my work on attracting birds and enhance social spaces for pedestrians, riverfront accessibility and biodiversity along the riverfront. More detailed concept diagram can be seen in the result part.

## **Design Development of Toledo**

The design process resulted in a proposal of a vision and design of the sites; Penn 7, Penn 8 and Riverside. The proposal is designed in three different scales from the overall-big scale to medium scale and fine-site specific scale. The overall scale show city-green infrastructure connection, medium-scale show the Riverfront and the fine scale the site specific solutions of the chosen areas. The design aims, developed from inventory and analysis, were to create habitats for local species and enhance biodiversity and social life. The design also follows the requirements from the competition e.g. using dredged material.

## **Presentation of Toledo Design Proposal**

The presentation of the design was presented on 3 posters consisting sections, perspectives, site plans and vision plans. The presentation process started with sketching and continued with computer work. Sections and perspectives were made in Photoshop while inventory maps, analysis maps and site plans were made in both Illustrator and Photoshop. The posters and the layout of the master thesis were then designed in Adobe InDesign. The material from the competition was used when laying out the master thesis.

## Reflection of the Design Process

The previous texts describe the design process as a simplified linear process but the process is rather a mix between a linear and circular process of LaGros method. This is because some steps provide extended information which affect earlier steps. Some previous steps may therefore need to be redone before moving on to the following step again. As example this means that program of selected sites may have given information which made it necessary to add inventory and then continue with the site analysis and so on. This has been the case in my design process.

## Inspiration – Case study

While working I got inspired by several landscape architecture proposals designed with ecological approach. The projects have helped me to understand how ecological design and ecological principles could be applied in other projects. The case study includes two projects: *Red Ribbon Park* and *Moscow Blue Circle* and is described briefly in the result part of my thesis.

## Methods Writing Process

The second phase of my work investigated the research question “how ecological design principles can be applied in the re-design of Toledo Riverfront” by analyze how the proposal of the design phase was implemented. This phase of the work also included a literature study to understand ecological design in landscape architecture.

## Literature study

When reading the literature I have found new areas of interest which has affected my proposal and design of Toledo Riverfront. During the literature study and while working with the proposal I understood that explaining not only ecological design and principles but also brownfield redevelopment and green infrastructure were fundamental. Scientific articles and books were advices of my supervisor or found by searching in Libris at the homepage of SLU’s library. Libris was chosen as search engine though it is a collection of many search sites. Search words were “ecological design, ecological principles, landscape architecture, brownfield, brownfield redevelopment and green infrastructure”.

## Limitations

The major part of this thesis was the participation in the design competition. There was strict due date of presenting 3 posters with identified requirements. The due date was 15th of April 2014. Since I couldn’t visit Toledo during my project I was restricted to maps, photographs and documents when inventorying, analyzing and designing the riverfront.

## Audience

Though the work is divided into two parts the audiences of the different parts diverge. The first part, submission of the competition was delivered to the North Coast Design Competition 2014 with the jury of the competition consisting of Andrew Moddrell (urbanism), Kathy Velikov (Assistant Professor at University of Michigan), John Hull (chairman of Hull and Associates), Joe Cappel (cargo development) and Dennis Garvin (parks, recreation and forestry). The submission (3 posters) should be seen by other landscape architects and legible for dwellers of Toledo city. The second part, master thesis for Swedish University of Agricultural Sciences, is investigated how ecological design can be applied to a proposal of re-designing Toledo Riverfront as in the submission of the competition. The thesis can be interesting for landscape architects, landscape architect students, city planners, landscape ecologists and urban planners.

## Definitions

This part explains definitions used in the thesis.

**Biodiversity:** The term biodiversity refers to the complete variety of life on earth, an important aspect and indicator of healthy biological ecosystems (Rottle & Yocom 2010, p.54).

**Brownfield:** A property that is no longer used for its original purpose and may be contaminated. Examples would be old petrol stations, abandoned factories or former Confined disposal facilities. (Yeang 2006, p.443)

**Confined Disposal Facility (CDF):** CDF is an area upland which is used for storage of contaminated dredged material (North Coast Design Competition 2014).

**Climate change:** Climate change is the changes of environmental conditions occurring due to enhanced emissions of greenhouse gases.

**Dredging:** Removing sediment material from the bottom of the river in order to maintain the depth for cargo vessels (North Coast Design Competition 2014).

**Ecological design:** *Ecological design is the use of ecological design principles and strategies to design out built environment and our ways of life so that they integrate benignly and seamlessly with the natural environment that includes the biosphere, which contains all the forms of life that exist on earth.* (Yeang 2006, p.22).

**Ecological footprint:** The ecological footprints are the total effects of every individual action that has impact on climate change (Rottle & Yocom 2010).

**Ecological integrity:** a natural system exhibits integrity if, when a subject to a disturbance, it has a self-correcting ability to recover to an end state that is normal for that system, not necessarily one that is pristine or naturally whole (Yeang 2006, p.446).

**Ecosystem:** The interaction of organisms from the natural community to one another and their physical environment, acting together to form a whole (Yeang 2006, p.446).

**Green infrastructure:** is comprised of the natural, semi-natural and artificial networks of multifunctional, ecological and low-impact systems that provide ecological services while promoting the health of humans and their related environments (Rottle & Yocom 2010, p.48).

**Habitat:** Place or type of place where an organism or community of organisms lives and thrives or a specific plant and animal species naturally found; contains food, water, shelter and space (Yeang 2006, p.448).

**Landscape architecture:** Landscape architecture is simply the design and planning of physical environments from development of plans for wildlife refuges, urban design plans to physical designs for parks. Includes design and planning of all scales and encompasses preservation, conservation, restoration and the management of existing landscapes. (Olin 1997, pp.115-116)

**Remediation:** The cleaning process of contaminated sites is called remediation (Ignativa 2013).

**Resilience:** Resilience is the site's ability to recover and resist from environmental condition changes. Higher resilience is achieved with increased biodiversity. (Rottle & Yocom 2010)

**Sustainability:** The ability to support, endure, or keep up. Meeting present needs without compromising future resources. (Yeang 2006, p.460).

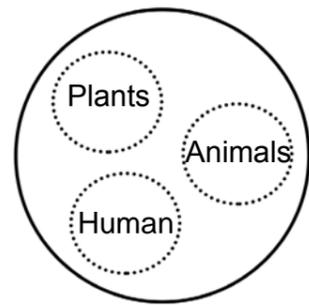


Figure 18. The big circle represent the biosphere where we coexistent. Environments suitable for all three parts are to be preferred.  
© Sara Henriksson

In this chapter answers about what ecological design is and what it is in landscape architecture are told. There are some examples of how it can be implemented in an existing place e.g. brownfields.

## What is Ecological Design?

According to Rottle & Yocom (2010, p.7) Ecological design has emerged though there is “an increased awareness of the decline of local and global environmental conditions”. Because of human activities our green environments get more and more fragmented. Baschak and Brown (1995) believe that using ecological approaches when designing can reverse this negative trend.

Ecological design can be seen as an approach of designing and there are different principles “tools” how to apply it into the design project. This approach tries to integrate and heal the broken link between human and the physical human-made environments (Laurie 1997, p.165). For successful ecological design one has to understand the relationships of the environment of where it should be implemented. Rottle & Yocom (2010, p.7) say that understanding the interrelationships between environmental processes and human’s needs today is seen as an essential foundation of ecological design. Ecological designing means investigating relationships with ecosystems, understand them and when designing maintain or improve them to be able to create environments suitable for both human and non-human species (Yeang 2006, p.67).

## The definition:

The definition of ecological design has evolved from the two words it is composed of: ecology and design, and resulted in following definition:

*Ecological design aims to improve ecological functioning, preserve and generate resources for human use, and foster a more resilient approach to the design and management of our built environments. As an interactive approach and process, ecological design includes human as well as non-human communities and systems, applying the best available scientific theory and evidence to create resilient, sustained environmental quality.* (Rottle & Yocom 2010, p.13)

## What are the positive aspects of Ecological design?

When applying ecological design, Ken Yeang (2006, p.22) means that there are 4 different interactions that need to be taken into account. These are external relations, internal functions, resource inputs and resource outputs (energy and material from the designed system). To create a good environment these 4 interactions needs to be in balance to be a sustainable designed system. If they are in balance the designed system will also affect the environment as minimal as possible.

Less effect of the environment will be achieved if:

- Respect and high-efficient use of site resources and energy
- Fulfill the users’ needs
- Minimize the emissions and the negative effects of climate change
- Reducing the greenhouse gases emissions

The design should integrate with nature, be a suitable environment for all other species living in the environment (Byrne & Parwinder 2008). Yeang (2006, p. 44) finds that ecological design needs to fulfill three principles which are first to remain a pleasurable environment for future generations, second is based on restriction and growth of the earth’s resources and carrying capacity and third create good environments for all species, both human and non-human species.

Ecological design enhances the biodiversity while using native species and protects the environment (Ignatieva 2012). The biodiversity is seen as one of the indicators of sustainable landscape design. Higher biodiversity is achieved if the designed system is linked to a bigger context for example if it is a part of a green ecological corridor.

## Urban Green Infrastructure

Urban Green Infrastructure is a tool to apply ecological design in the design in a big scale (city scale). Nancy Rottle (2013) indicated five systems of Green Infrastructure: the social, biological, hydrological, circulatory and metabolic. This Urban Green Infrastructure can be seen a strategy to mitigate and adapt to climate change.

- The social system contains all public spaces and through encouraging to interactions and outdoor activity an indirect consequence will be lowered greenhouse gas emissions.

- The biological system includes areas which enhances biodiversity and is suitable for multiple species. Green areas like these contribute to a better climate by cooling effects and absorbing carbon in soils.
- The hydrologic system handle the water can store carbon in water environments; regulates storm water and contribute to less green house gases because of less grey infrastructure.
- The circulation system offers well designed networks of walking and bike paths and encourage to less car driving.
- The metabolism system offers alternative local renewal energy resources and reduces the green house gases.

The core of Urban Green Infrastructure is to maintain the existing climate conditions, build resilience of a site and to create a suitable environment for native species which will increase biodiversity. By implementing Urban Green Infrastructure cities will be more ecological and healthful.

### ***The role of landscape architects in ecological design projects:***

Ecological design is multidisciplinary in its nature and requires thinking at all levels to understand the landscape and its processes (Rottle & Yocom 2010, p.8-10). To solve the multifaceted issues of areas, where ecological design will be implemented, it is crucial to have integrated teams of ecologists, planners and scientists. Though landscape architects have an overall knowledge of design, planning and ecology they are often team leaders of such project.

### ***The discussion:***

Even though there is a growing interest in ecological design around the world there is still a gap between the interest and the design that is actually implemented (Calkins 2004). Measurements have shown that ecological design strategies have not been used that much as expected in many countries including Europe and the US (idib.) The contemporary designers argue that it depends on the lack of information and knowledge about ecological design. Rottle and Yocom (2010, p.31) agree and mean that there is a need to understand complex ecological processes in

different situations to be able to implement ecological design. In most cases the designers are not ready to spend more time for gathering all necessary information about the site (Byrne & Parwinder 2008). Byrne & Parwinder (2008) noticed about the lack of knowledge during education process which is a main limitation for wider spreading of ecological design.

There is also another problem with ecological design: clients don't know about the long-term advantages and believe it is too costly. This is why some principles are deselected especially the strategies that take too much time to gather information.

Byrne & Parwinder (2008) also believes that if we make ecological design projects more visible the long-term advantages will be much more exposed. Every accomplished project can be seen as a new research project to gather knowledge and understanding how different design strategies can enhance ecological functioning in a specific site (Rottle & Yocom 2010, p.31).

### ***Importance of Green Places and Spaces for People in Urban Environments***

Green places can be called the lungs of the cities, they contribute to a better climate of the cities and reduces greenhouse gases emissions and the heat island effect that is a common impact of the climate change (Makhelouf 2009). Green places such as parks and ecological green corridors are advantages for the city climate but also for human. The inhabitants of the cities are given an enhanced quality of their everyday environment, indirect a healthier life and improved mental well-being (Kinham, Nutsford & Pearson). Recreational benefits for inhabitants are the most valued importance of urban green spaces (Mwendwa & Giliba 2012). Because life in cities often is stressful the green lungs are important free zones providing the cities with recreational activities and reducing the stress level of the citizens (Mwendwa & Giliba 2012). Studies have proven that green areas increase the social life because providing new possibilities of social interactions (Kinham, Nutsford & Pearson). Mwendwa & Giliba (2012) mean that the connection between human and nature is important for the human health and the everyday environment. Green places of ecological design can contribute with many positive aspects in urban environments for both human and nature.

## ***From Ecological Design to Brownfields***

Ecological design can be implemented in all scales and areas. When industries close down many of them are just left to degrade so called brownfields. Ecological design can transform these areas within cities from empty abandoned areas to effectively compact cities and increase the quality of our environment.

## ***What is a brownfield?***

A brownfield could be a former industrial area that is not used for its purpose anymore and could be contaminated (Gold, Hollander & Kirkwood 2010, p.72). It is often stated that a brownfield also is underused (Ignatieva 2013). The definition of brownfield, in the Public Law 107-118 (H.R.2869) of US, is: A brownfield means *real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant* (U.S. Environmental Protection Agency 2012b). One of the very common contaminations are PBC's (Polychlorinated biphenyl), petroleum substances, heavy metals or tar (Ignatieva 2013).

The brownfields started to establish after the Second World War when the industries started to decline (Cizler 2013) meaning that the former industrial sites were abandoned and left to degrade and is the rise of the brownfield era. Just in United States of America there are computed to be around 450 000 sites and 20% of US urban spaces are marked as brownfields (U.S. Environmental Protection Agency 2012a).

Today there is a contemporary discussion about using these areas. Urban sprawling is occurring in many cities and such brownfields have big potential for creating green spaces (Cizler 2013). This would effectively decline urban sprawl and boost the quality of the environments instead of being empty, fenced, inaccessible and unused areas.

## ***Negative aspects***

According to U.S. Environmental Protection Agency (2012c), brownfields are connected with three negative aspects. The first risk is safety, though

an abandoned unused area easily could be occupied by criminal gangs, vandalized or constitutes a safety risk due to its contaminations. Secondly there are social and economic factors, meaning that a brownfield sends a bad signal and reduces community connections. If crime and vandalization occurs private property values may be lowered. Final negative aspect is the environmental effect that a brownfield could bring pollution of groundwater (U.S. Environmental Protection Agency 2012c). To eliminate these risks that brownfields may bring out the EPA Brownfields Program awards grants to communities, states etc. to encourage them to clean and reuse these empty patches within their cities (EPA 2012). When given grants they believe that more projects will be implemented.

## ***Remediation methods and approaches***

The remediation of the brownfield can be done in multiple ways. The site can be cleaned up by reducing, isolate or remove the contamination (Ignatieva 2013). As long as the site is safe for public use the used method should be chose regarded and most suitable to the site specific conditions. One example of cleanup methods is phytoremediation and can be explained that native plants are planted on site, could be as a part of the design, which will absorb the pollutants from the soil and by time the site gets remediated. Species that are short-lived need to be taken care of though they absorb and contain hazardous pollutants, while more long-lived species, like trees could remain on site (Ignatieva 2013). When choosing method for remediation there is not only one way to remediate brownfields and one approach can't fit all projects (Saginer 2011). This is because one brownfield is not the other one similar meaning that every brownfield need to be inventoried and analyzed to investigate which method is most suitable for this site.

## ***Positive aspects***

After cleaning brownfields can be redesigned as new residential areas, schools, health care centers or open spaces such as parks and green areas. The U.S. Environmental Protection Agency (2012d) means that redeveloping brownfields into parks and green areas will enhance the public health since people will be encouraged to use bike trails in ecologically friendly environments and there will be more opportunities for recreational activities and interactions with nature. Another positive

aspect is that redeveloping green areas can contribute to a better environment while reducing heat islands effect. Cizler (2013) is proven that brownfield redevelopment can be used as a strategy for mitigation negative effects of climate change. Redeveloping brownfields, e.g. designing parks, is not only having positive impact on climate change but also is a sustainable solution for such derelict. It is also a reduction of the energy consumption as well as the way to develop the compact urban development which potentially will reduces the greenhouse gases.

### ***Summary of the benefits of brownfields redevelopment:***

- Cleanup site of pollutions which creates a safe area for human health.
- Creates job opportunities when building the site and the continuing maintenance.
- Protects the environment
- Compacts the cities which reduces distances, car use and urban sprawl
- Redeveloping brownfields as green areas contributes to reduced heat islands and lowering negative effects of climate change
- Enhances public access and use of area
- Encourage physical activities
- Enhances social life when increasing interaction opportunities

(U.S. Environmental Protection Agency 2012a)



*Figur 19. The district of Duisburg Nord is one of the industries that were closed down in 1985. Photo: © “Landschaftspark Duisburg Nord (40)” by TijsB, (CC BY-SA 2.0)*

*In communities where brownfields are reused for public health facilities, the benefits are obvious: in addition to the restoration of blighted, idle land and the removal of contamination, residents enjoy improved access to health care, new jobs, and local economic engines that leverage additional improvements and enhance the local quality of life.*

(U.S. Environmental Protection Agency 2012d)

# CASE STUDIES - *Brownfield Redevelopment*

*Among its lessons are to be aware of the importance of thorough site analysis; to give equal weight to social and ecological considerations; to respect the genius loci; and, most importantly, to allow the form of a park to evolve from the past use of a site.*

(Judith Stilgenbauer 2010)

The following parts is describing four good examples of brownfield redevelopment and ecological design. The cases have been chosen because of their well-developed design and are world-known good and exemplary examples of brownfield redevelopment and ecological design projects to learn from.

## *Duisburg Nord*

Landschaftspark Duisburg Nord is 230 hectares large industrial park located in western Germany which was initiated in 2002 (Landezine 2011). When the industries were closed down in 1985, as many industries during the 1980s, the municipality of Duisburg decided to create open social space instead of residential areas due to their restrictions of more open space within the cities (Landschaftspark Duisburg-Nord 2014a.). As a former brownfield the area of Duisburg Nord had to deal with many ecological issues of the site before the transformation into a landscape park. The challenges was mastered by Latz + Partners which decided to design the industrial area and preserve the existing elements while remediate the contaminated site (Stilgenbauer 2010). This was done through phytoremediation method, meaning that the vegetations absorb the pollutions, and slowly the contaminated soil was cleansed (ibid).

The nature has been resurrected and the vegetation is taking the lead while industries are still present (Landschaftspark Duisburg-Nord 2014b). By preserving the old structure visitors can be reminded about the industrial history of the place.

Ecological principles can be noticed in the project, it's designed to reduce maintenance and keep low costs and low energy outputs (Stilgenbauer 2010). Recycled materials from the former industry are used in the design, for example in paving material or planting substrates. New Emscher Canal has the same structure as the old canal but these canals are separated from each other because of contamination. The new canal collects rainwater, creates aquatic habitats and serves as a new ecosystem (ibid). One could see that the industrial landscape has developed with regard to ecological, social and cultural factors (Landschaftspark Duisburg-Nord 2014b).

The landscape park is built upon following areas: Blast Furnace Park, Water Park, The Railway Park, Ore Bunker Gallery, Sinter Park and Play points (Landezine 2011). Natural physical processes are common phenomena within the park and are used as a very specific feature of the design. In Blast Furnace Park, which is defined by a piazza of 49 recycled iron plats, these plats are let to erode as time passes (Stilgenbauer 2010). The natural native vegetation which was developed in the extreme biological



Figure 20. Duisburg Nord, a past industrail abandoned area has transformed into an attractive landscape park. Photo: © "Landschaftspark Duisburg-Nord" by Antonio Gallud, (CC BY-SA 2.0)



Figure 21. The new Emscher River creates new aquatic habitats within the park. Photo © "Waterway" by Michael Pereckas, (CC BY 2.0)



Figure 22. Industrail elements from the previous time when the industry was in use have been preserved. Photo: © "064 of 365 - Gas Works Park" by Yogesh Mhatre (CC BY 2.0)



Figure 23. Gas Works Park is located to the Lake Union but the shoreline is limited due to the contaminations in the water. Photo © "Gas Works Park Seattle" by Hairyeggg (CC BY-SA 2.0)

conditions reflects the site's industrial past. Now exotic seeds have been brought here (from the industrial shipments in the neighborhood) and there is a mix of native and exotic species which are involved in natural succession (idib).

Although the site was heavily polluted it now offers recreational activities in the former industrial elements. A gas tank is filled with water and serves as a huge indoor diving center, the concrete bunkers around the park are used as climbing rocks, there are possibilities to skate, perform parkour, bike or just have a pleasant walk. Duisburg Nord was an industrial abandoned area inaccessible to the inhabitants but today it is a well-known park visited by thousands of people.

## *Gas Works Park*

Gas Works Park in Seattle is another example of a brownfield that was successfully transformed from an industrial abandoned area to an 20-acres attractive park next to lake Union in the north of downtown Seattle (Department of Ecology State of Washington 2013). The redeveloped brownfield is designed by landscape architect Richard Haag. Haag, like Peter Latz, saw the beauty of preserving the old structure and elements of the site. He also involved people of Seattle to support his proposal decision (Preservation Seattle n.d.). The site was abandoned for almost 20 years and in 1975 it was converted to a city park . The former industrial elements, such as gasification plant that converted coal and oil into manufactured gas was closed down in the 50s but preserved in the design (Department of Ecology State of Washington 2013). Saving the elements spared effort, energy and negative environmental impacts which could come with construction works. The site consists of open areas and pathways mixed with the industrial elements which are worked as ruins. Other elements were restored and given a new activity purpose .

The site still contain petroleum chemical why remediations has been necessary during time (Department of Ecology State of Washington 2013). In 2000-2001 an environmental cleanup was implemented to enclose the contaminated soil. A new top layer of clean soil was placed on the ground as a protection layer (idib). A ground water remediation started in the same year and during 2013 additional clean up was initiated (Preservation Seattle n.d.). Because if this the access to the shoreline of the lake is limited and fishing, swimming or wading in the lake are not allowed to minimize the human health risks. Preservation Seattle (n.d.) is still believing that Haag's proposal was the best solution for this industrial area even it was needed continuing cleanup efforts.

## ***Reflection thoughts about the redevelopment of the two brownfields case studies***

Two examples have improved the environments and created more suitable places for urban citizens. Ecological design principles have been wisely applied while redeveloping the brownfields.

In Duisburg Nord the nature has taking the lead within the design proposals and new habitats have been created. Many animal and insects species found homes here. Before it was a totally unlivable environment for these kinds of species. Gas Works Park in Seattle at the moment is represented mostly by open lawns which are mown very often. Here the question of enhancing biodiversity can be discussed further on. In both examples relatively small efforts have been applied. If the sites would be totally redesigned much more energy and resources would be needed. So by preserving the old structure, roads and industrial elements the sites not only reduced the emissions of greenhouse gases but also preserved the genius loci of the sites and provided new recreational activities. The designed systems are in balanced though the reduction of greenhouse gases are remarkably lower than before though additional vegetation helps to absorb carbon dioxide. Positive outcomes of the sites are quite clear since the quality of the environment was increased and healthier sites were created. Formal industrial sites have been transformed into safe habitats for human. It was increased the social interactions while also enhancing the site's biodiversity.

## ***Summary of Duisburg Nord benefits:***

- A small effort (compare to conventional redesign) to really improve the environment
- Preserving the old structure
- Remediation of the site and isolation of contaminated material
- Using native species
- Natural succession and letting exotic species introduce
- Created a safe environment
- Chose method of designing the place saved energy and reduced the emissions compared to totally redesign the site.
- Reduced negative impacts to climate change by designing green areas
- Enhanced social life, interactions and new activities.

## ***Summary of Gas works Park benefits:***

- Remediation of the site
- Preserving the old structures
- Enhanced the public access
- Possibilities for social interactions
- Created a safe environment
- Chose method of designing the place saved energy and reduced the emissions compared to totally redesign the site.
- Reduced negative impacts to climate change by designing green areas

# CASE STUDIES - Ecological design

*We could not take more than we need and we should create what we need.*

Kongjian Yu (ASLA 2014)

## Red Ribbon Park, China

Kongjian Yu, a Chinese landscape architect, speaks for ecological minimalism and designing with simple characteristics aiming to enhance social life in a natural way (Saunders 2012, p.84). He thinks that contemporary landscape design is too expensive for both economy and environment. In an interview, with ASLA (2014), he tells that we can create dramatic landscape through minimal intervention.

Red Ribbon Park is located along Tanghe River in the outskirts of Qinhuangdao, China. Kongjian won the Design Award in 2007 for this project (ASLA 2014). The north part of the area was a former garbage dump and the rest of the area had lush diverse native vegetation but shabby and not well maintained (Saunders 2012, p.84). The area felt unsafe and non-accessible because of the dense vegetation.

The goal of the proposal was to create a recreational area for the inhabitants while also preserve the natural environment and its diverse vegetation. The solution was to settle up the existing natural vegetation and terrain and complement the site with a main focus element. The red ribbon, a 500 meters long bench of fiberglass forms seating, lighting and orientation in the elongated river park. Four perennial gardens are established as a patchwork to “brighten” the natural vegetation. Five pavilions along the bench created social points and sun protection while information boards had an important educational purpose. The bench connects the park. Four perennial gardens and five pavilions provide an easy orientation along the long red bench (Saunders 2012, p.84).



Figure 24. River access in Red Ribbon Park. Photo: © Turenscape



Figure 25. Integrated lightning in the red bench. Photo: © Turenscape



Figure 26. The red bench meander along the river. Photo: © Turenscape



Figure 27. Siteplan of Red Ribbon Park. Photo: © Turenscape

# CASE STUDIES - Ecological design

## The Blue Circle, Moscow

Zaryadye Park in Moscow stands in front of a transformation from the wasteland to the important municipal park next to Kremlin. Turenscape has created a proposal for the advertised design competition of the area in Moscow's heart. The Blue Circle of Moscow is according to Turenscape, a new icon for the city for all citizens in Moscow (Rosenfield 2013). The site is at the moment an empty lifeless 13 acres big area, fenced and inaccessible. Located next to the waterfront in the center of Moscow it has great value and opportunities for the city (Zaryadye park 2013).

The aim was to link the site to the neighborhoods and design a suitable area for all people who pass this area every day Moscow (Rosenfield 2013). Further the design should be unique but adapted to the national identity and handle the harsh Russian climate.

Turenscape's proposal is designed to be an urban ecosystem providing new eco-services to environment and humans (Turenscape 2014). A mix of diverse ecosystems and activities for people and with respect of past and the genius loci of the place the Blue Circle of Moscow suggested the reconnection of man with nature and links the city. The park's proposal was built upon five Russian native habitats: birch forest, meadow, wetlands, traditional monastery gardens and a pond. The goal of the design was to create a park that is suitable for different types of people and requires low maintenance (Rosenfield 2013). The pond, main focus in the park, should be maintaining the urban storm water. It is also an ecosystem that cleans the water and at the same time could be a reflection mirror for the Moscow skyline. Adapted to the local harsh climate it's contributing to enhancing social life all year-round.



Figure 28. Overview of the park.  
Photo: © Turenscape



Figure 29. Riverfront nighttime.  
Photo: © Turenscape



Figure 30. The pond that reflect the skyline of Moscow. Photo: © Turenscape



Figure 31. Siteplan of Blue Circle. Photo: © Turenscape

## ***Reflection and lessons learned from ecological design case studies***

When studied the case studies I understood that one important aspect of ecological design is to adapt the theoretical principles to the specific site design. As Saginor (2011) said one method for redevelopment of a brownfield is not suitable for two projects though two brownfields are never the same. I found that “The Blue Circle in Moscow” is a large project and will require a lot of energy when implementing while the Red Ribbon Park required much less efforts for implementation. But the common feature of both projects is that it requires a low maintenance after the implementation phase. Blue Circle is renewing the site with new vegetation while the Red Ribbon is more into preserving the existing vegetation. Another commonality is that both projects use native species and peculiarities of local plant communities and strongly consider the local climate.

Ecological principles that have been used in the Red Ribbon Park:

- Design with respect to the original site
- Preserving the old local vegetation and renew with patches of additional vegetation
- Small efforts generate low emissions of the implementation phase
- Enhancing social life and accessibility of the area
- Reconnecting man, river and nature
- Increasing safety of the area from dense and unsafe to more open and well-visited
- Suitable place for human and non-human species

Ecological principles that have been used in the Moscow Blue Circle

- Designing in regard to the site climate
- Creating Russian local habitats and using native vegetation
- Increasing biodiversity
- Designing for low management and maintenance
- Enhancing social life and accessibility of the area
- Suitable places for human and non-human species
- Creating self-maintaining ecosystems
- Lower in greenhouse gases due to creating a large amount of green areas in the central part of the city.

## ***Conclusion of the theoretical background to consider in the design process***

From the previous chapter theoretical background about ecological design, urban green infrastructure and brownfields I later in the thesis discuss the design proposal of the competition with regard to this subjects. Summarized the positive aspects of ecological design as example the integration of nature, the attempt to remain a pleasureable environment for future generations and creating better environments for both human and non-human species will be considered in the design. From the Urban Green Infrastructure I will in the last part of the thesis discuss the five different systems and analyze my design proposal based on these five systems. The systems are: The social system, the biological system, the hydrological system, the circulation system and the metabolism system. The ecological principles mentioned in the four different case studies will be the base of the same analyze of the design proposal of the competition.

There is also important to remember that ecological design often are done in integrated teams of many scientists, ecologists, architects and planners. In this project I work by my own and only have my self to rely on and may with probability affect my result.

# SITE ANALYSIS - Information about Toledo

Following chapter describes the situation in Toledo to be used for further design.



Figure 32. Toledo city is located in south of Lake Erie in the state of Ohio, US.  
© Sara Henriksson



Figure 33. Toledo city borders to Canada, state Michigan in the north and West Virginia in south. © Sara Henriksson

## **Climate:**

The average temperature in Toledo over the year is around 10 Celsius degrees (NOAA 2014). Compared to rest of the US it's listed in the middle where highest average annual temperature is San Juan (27,2 Celsius degrees) and lowest Barrow (-11,6 Celsius degrees ). With an average annual precipitation (in Ohio) of 973 mm per year the summer gets humid and hot while the winter are cold with snow (The National Atlas of the United States of America 2014).

## **Location of the city:**

Toledo city is located in north central area of US and at the south of Lake Erie in the state of Ohio (Toledo.com 2014). It borders to state Michigan and Canada in the north and state Kentucky and West Virginia in the south. The city has a population of 310 000 inhabitants and is a relatively large city. It's founded in year 1833, developed and is now well-known of its industries, especially glass industries (idib). Because the city is established in direct contact to Lake Erie and Maumee River is floating through the city it has almost perfect conditions for commercial shipment and industries.

## **Situation of Toledo Riverfront:**

The port of Toledo in Maumee Bay, Ohio, US, ranked as the 7th most important ports in the Great Lakes with annual of almost 11 million tons cargo management (North Coast Design Competition 2014). Maintaining the depth of the Maumee River and Bay, as a transportation channel of cargo vessels, almost 1 million cubic meters bottom sediments are dredging every year. The major part of the material dredged from Maumee Bay is transported to open water in Lake Erie and only a small part is placed on land or re-used. Not all material is accepted for open water placement though material is contaminated it's placed in Confined

Disposal Facilities (CDF's). Material for open water placement requires the same composition as the bottom material at the location of placement in the lake.

Along Maumee River CDF's, parks and industries are established but human access to the riverfront is highly restricted (North Coast Design Competition 2014).

## **Consequence of the urban sprawl of Toledo:**

When the city established in the area of northwest Ohio around Maumee River the former large wetland called the Great Black Swamp was declining (Hallett 2011). Today the Great Black Swamp is almost totally disappeared. Settlers drained the swamp for constructing roads, houses and agricultural land hence Ohio today has lost approximately 90% of their wetlands.

## **Native local habitats of Ohio:**

In Ohio the main types of local habitats are prairies, oak openings, oak savannah, dunes, prairies, wetlands and the mixed forests (The Nature Conservancy 1997). The areas are fragmented and small and many in need of restoration and protection to be able to survive. EPA (2013) means that when the habitat are separated from each other and the

# SITE ANALYSIS - Information about Toledo

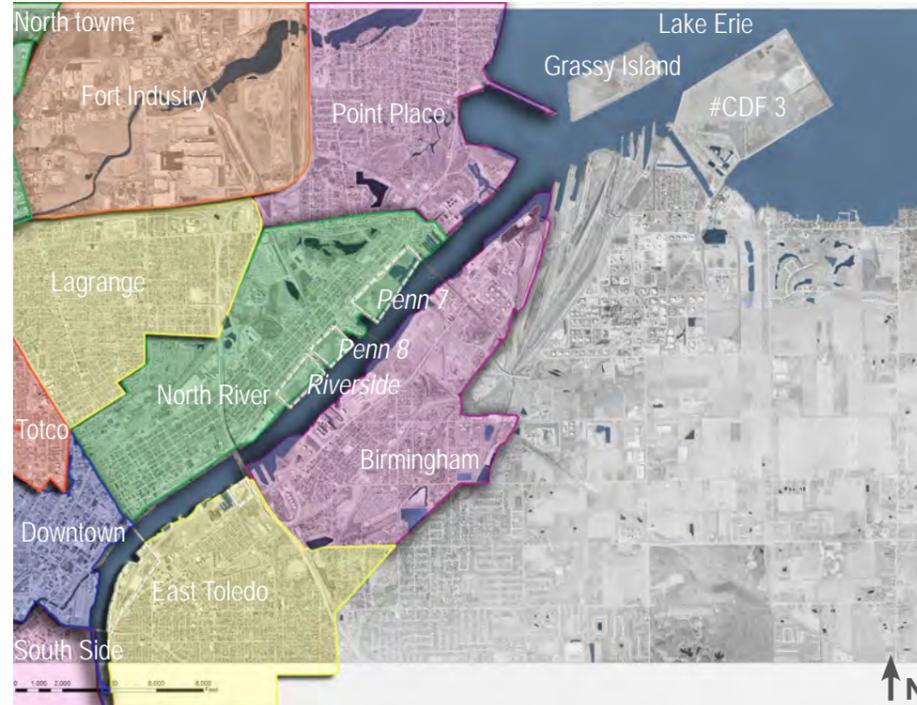


Figure 34. District map of Toledo City with Maumee River floating through the city. Map built upon basis map of © Courtesy of North Design Competition.

ecological connections between them are bad affecting that they also differ in vegetation compositions. This has a threatening risk at the biodiversity of the areas though species have higher risks to extinct. And the Great River basin are home of more than 100 globally rare species (The Nature Conservancy 1997).

The specific area of Toledo is divided into an ecoregion of Oak openings, sand dunes and is surrounded by agricultural plains of fertile drained soils (EPA 2014). As mentioned before the drainage of the area around Maumee River it was a large swamp and beech forests were common. The northwest Ohio has important habitats with high biodiversity important to preserve. The watershed of Maumee River and Ohio's all smaller tributaries contribute to the increased biodiversity within the state, but these aquatic habitats are threatened because of industries and contaminations.

On islands in the Great Lakes there are many endemic species that is globally endangered which can be extinct (idib). Along the shoreline of Lake Erie habitats of dunes, wetlands and sand beaches are included in habitats of Ohio and contribute to high biodiversity. The ecological value is unique in Ohio of meadows, prairies, savannas and woodlands on thin soils. But even though the biodiversity is high habitats are rare and fragmented and risk to extinct, especially Savannah, prairies and wetland

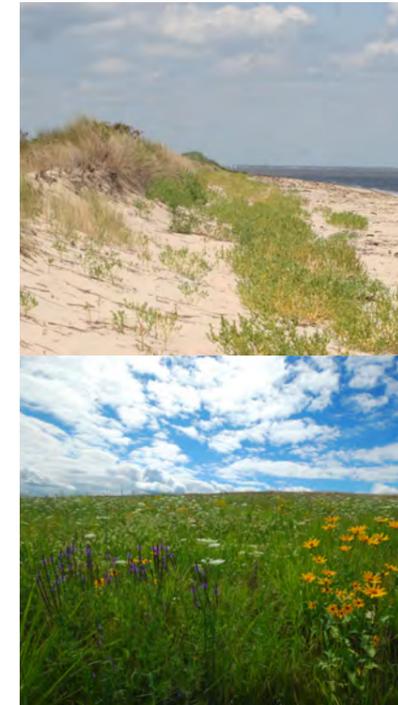


Figure 35. Dune habitat. © "Dunes habitat." by U.S. Fish and Wildlife Service Northeast Region (CC BY 2.0)



Figure 37. Prairie habitat. © "Prairie" by Joshua Mayer (CC BY-SA 2.0)



Figure 36. Oak forest. © "Oak Forest" by Joshua Mayer (CC BY-SA 2.0)



Figure 38. Wetland habitat. © "Baraboo Waterfowl Production Area, Leopold Wetland Management District" by USFWSmidwest (CC BY 2.0)

communities.

Activities of human that stresses, threatens or even direct damage the local habitats and its species are mainly industries and constructions which contributes to degradation and fragmentation of habitats and indirect because of contamination (The Nature Conservancy 1997). Agricultural activities in the outskirts of Toledo city have also degradation and pollution effects of the communities (EPA 2013). The rare habitat tallgrass prairies prefer the fertile soils that are most attractive as agricultural areas (The Nature Conservancy 1997). Side-effect of extinct habitats is the losses of butterflies, insects, birds and other animals that lose their homes.

EPA (2013) contributes to protect the threatened habitats through developing different programs, maintaining and controlling restrictions of actions that could damage the habitats. They mean that enhancing biodiversity and protect the local habitats are an important work which also other organizations work for preventing losses of local habitats such as the Ohio Department of Natural Resources Division of Natural Areas and Preserves, Parks and Recreation, Wildlife, and Forestry. The USDA Natural Resources Conservation Service protects the wetlands along Lake Erie and prevents them from being fragmented (idib).

# SITE ANALYSIS - Information about Toledo

## **Ecological corridors and trails in Toledo:**

The Green Corridor Program and Maumee River Trail Project are going on in Toledo. The two projects will enhance the green areas and safety of biking and walking paths within the city. The Vision of Toledo will consider these project in the design why they are important to know.

### **Green Corridor Program**

The Green Corridor program is a fusion of five greenway trails within Toledo. The greenway trails are; Westside Trail, University Park Trails, Backside Trail, Anthony Wahne Trail, Ravine Trail and Riverside Trail (City of Toledo Ohio 2014, p.3-13). A green network from the north to south and west to east of Toledo is spread and creates safe bike lines, walking paths, hiking trails and connections between parks, recreational areas, university and other destinations in Toledo (City of Toledo Ohio 2014, p.3-4).

The plan is developed by Toledo Department of Parks, Recreation and Forestry. The expansion of the green infrastructure can be seen on the map and will not only enhance the bike and pedestrian paths network but also provide a habitat corridor for animals (City of Toledo Ohio 2014, p.3-12).

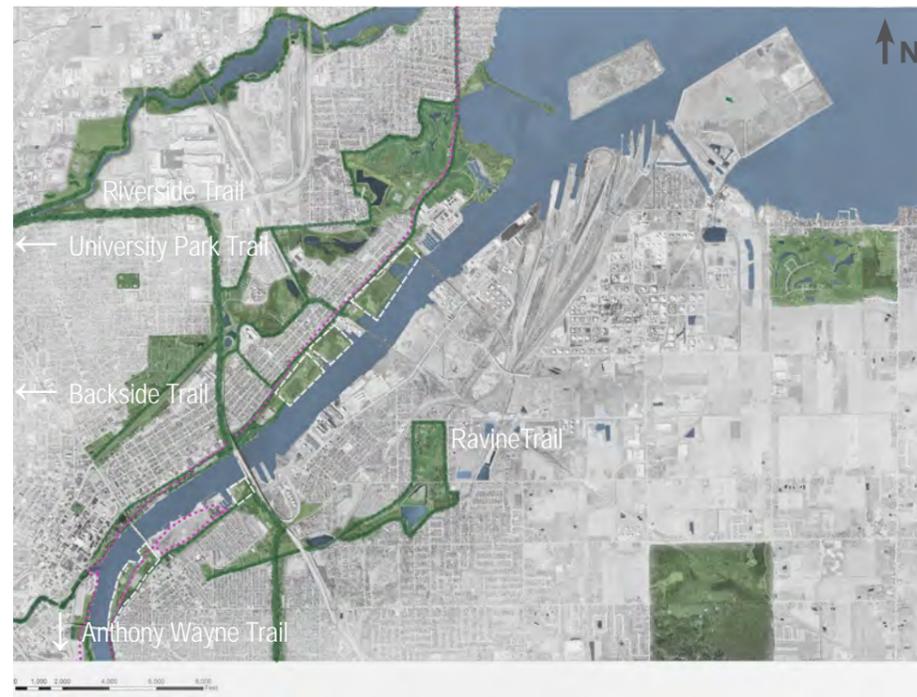


Figure 39. The Green Corridor Program links the green areas within the city. The white lines mark the given areas along the riverfront. Map built upon base map © Courtesy of the North Coast Design Competition 2014.

### **Maumee River Trail Project**

Maumee River Trail is a multi-use trail that is being developed along the riverfront from the north river mouth in Lake Erie to the south of Toledo (Maumee River Trail Report 2012). The goal of the Maumee River Trail is to connect different destination points around Maumee River. The Design Center, a division of the Downtown Toledo Department Corporation, has produced the Maumee River Trail Report in July 2012 and means that Toledo has a lot of different destinations, like the Toledo Zoo, Toledo Art museum etc. but without a car the trip between them is unsafe and connections bad (p.36). By connecting fragmented bicycle lines and expand the bike and pedestrian infrastructure safety enhances while the project also hope to encourage outdoor activity, use of public parks and generate a more healthy city. Bike share stations will be established in nodes of the infrastructure. Though bikes are expensive the project gives the inhabitants or tourists opportunities to borrow bikes and the amount of bicyclists will increase in the city. Enhancing the network of connections will resurrect reclusive areas in Toledo e.g. East Toledo and open up the possibility to add activities in sites along the riverfront.

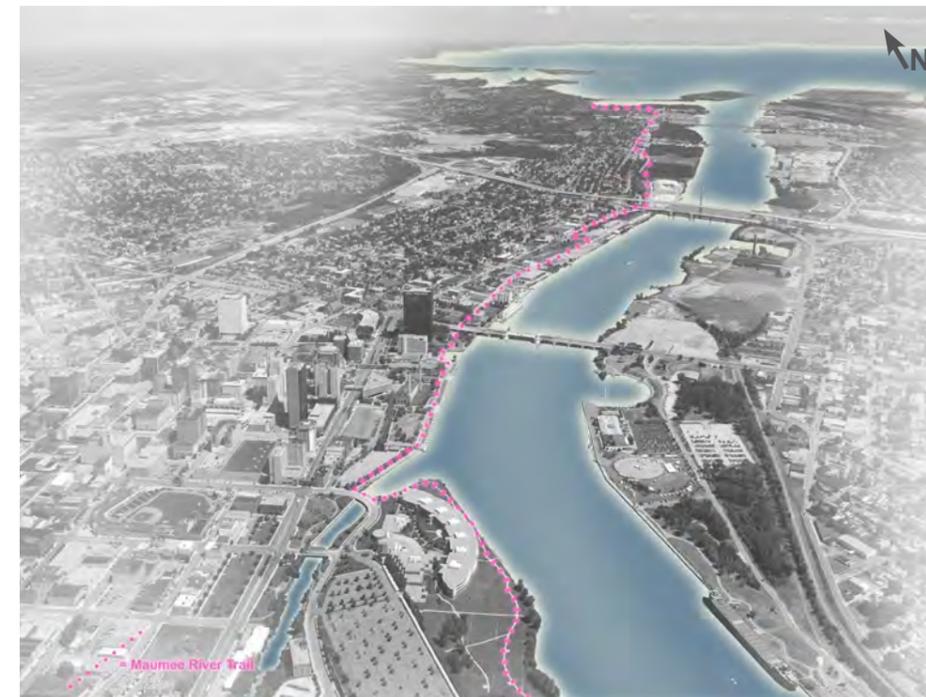


Figure 40. The map showing the route of Maumee River Trail. The base of the aerial view © Marge Beaver 2008.

## *Design proposal*

*The result parts will describe the products of the design process and the proposal of the competition. It will start with describing the problem of the Riverfront, how the vision will solve these problems and continuing the goals of the vision will be described.*

*The next part focuses on the sites, how they were chosen, inventoried and analyzed etc. The part Design of Sites will in more detail show the design of the Wetland Park, Urban Ecological Park and Riverside Park. What kind of habitats, activities, wildlife and how dredged material has been used in the design of the sites are also described.*



Figure 41. The basis of the aerial view © Marge Beaver 2008.

### **Past: A Non-Public Riverfront**

Toledo Riverfront as the situation looks like today. Major parts of the riverfront are today inaccessible because of industries, illustrated in red.



Figure 42. The basis of the aerial view © Marge Beaver 2008.

### **Future: A Public Riverfront**

The future situation of the new vision showing another Toledo Riverfront where major parts allows public access.



Figure 43. The basis of the aerial view © Marge Beaver 2008.

### **The Green Corridor**

The Green Corridor is a part of Vision of Toledo Riverfront. Green areas along the riverfront connected and together they create a green corridor.



Figure 44. The basis of the aerial view © Marge Beaver 2008.

### **Connected to the Green Corridor Project**

The Green Corridor is connected to the Green Corridor project of Toledo City and together they connect a green network within Toledo city.

# RESULTS - Goals of the vision



Figure 45. Vision plan of new Toledo Riverfront. Created by Sara Henriksson. The basis of the aerial view © Marge Beaver 2008.

The Riverfront will be a green corridor that linking the sites along Maumee River. The visitor can experience a variety of local habitats and wildlife. The green corridor improves the environment for pedestrians and bicyclist moving along the Maumee River Trail. The highlighted areas are the Wetland Park, Urban Ecological Park and Riverside Park.

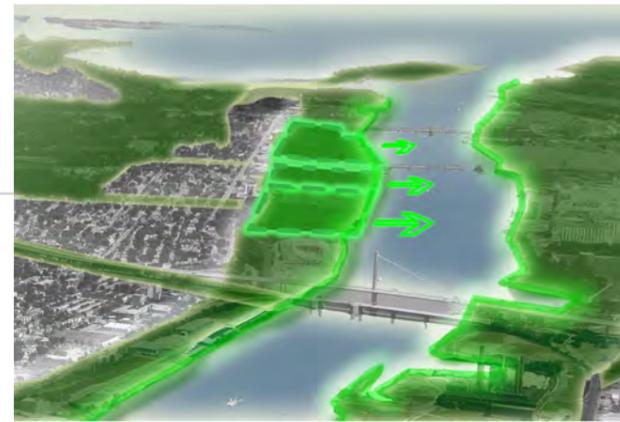


Figure 46. Enhance accessibility of the riverfront. The basis of the aerial view © Marge Beaver 2008.

## Goal 1: A public riverfront

The public access will increase by transforming industrial and non-accessible riverfront areas to accessible and walkable ecological parks.

Toledo today is a city based on both sides of the Maumee River and the access to the riverfront is highly restricted to humans. The areas along the riverfront are industrial buildings facilities. By giving the citizens of Toledo the chance to use the riverfront will enhance the quality of the city though water has a positive influence on human health and life.



Figure 47. Link the riverfront parks. The basis of the aerial view © Marge Beaver 2008.

## Goal 2: Enhance green urban infrastructure and social outdoor life

River parks will be an important green corridor-reconnector to other green patches within urban matrix of Toledo.

The new riverfront is inviting people for outdoor activity and will be a new icon for Toledo City. The vision will contribute to a more sustainable and healthier life for the people in Toledo due to its enhancement of green public areas.

The parks along the river will be connected and a part of the green corridor program of Toledo city.



Figure 48. Design different local habitats to enhance the biodiversity. The basis of the aerial view © Marge Beaver 2008.

## Goal 3: Enhance the biodiversity

By using native vegetation and wildlife lost local habitats typical for the region of Ohio will be reconstructed.

Riverside Park, Urban Ecological Park and Wetland Park are connected in the green network of Toledo. Different habitats are designed to offer a possible chance to enjoy the local habitats and their wildlife of Ohio within Toledo City. Habitats to be explored are: grasslands, prairies, oakforests, dunes, mixed forest and wetlands.

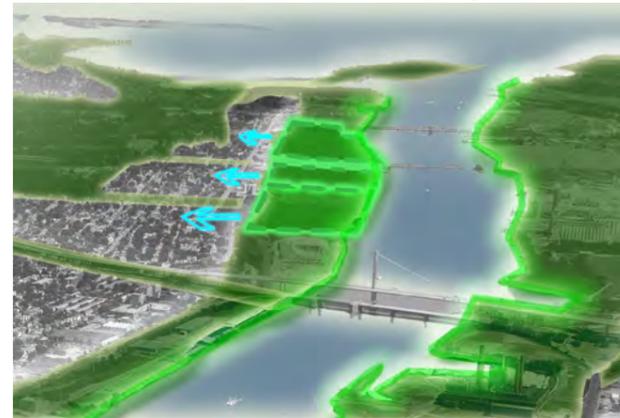


Figure 49. Enhance the connections to the surroundings. The basis of the aerial view © Marge Beaver 2008.

## Goal 4: Improve the connections between Maumee River and the city

Pedestrian paths and bike lines will increase the connections along the river and the surroundings. More entrances and walk paths increases the accessibility to the parks and riverfront. Paths inside the parks will also be connected to the Maumee River Trail, MRT. The green corridor improves the environment for pedestrians and bicyclist moving along the MRT.

## Goal 5: Consider the dredged material from Maumee River

The vision will show how dredge material can be reused in landscape by changing the topography and creating new habitats.

# RESULTS - Site selection



Figure 50. Riverside area.  
Photo: ©U.S. Army Corp of Engineers



Figure 51. Riverside area.  
Photo: © U.S. Army Corp of Engineers



Figure 52. Penn 8 area.  
Photo: ©U.S. Army Corp of Engineers



Figure 53. Penn 7 area.  
Photo: ©U.S. Army Corp of Engineers



Figure 54. Penn 7 area.  
Photo: ©U.S. Army Corp of Engineers

After studied the two cases Red Ribbon Park and The Blue Circle of Moscow and straighten the expressions of ecological design and brownfields I will now introduce my proposal for the design competition of Toledo Riverfront. I have used ecological design principles and the knowledge I have learned from previous parts of the thesis. The first parts will be site selections, inventory and analysis from parts of LaGro's site analysis method. Further the design of each selected site will be presented as an example of the vision.

### Site selections:

The competition had already specified five areas along the riverfront of which should be design in finer scale. My selection of Penn 7, Penn 8 and Riverside was made because of their total inaccessibility for the inhabitants of Toledo today in contrast to International Park which already is contemporary park. Edison Park is a green area with meadow-like vegetation which still contributes to lushness. Additionally the chosen areas are placed next to each other and they can be connected and be a part of the green corridor in Toledo.

Penn 7, 8 and Riverside are former CDF's why there should be prioritized for designing according to Yeang's (2006) method of ecological design. Edison Park is created on the place of a former soil dump. It is not connected to the three other areas and therefore excluded in our proposal.

Three chosen areas are located on the left side of Maumee River and the same site as Downtown and many residential areas. These sites will therefore in my opinion be easier to reach and they can be easily accepted due to the shorter distance. They are also located closer to the mouth of the river in Lake Erie and a can have more potentials for creating wetlands and attracting birds.

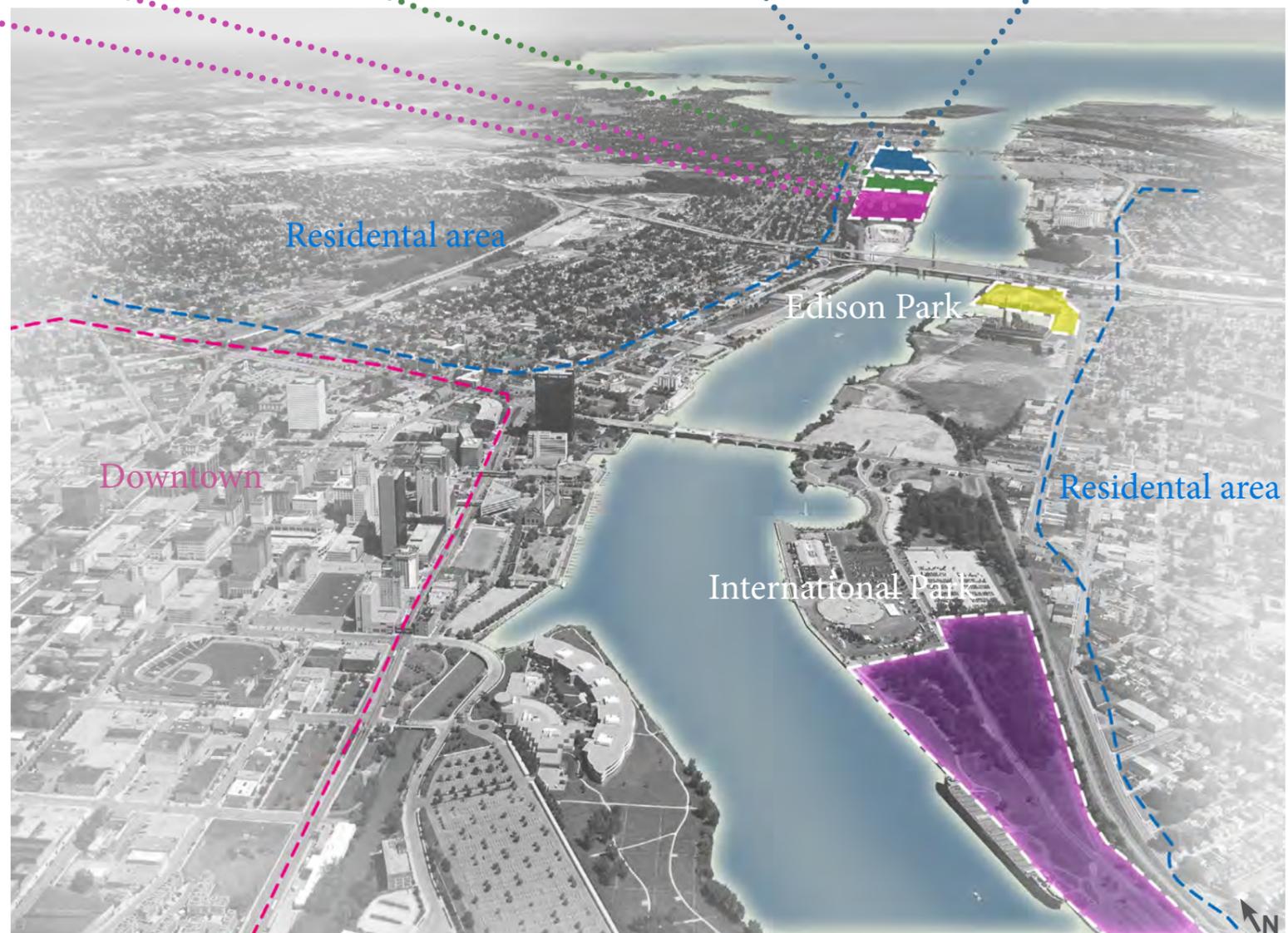


Figure 55. Toledo Riverfront and the sites along Maumee River. The basis of the aerial view is © Marge Beaver 2008.

# RESULTS - Site inventory



Figure 56. Inventory of Riverside. Approximately scale 1:300 feet. Created by Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.

## Inventory of Riverside:

Riverside is located closest to downtown compared to the other sites. The railway follows the western side of the boundary. Public park is located between the railway and North Summit Street and it has a swimming pool and a basketball court. Alfa Green Supreme is established in the north side of the Riverside Industries. Maume River Bike Trail follows the North Summit Street and turn into the existing park on a level of Cincinnati Street. There are two schools here as well. The northern area has a road for trucks and is open with upland disposal of dredged material. The area is approximately 15 hectares and quite flat. Maume River flows along the eastern edge of Riverside and two other sites (Penn 7 and Penn 8). Residential areas are situated on the west side of the North Summit Street.



Location. Created by Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.



Figure 57. Inventory of Penn 8. Approximately scale 1:300 feet. © Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.

## Inventory of Penn 8:

Penn 8 is a smaller site of approximately 11 hectares and located in the middle of the three areas. The site is flat and has open patches with lower vegetation. These patches are surrounded with higher vegetation, mostly deciduous trees and shrubs. The Maume River Bike Trail passes by the area along the North Summit Street. The railway sideswipes Penn 8 in the southwest corner of the site. Between North Summit Street and the railway there is a lawn. Industries are located around the area and a small harbor is situated in the north inlet of the area. It is connected to a repair hall for boats which also are placed here. Here the former road can be found which probably was used for trucks circulation when the site was a CDF.



Location. Created by Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.



Figure 58. Inventory of Penn 7. Approximately scale 1:300 feet. Created by Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.

## Inventory of Penn 7:

The site consists of one bigger area (to the left) and a smaller area (to the right) separated of a small inlet of the Maume River. There is higher vegetation composed of deciduous trees and shrubs. The topography of the Penn 7 is flat except for the southwest part of the site which has less vegetation and more open. Here is a swale were storm water is accumulated. The North Summit Street passes along the whole area. Industries are established to the east of the North Summit Street and residential areas are located on the western side. There are two schools not far from Penn 7.



Location. Created by Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.

## Legend

- Swimming pool area
- Open area
- Residential area
- Industries
- Water
- Higher vegetation
- School and direction
- Railway
- Maume River Trail
- Boundry of area
- Truck road

# RESULTS - Site Analysis



Figure 59. Analysis of Riverside. Approximately scale 1:300 feet. © Sara Henriksson. Map built upon © Courtesy of the North Coast Design Competition.

## Analysis of Riverside:

The railway is a barrier for entrance to the site. Though the area is private and a place for maintenance of dredged material the connectivity of the place is highly restricted. The area is partly forested but mostly used for dewatering dredged material. The circulation is centered in the northern part where the roads are located. Most pedestrian and motor traffic take place on the North Summit Street which is a transit route. Pedestrians also move along the Cincinnati Street towards the school. The existing park, the basketball court and swimming pool are also destination points. Riverside has a good climate though the residential areas protects from the north wind and Maume River keeps the area open from the south and creates opportunities for sun. The riverfront accessibility for an inhabitant of Toledo does not exist.



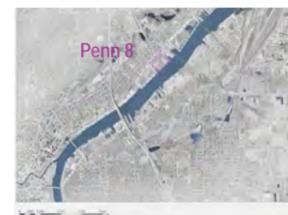
Location. © Courtesy of the North Coast Design Competition.



Figure 60. Analysis of Penn 8. Approximately scale 1:300 feet. © Sara Henriksson. Map built upon © Courtesy of the North Coast Design Competition.

## Analysis of Penn 8:

Penn 8 has a road in the southwest corner. This road is not to be used by the citizens but rather by trucks when the site was used as a CDF. From investigating this area more closely by photographs and maps it looks like there is a gate blocking the access and the site therefore is inaccessible. Circulation of car, bikes and pedestrians occurs mostly along the North Summit Street. The railway together with the band of industrial buildings creates a barrier along the street. The site doesn't have any destination points if you don't live in one of the houses in the residential areas or work in one of the industrial buildings. The climate is good with protection from north winds and openness from south as well as good solar opportunities.



Location. © Courtesy of the North Coast Design Competition.



Figure 61. Analysis of Penn 7. Approximately scale 1:300 feet. © Sara Henriksson. Map built upon © Courtesy of the North Coast Design Competition.

## Analysis of Penn7:

Penn 7 has almost full cover of vegetation except a small open area with lower vegetation in the south part. The site has a superb south facing position and protected from cold north wind. The industries, between Penn 7 and the North Summit Street, are blocking access to the area. There is no circulation within the site though all industries are fenced and can be seen as a serious barrier. The only destination points are two schools and a park located in the north part which why also these streets are assumed to be more used by pedestrians and cars. There are most motor traffic, bikes and pedestrians along the North Summit Street where also the Maume River Bike Trail are planned.



Location. © Courtesy of the North Coast Design Competition.

## Legend

- Inaccessible and private area
- Public area
- Barrier
- Wind from north
- Sun direction
- Circulation pedestrians
- Destination point
- Railway
- Boundry of area

# RESULTS - Programs of the selected sites



Figure 62. Program of Riverside. Approximately scale 1:300 feet. © Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.



Figure 63. Program of Penn 8. Approximately scale 1:300 feet. © Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.



Figure 64. Program of Penn 7. Approximately scale 1:300 feet. © Sara Henriksson. Basemap © Courtesy of the North Coast Design Competition 2014.

The sites are programmed for pedestrian use and not for cars. It is a contrast to the rest of Toledo which is absolutely dominated by dependency from cars. Toledo Riverfront is in need of more accessible park areas and in direct contact to Maumee River. Today the areas of the three sites are totally inaccessible for citizen of Toledo due to location of private industrial lands. The design will destroy the barrier that blocking the access to the riverfront and provide different types of local habitats for recreational use. These areas will also provide habitats for wildlife, because of the interest of eg. birdwatching in Toledo. By enhancing the possibilities for activity within the areas there will also be a suitable place recreational area with the respect of local ecology.



Location. © Courtesy of the North Coast Design Competition.

will be used to create a dynamic topography which forms locations for local habitats with different condition requirements. Two safe railway crossings will be built in the corner of the area of boundary. These new entrances will be connected to the Maumee River Trail project and enhance the connection to the surroundings. The riverfront and the city area resurrected and enable human riverfront access.



Location. © Courtesy of the North Coast Design Competition.

### Program of Penn 8:

Penn 8 will be connected to Riverside Park and the Maumee River Trail project through three new entrances. These entrances are placed where between the industries buildings and break the former barrier which the industry buildings formed. The southeast entrance crosses the railway. In the existing vegetation in the east part of the area could if possible be used in the new design. As well as in Riverside Park dredged material will be considered

in the design to create conditions of different local habitats. The area will enable the riverfront access and possibilities to water contact.



Location. © Courtesy of the North Coast Design Competition.

### Program of Penn 7:

Penn 7 will be provided with the local habitat: wetland, because of it position closest to the mouth of Lake Erie. Due to its location birds will have the closest way to find their habitats for stopover and therefore most suitable site for this habitat. A boardwalk will make it possible for pedestrians to experience wildlife closely. The existing vegetation in the east part of the area will be preserved if possible. The north part of the area will be accessible only for wildlife for species susceptible of humans. Four new entrances enhance the connections to the surroundings and the Maumee River Trail. The new green area enhances the link between nature and human.

### Legend

- Walkable friendly area
- Area for only wildlife
- Consider if possible save vegetation
- New connection
- Access to riverfront
- Railway
- MRT
- Boundry of area

### Program of Riverside:

Riverside will be transformed into a green accessible area with a well-developed walk path system. Dredged material

## Design statements

The development of the areas is aiming to create the accessible riverfront parks based on local habitats which will attract citizens and wildlife. The following statements are used in the design:

Concept statements:

- Enhancesociallifebycreatingaccessible space which contributes to recreation and interactions between humans and nature.
- Create local habitats which enhance the biodiversity and attract wildlife
- Transform from industrial brownfields to recreational accessible riverfront parks by introducing pedestrian trails
- Consider the dredged material in the topography of the design

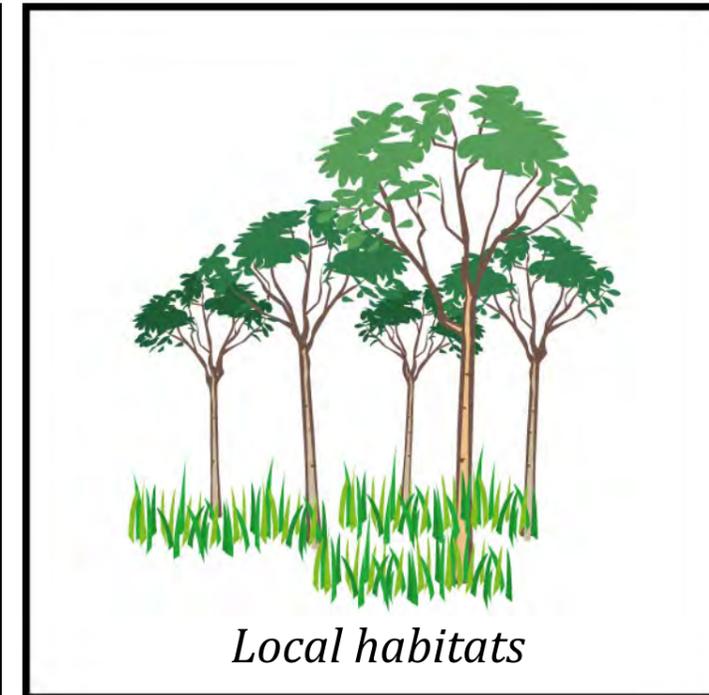
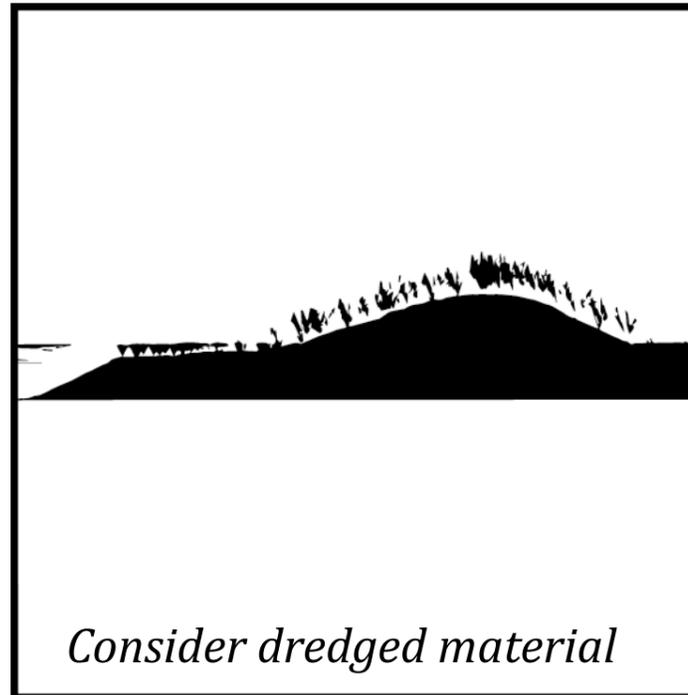
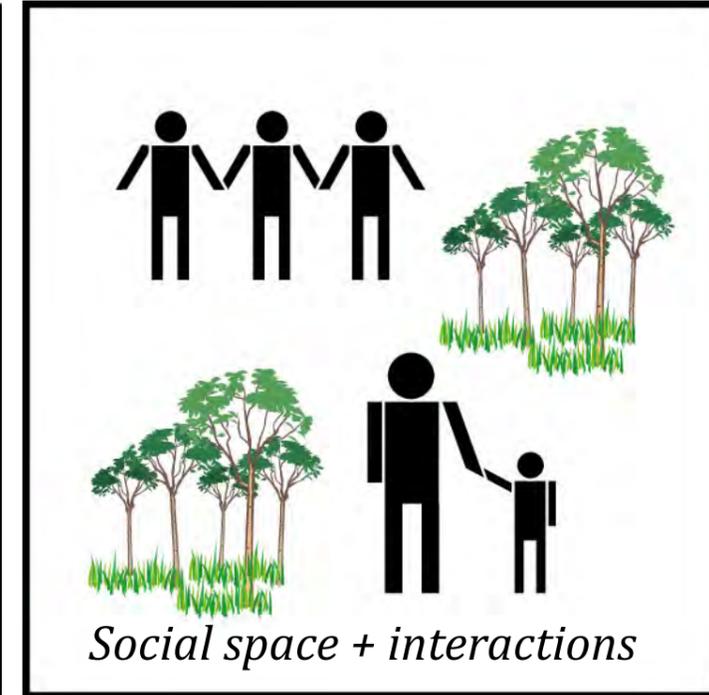


Figure 65. Design statements. © Sara Henriksson.

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*DESIGN*  
*of SITES*



## PROPOSAL - Wetland Park

**Figure 66. Perspective over the Wetland Park.** The picture is created by Sara Henriksson and built upon © References pictures built upon: "London Wetland Centre" by Gordon Joly. (CC BY-SA 2.0), "Hunneyman Road Wetland Restoration" by USFWSmidwest. (CC BY 2.0), "Watching the Bird Watchers" by Matty Ring (CC BY 2.0), "Boardwalk" by Lori L. Stalteri (CC BY 2.0), "Red-winged blackbird at Huff Park" by John Winkelman (CC BY 2.0), "Common yellowthroat in flight" by USFWS - Pacific Region (CC BY 2.0)



# PROPOSAL - Wetland Park

Figure 67. Siteplan Wetland Park. Scale: 1:100 feet. The Wetland Park offers wildlife in the city. Siteplan created by Sara Henriksson and built upon map © Courtesy of the North Coast Design Competition 2014.

# PROPOSAL - Wetland Park



**1** *Figure 68. Perspective; birdwatching tower. Perspective created by © Sara Henriksson.*

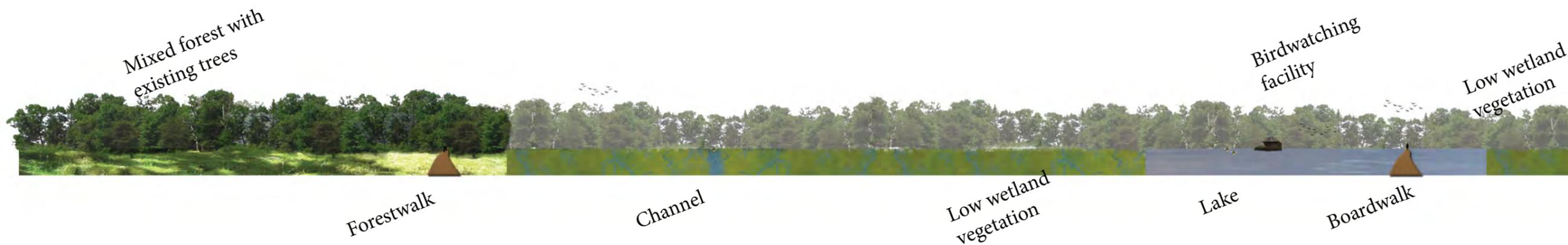


**2** *Figure 69. Perspective; kayaking in one of the channels in the higher part of the wetland. Perspective created by © Sara Henriksson.*

Losses of natural wetlands occurred due to the industrialization and expansion of the city. A constructed wetland is being designed in Penn 7 closest to the mouth of Maumee River. The site has two types of habitats. The northern part with higher wetland vegetation and closest to the river lower wetland vegetation to enhance the biodiversity. To construct the

wetland native species are used which also are a natural cleanser of the water.

The bird watching towers and hiding huts let birdwatchers observe wildlife close. The site can be explored through kayaking in the channel passing through the Wetland Park or the pedestrian paths and platforms.



*Figure 70. Section A<sub>1</sub>-A<sub>2</sub> Wetland. Scale: 1:100 feet/A1.*

# PROPOSAL - Wetland Park

## Attracted birds in the wetlands



**Common Yellowthroat.**  
Figure 71. Reference: "Common Yellowthroat" by Dan Pancamo (CC BY-SA 2.0)



**Red-winged blackbird**  
Figure 72. Reference: "Male Red Winged Blackbird - Montlake Fall" by brewbooks (CC BY-SA 2.0)



**Marsh wren**  
Figure 73. Reference: "Marsh\_Wren.jpg" by Ken Janes (CC BY-SA 2.0)



**Swamp sparrow**  
Figure 74. Reference: "Swamp Sparrow (Melospiza georgiana)" by U.S. Fish and Wildlife Service Southeast Region (CC BY 2.0)



**Prothonotary warbler**  
Figure 75. Reference: "prothonotary warbler" by Bill Majoros (CC BY-SA 2.0)



**Willow flycatcher**  
Figure 76. Reference: "Willow Flycatcher 5/19/2013" by Kaaren Perry (CC BY 2.0)



**Eastern phoebe**  
Figure 77. Reference: "eastern phoebe" by Chris Luczkow (CC BY 2.0)

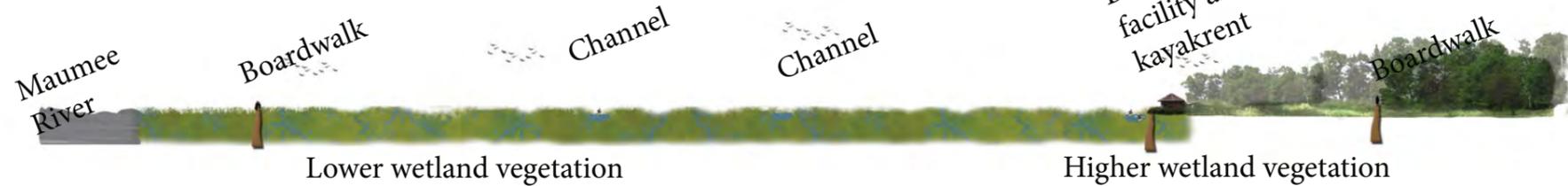


Figure 78. Section B<sub>1</sub>-B<sub>2</sub> Wetland. Scale: 1:50 feet/A1. The section is created by © Sara Henriksson Reference: Birdwatching facility "Watching the Bird Watchers" by Matty Ring (CC BY 2.0)

## Local habitats



**Wetland habitat**  
Figure 79. Reference: "Hunneyman Road Wetland Restoration" by USFWSmidwest. (CC BY 2.0)

## Recreational activities



**Kayaking**  
Figure 80. own picture



**Bird watching facilities**  
Figure 81. Reference: "GMP Architecture - Bird Watching Tower - Photos 13.jpg" by Forgemind ArchiMedia (CC BY 2.0)



**Canoeing**  
Figure 82. Reference: "Kids canoeing on Lake Bennett" by Tommy Trussell. (CC BY 2.0)



**Bird watching**  
Figure 83. Reference: "We're for the birds!" by U.S. Fish and Wildlife Service Northeast Region (CC BY 2.0)

Higher wetland vegetation

Wetland vegetation only for wildlife



Section A<sub>1</sub>-A<sub>2</sub> Wetland. Scale: 1:100 feet/A1.

# PROPOSAL - Wetland Park - Dredged material

Together the selected designed sites show how dredged material can be used in changing the landscapes topography, enhance the experience and create a variety of local natural habitats of Ohio such as oak forest, dunes, prairies and wetlands.

## How to use the dredged material in Penn 7

The Wetland Parks topography was quite flat before the transformation to a wetland park. The area has now been constructed as a wetland park with channels and habitats that are adapted to wetland species. The material that has been dug out for construction of the channels has been placed closely to the channel to minimize distance transportations. The dug out material forms the new topography of the area with small “hills” mixed with dips and wetter spots. In the areas next to Maumee River the ground is wettest while closer to the North Summit Street the elevation is higher and the soil is drier. Within the wetland park there are different kinds of wetland habitats suitable for a range of different wetland vegetation species to enhance the biodiversity. Due to the different vegetation habitats there will also be attracting different kind of birds that prefer higher to lower wetland vegetation.

The material that has been dug out for the channel is around one fourth of the material that has been used in the change of topography. The rest of the dredged material has been collected from the #CDF3 area close to the mouth of Lake Erie (see map of competition under the title “competition description” in methods and implementation chapter, p.13). The total amount of dredged material that will be used in the Wetland Park is after calculations approximately 250 000 cubic yards equal to roughly 191 000 cubic meters.

The dredged material has good characteristics of been high in silt and low drainage capacity and hence a suitable material for constructing wetlands (North Coast Design Competition 2014). As a growing medium

the area’s soil is enriched by the dredged material why the vegetation will thrive.

The Wetland Park meet with the surrounding in the same elevation level, see site plan of Wetland Park p.43. The small “hills” closest to the Maumee River are maximum of 1 meter above the river surface while the elevation of the ground in the higher parts are up to 4 meter above the river surface.



Figure 84. The section  $C_1-C_2$  show the smaller “hills” of dredged material closest to Maumee River (left in the section). © Sara Henriksson



Figure 85. Section  $D_1-D_2$ . Higher upland more dredged material is needed to shape the topography and the shoreline habitat. © Sara Henriksson



## PROPOSAL - Urban Ecological Park

# PROPOSAL - Urban Ecological Park



The view is built upon aerial photo of © Marge Beaver 2008.

Figure 87. Siteplan Urban Ecological Park. Scale: 1:100 feet. Siteplan created by © Sara Henriksson and built upon map © Courtesy of the North Coast Design Competition 2014.

# PROPOSAL - Urban Ecological Park



**Botanical gardens**  
Figure 88. Own picture



**Butterfly gardens**  
Figure 89. Reference: "2010 June, Butterfly" by Lee Ruk (CC BY-SA 2.0)



**Hare**  
Figure 90. Reference: "Another wet hare day" by Steven Ward (CC BY 2.0)

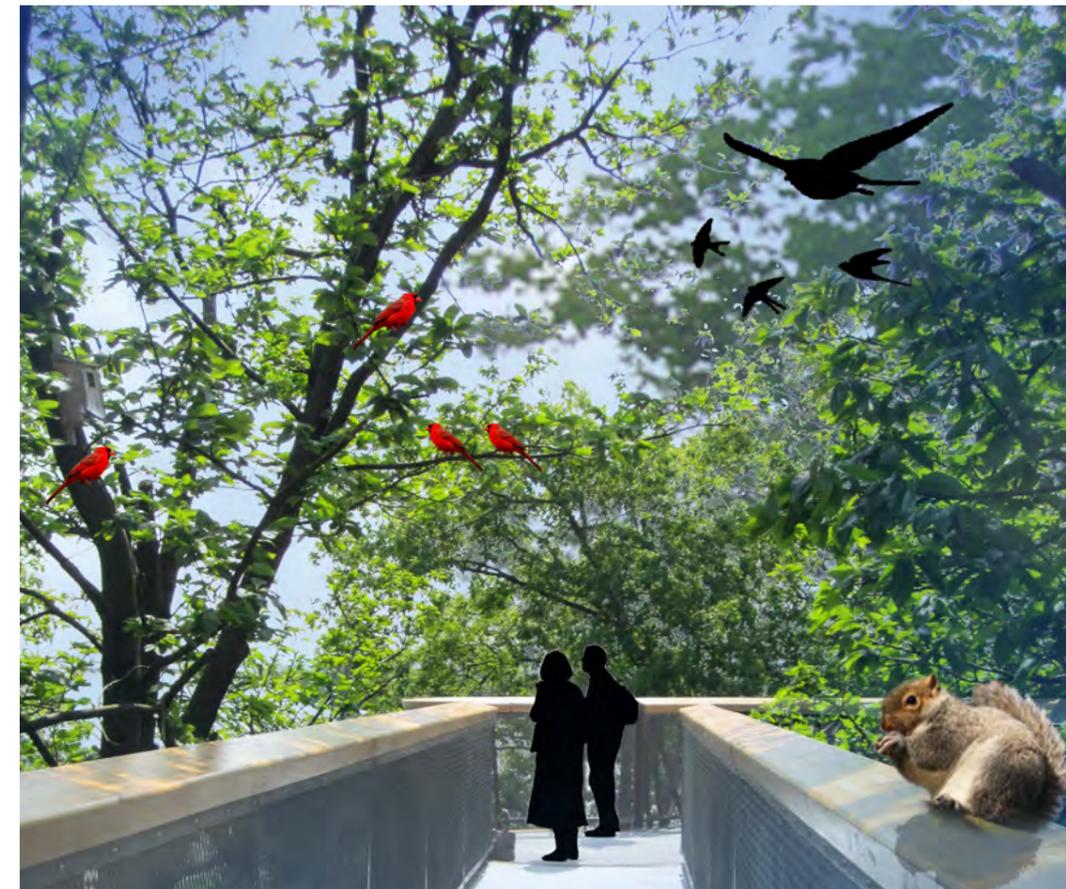


**Butterflies**  
Figure 91. Reference: "Monarch butterfly" by Harald Hoyer (CC BY-SA 2.0)

## Recreational activities

Urban Ecological Park is a city park with wildlife where ecosystems and human activities occur side by side. Birds have nest in the forest, butterflies can be observed in the grasslands and ecological weekend market is taking place. Botanical gardens and a café are located on the grassland hill. The skywalk passes through all habitats in the park; the mixed forest, the pond, grasslands and birch forest.

Along the riverfront, totally accessible for human, sunbathing platforms makes a natural rest stop for the visitor. Urban Ecological Park is a meeting point for outdoor activity and enhances social life in Toledo city.



**3** Figure 92. Perspective; Skywalk in Urban Ecological Park. Created by © Sara Henriksson

## Attracted birds in the forest, birch forest and grasslands



**Great horned owl**  
Figure 93. Reference: "Great Horned Owl" by Brendan Lally (CC BY 2.0)



**Redstart**  
Figure 94. Reference: "Redstart" by Carly Lesser & Art Drauglis (CC BY-SA 2.0)



**Baltimore oriole**  
Figure 95. Reference: "Baltimore Oriole\_6515" by Laura Gooch (CC BY-SA 2.0)



**Carolina wren**  
Figure 96. Reference: "Carolina Wren" by Manjith Kainickara (CC BY-SA 2.0)



**Northern bobwhite**  
Figure 97. Reference: "Northern Bobwhites" by leppyone (CC BY 2.0)



**Sedge wren**  
Figure 98. Reference: "Sedge Wren" by Peter Wilton (CC BY 2.0)



**American kestrel**  
Figure 99. Reference: "American Kestrel" by Anita Ritenour (CC BY 2.0)



**Red-bellied woodpecker**  
Figure 100. Reference: "Red-bellied Woodpecker" by Mike's Birds (CC BY-SA 2.0)

## Local habitats

Mixed forest of existing trees

Skywalk  
Walk path

Walk path

Birch forest

Botanic gardens  
Skywalk

Grassland

Walk path

Walk path

Mixed forest of existing trees

Figure 101. Section E<sub>1</sub>-E<sub>2</sub> Urban Ecological Park. Scale: 1:50 feet/A1.  
Reference: prairie built upon "Prairie" by Joshua Mayer (CC BY-SA 2.0).

*“Inhabitants of Toledo will see how dredge material can be reused and create beautiful places to enjoy nature”*

## How to use the dredged material in Penn 8

In Urban Ecological Parks the topography has been changed in a way that there is a large hill of dredged material placed in the east part of the park. Originally this site was without any change in the topography, see site inventory of Penn 8. The material that the hill exists of is mostly dredged material but the top soil is mixed up with sand to create a soil with better drainage capacity and is suitable for the grasslands that will be established here. It will then also be a good growing medium for this kind of drier vegetation habitats.

The grassland hill will be 10m high and offer a view over the park and the riverfront. On top of the hill a café is placed. 250 000 cubic yards are the approximately amount of dredged material that will be used in the Urban Ecological Park area. A small amount of that material are also

placed along the border of the area in north, east and west to form the ground of the habitat of the mixed forest which is established here. In the same way as Penn 7 the dredged material is brought from the #CDF3 by truck.

When constructing the area closest to Maumee River dredged material will be used as construction material. The dredged material has low bearing capacity and cannot be used to construct residential areas and other buildings but is able to bear constructions for recreations and vegetation (North Coast Design Competition 2014).

The topography of Penn 8 will create dynamic and contrast to the site by the form of the large hill.



Figure 102. Dredged material is being used to construct the grassland hill and the topography of the Urban Ecological Park. Section  $F_1-F_2$  in the site plan of Urban Ecological Park. © Sara Henriksson



*PROPOSAL - Riverside Park*

Figure 103. Perspective; Prairie hill with the research center and terrace. This picture is created by © Sara Henriksson and references picture built upon: "2010 June, Butterfly" by Lee Ruk (CC BY-SA 2.0), "Monarch butterfly" by Harald Hoyer (CC BY-SA 2.0), "Dickcissel (Spiza americana)" by Joshua Mayer (CC BY-SA 2.0), "Ruby-Throated Hummingbird" by thefixer (CC BY 2.0), "Elevator to Treetop Walk" by La Citta Vita (CC BY-SA 2.0), "Prairie" by Joshua Mayer (CC BY-SA 2.0)

# PROPOSAL - Riverside Park



The view is built upon aerial photo of © Marge Beaver 2008.

Figure 104. Siteplan Riverside. Scale: 1:100 feet. Siteplan created by © Sara Henriksson and built upon map © Courtesy of the North Coast Design Competition 2014.

# PROPOSAL - Riverside Park



**Squirrel**  
Figure 105. Reference: "squirrel"  
by jans canon (CC BY 2.0)



**Frog**  
Figure 106. Reference: "Frog"  
by Kev Chapman (CC BY 2.0)



**Fishing in the lake**  
Figure 107. Reference: "34/365"  
by Emily Hildebrand (CC BY-SA 2.0)



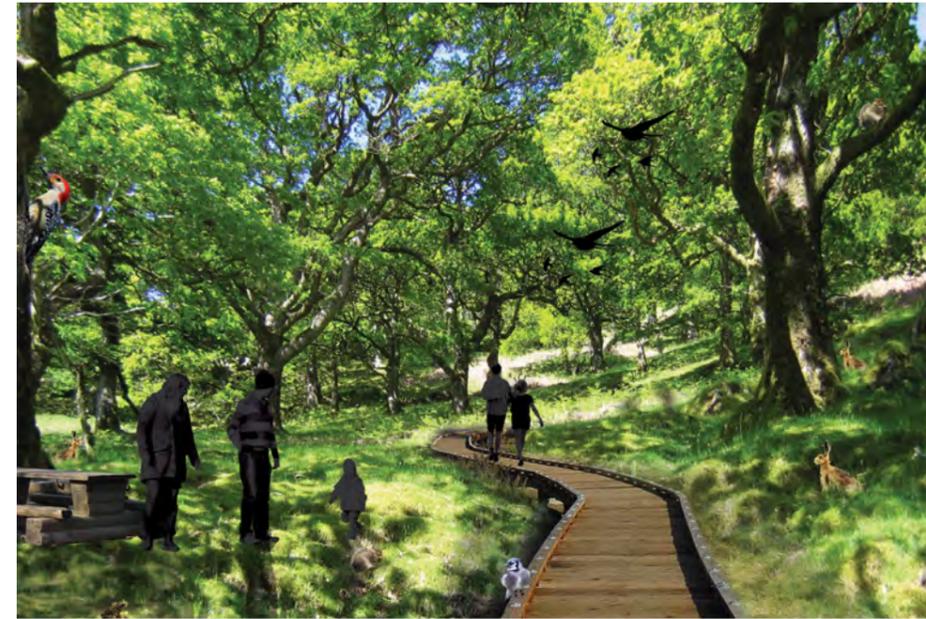
**Fishing**  
Figure 108. Reference: "Fishing at Sunset"  
by Michael Coghlan (CC BY-SA 2.0)

Recreational activities

There are chances to see birds, squirrels, hares or fishes in the lake while visiting Riverside Park. The site exists of an oak forest, recreational prairies, dunes, a lake and the research & visitor center.

RiversideParkhas an accessible waterfront and offers recreationalactivities such as fishing in the lake, prairie walks and picnic possibilities in the forest.

Riverside Park Research center, located on the top of the prairie hill, is an educational building with a green roof and a big terrace offering a view over the different habitats and the riverfront. From the visitor center a skywalk connects Riverside and Urban Ecological Park. Riverside Park makes inhabitants of Toledo see how dredge material can be reused and create beautiful places to enjoy nature.



References picture built upon: "Sessile Oak forest" by Graham (CC BY-SA 2.0); "Memphis Pecker Wood!" by Noel Pennington (CC BY 2.0); "Blue Jay Fluff" by Dawn Huczek (CC BY 2.0); "Frog" by Kev Chapman (CC BY 2.0); "Another wet hare day" by Steven Ward (CC BY 2.0); "squirrel" by jans canon (CC BY 2.0)

**4** Figure 109. Perspective; Walking path in the oakforest. Picture created by © Sara Henriksson

## Attracted birds in prairies, oakforest and the dunes



**Dickcissel**  
Figure 110. Reference: "Dickcissel (Spiza americana)" by Joshua Mayer (CC BY-SA 2.0)



**Blue jay**  
Figure 111. Reference: "Blue Jay Fluff" by Dawn Huczek (CC BY 2.0)



**Redheaded**  
Figure 112. Reference: "Memphis Pecker Wood!" by Noel Pennington (CC BY 2.0)



**Northern cardinal**  
Figure 113. Reference: "The Red Bird" by spisharam (CC BY-SA 2.0)



**Prairie warbler**  
Figure 114. Reference: "Prairie Warbler" by Mike's Birds (CC BY-SA 2.0)



**Bobolink**  
Figure 115. Reference: "Bobolink" by Seabamirum (CC BY 2.0)

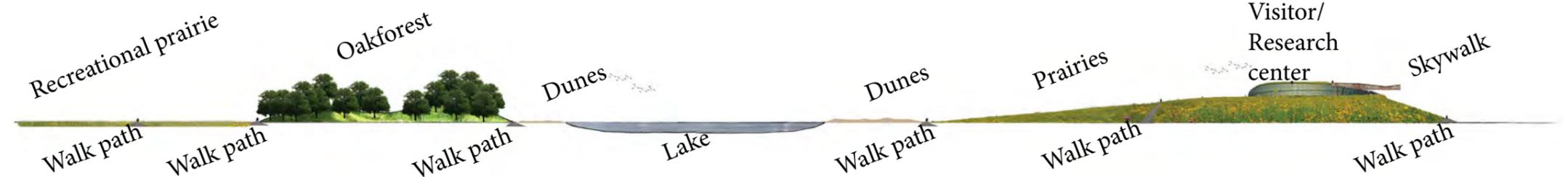


Figure 116. Section G<sub>1</sub>-G<sub>2</sub> Riverside Park. Scale: 1:100 feet/A1. Section created by © Sara Henriksson Reference: prairie built upon "Prairie" by Joshua Mayer (CC BY-SA 2.0).

## How to use the dredged material in Riverside Park

Though a large area of the Riverside site was open with hardly no vegetation the soil was in need of renewal. The soil was mixed up with dredged material, a good growing medium, to create a better soil for vegetation to grow.

By the change and adding of dredged material the topography of the site will be more dramatic and exciting. The site will benefit from two larger hills built up of dredged material from #CDF3 (see map of competition under the title "competition description" in methods and implementation chapter, p.XX). Prairie slope and the Research and Visitor Building on the top (see section E1-E2) are containing roughly 322 000 cubic yards (246 000 m<sup>3</sup>) of dredged material. Under the Research and Visitor Building the ground needs to be strengthening with the stocks to be able to bear the construction of the building. The other structure containing dredged material is the large oak hill in the western part of the Riverside Park (188 000 cubic yards of material). The total amount of used dredged material is around 508 000 cubic yards.

In the same way as in Urban Ecological Park the top soil has to be mixed up with material with large grain size in order to match the requirements of the different habitats. The prairie slope needs drier soil than the oak tree habitats and therefore claims larger amount of sand material.

The oak hill is forming a big area and the park has an undulating landscape and rounded hills.

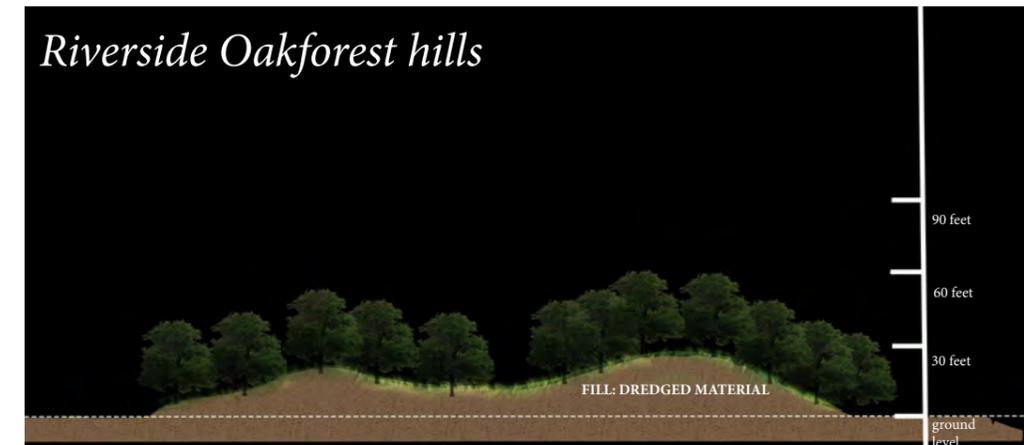


Figure 117. Dredged material is being used to construct the hills in the oakforest. Section H<sub>1</sub>-H<sub>2</sub>. © Sara Henriksson



Figure 118. Dredged material is being used to construct the prairie slope. Section I<sub>1</sub>-I<sub>2</sub>. © Sara Henriksson

The aim of this thesis was to participate in a design competition and while designing sites along the Toledo Riverfront using ecological design approach. Ecological design is an approach which is often applied for compensation of urban biodiversity lost. Global homogenization, urban sprawl, empty abandoned brownfields and expanding industries increasing biodiversity losses. Negative effects of climate change are also visible in our contemporary environment. These factors are declining the quality of our environment. The industries in Toledo have conquered the riverfront and local habitats were completely destroyed. Urban habitats are getting very fragmented and degraded. Rules and regulations are urgently needed to protect these sensitive and fragile habitats. The State of Ohio has lost about 90 % of their wetlands and many other local habitats due to the industrialization and the expansion of the cities. Applying ecological design principles in urban planning will increase urban biodiversity and enhance the quality of our everyday life.

By participating in this competition and studying literature as well as good practice from case studies I have learnt that implementing ecological design in landscape architecture can multiple benefits to our environment. I have tried to implement for the Toledo Riverfront better living conditions for inhabitants and increase biodiversity and resilience of urban habitats. Ecological design is a tool for mitigating climate change and creating sustainable urban environment.

### ***Challenges of ecological design***

Two challenges have been found during my work with implementing ecological design principles into my proposal. Ecological design and sustainable management are in a high demand at the moment however it is still quite young field of landscape architecture. Lack of information and limited number of good implemented case studies is the limited factor in accepting and wide use of ecological design principles. Long-term benefits of implementing ecological design aren't research adequately. That is why many clients think that ecological principles may appear costly and future financial benefits are too low compare to conventional landscape design principles. Some international firms such as Chinese Turenscape and some other landscape architect firms around the world do their best to popularize this approach by designing good ecologically sound sites. Ecological design is still in its' developing phase. More research is needed to gather knowledge about the advantages of ecological approach for present and future.

The second challenge about ecological design is the need of interdisciplinary knowledge. Ecological design needs to be formed by integrated teams with expert knowledge from different subjects. Gathering all knowledge is time-consuming and requires cooperation between the disciplines. This could be one aspect why ecological design may be hard to implement.

### ***Proposal of the design competition***

The objective of this thesis was to find out what is ecological design and how its principles can be applied for re-design of Toledo riverfront. The proposal for the design competition resulted in an overall vision for the riverfront with five different aspects and goals to consider when designing and 3 site designs in the fine scale. The goals of the vision were the following: 1. To create a public riverfront. 2. Enhance the green infrastructure and social outdoor life. 3. Enhance the biodiversity. 4. Improve the connections between Maumee River and the city. 5. Consider the dredged material from Maumee River when designing. I decided to work with ecological design first of all because of my personal interest in ecology and interdisciplinary complex approaches in landscape architecture. By choosing this approach I also rely on my Swedish experience of thinking ecologically and living in green, clean, cycle and pedestrian friendly environment. It was quite naturally try to implement my ecological design experience into the US city.

Following texts describe an analysis of the ecological advantages that were the outcome of the designed sites in Toledo. The ecological advantages have been analyzed in regard to the ecological design principles I have studied in the literature study. Because of that the literature study was done parallel with the design proposal not all principles were not known from the beginning of the site design and the vision. The design of the sites had to be designed before gathering all knowledge about ecological design principles because of the timing with the competition deadline. The following texts will analyze the ecological design principles I have presented in the theoretical background and have been analyzed after finishing the design of the site and the vision.

### ***How does the new Riverfront of Toledo contribute for mitigation of climate change?***

The Riverfront as a green corridor provides Toledo City with connection and it integrates Maumee River with the city. Laurie (1997) said that the

integration is the key aim in ecological design and in my proposal I have also worked with the question of reconnecting the man, nature and river again. The suggested ecological design systems could mitigate and adapt to climate change in following ways:

*The social system* of public space encourages the citizen of Toledo to outdoor activity. Social life enhances and together with a well-developed pedestrian and bike path system will decrease the use of automobiles. This will lower the greenhouse gas emissions. The social system of the riverfront could mitigate climate change and create a better environment in the long-term.

The green corridor along Maumee River is built upon many green areas. It contributes to social activities and improves *biological system* by creating many new wildlife habitats.

*The hydrological system* (the lake, channels, ponds and wetlands) stores carbon in water. Water vegetation absorbs carbon dioxide and indirectly mitigates the effects of climate change.

*The circulation system* of pedestrian and bike paths are important to increase the use of these areas. In the Toledo Riverfront the areas along Maumee River are connected to the Maumee River Bike Trail and are therefore would be accessible and easy to enter from many urban points. The connection between the river and the neighborhoods could be improved remarkably through the access to the riverfront.

*Metabolism system* had limited use in this project but still there are influences that could be said are designed to mitigate and adopt the climate change. As example the visitor and research building is designed with a green roof which will regulate temperature regime and stormwater management. There is also a thought about using solar panels on one part of the roof. Energy to lightning in the designed areas should be generated from local renewable energy sources in the Toledo City.

When analyzing the design of the three chosen sites following aspects of brownfield redevelopment and ecological principles can be found:

#### ***Wetland Park, Urban Ecological Park and Riverside Park:***

- Habitats for both urban citizens and wildlife

- New activities with respect of nature
- Sustainable use of site resources
- New recreation possibilities are given from users' needs of more pedestrian and green areas in the City of Toledo.
- Minimizing negative effects of climate change by creating sustainable ecosystems which absorb and store carbon and cleaning water.
- Protects local habitats of the State of Ohio by introducing them in the park
- Enhances the biodiversity and attracting wildlife
- Enhances the social life and integration possibilities for healthier life style
- Connects the riverfront with the city
- Education about the situation of Toledo Riverfront in the Visitor Center and Research Building (Riverside Park).

#### ***Challenges of the thesis and the design proposal***

Rottle and Yocom (2010, p.8-10) stated "*Ecological design is multidisciplinary and requires thinking at all levels to understand the landscape and its processes. To solve the multifaceted issues that areas, where ecological design will be implemented, are best solved in integrated teams of ecologists, planners and scientists of experts*". Unfortunately in this proposal I had to work by my own and had no even the opportunity to work in interdisciplinary team or even to visit the site. My proposal could be more granted and valuable if I could take soil samples and investigate contamination and how remediation of a site can be implemented. That can give me more precise information about plant species which can be used for remediation. But by doing more and deeper investigations I needed a cooperation with a team of different experts, as Rottle and Yocom mentioned, together with different experts we can create deeper and clearer projects. Me as a landscape architect student has wide knowledge but misses the expertis in specific subject which then demands more time to gather knowledge about. Because of this my proposal could have been more pointed if working in an integrated team.

Nevertheless I'm satisfied with my proposal and my thesis. If I have had more time I would have investigated more case studies and gathered more inspiration.

The second challenge for me was to design in another country which I never visited. In the US many cities are designed in different way to European cities (dense and high downtown and suburbia sprawl model). Cities there are made for cars with far distances between destination points. It is a very different to Sweden where the city centers are compact and have well-designed pedestrian path and bike networks. I tried to apply the pedestrian friendly approach in my proposal by creating social green space linked together and connected to the city's green infrastructure. In Sweden the *Right of Public Access* (Allemansrätten) is a regulation saying that you have the right to be in nature as long as you don't cause damage. With this as given fact I want to design areas for all inhabitants of the City of Toledo.

Some aspects have limited my design and work of the proposal. One of them is connected with the aspect of working with a country I haven't visited and couldn't be able to visit was the left out of the social aspect. There was a hard challenge to know what the inhabitants of Toledo really requested and what kind of people are living in the surroundings of the parks I designed. If I could have visited the place a study of the citizen would have improved my proposal and made it easier for me to understand what kind of activities would be suitable for Toledo Riverfront. In my proposal I focus on birdwatching because this was one of the activities I understood citizens and tourists in Toledo were interested in. But if investigated deeper more activities for different categories of people could have been satisfied.

The third challenge was to develop a thesis out of the design proposal for the competition. The competition gave me the area of where I could implement my ecological design approach. On the other hand, competition gave some restrictions, such as considering the dredged material in my design. Without the competition this was an aspect I wouldn't have thought of, I would probably select another site which is closer and easier to visit. Research question and thesis was built up after the completing the competition and I could not do too many changing in the design part. However the result as thesis is satisfying but requested extra time of thinking.

The fourth challenge that has limited my design proposal is the challenges

that exist within the field of ecological design such as that ecological design isn't well-known around the world and that it is still not a self-evident approach to apply within landscape architecture. This has affected the easiness of finding good examples of inspiration. I have used the four well-known cases in China, Germany and US. If there would have been easier to find more examples I think I could have been inspired of other projects which may have resulted in another proposal of the competition.

## ***Use of Methodology***

### ***Literature study:***

The literature study was going on parallel with the design process, if the deadline for the competition would have been scheduled later I would have got more time to study the expression of ecological design and how to implement it before finishing the design proposal. If that would have been possible I think I could have structured my design process better since I learned knowledge that could have been useful to know from the beginning. As example I found Yeang's book *Ecodesign – A Manual for Ecological Design* after finishing the competition proposal and with his guidelines about using ecological design I think the design would have looked different. The ecological principles could have helped me thinking at all these aspects from the beginning and designed each principle more clear in the sites. I think there were also advantages with studying the literature parallel with the design process hence the literature had impacts on my design choices.

### ***Case studies:***

Case studies were an inspirational part of the thesis work. The choice of *Red Ribbon Park* and the *Blue Circle of Moscow* definitely affected my design directly. The first case, Blue Circle of Moscow, was chosen in cooperation with my supervisor Maria Ignatieva, since she was a part of the interdisciplinary team of Turenscape and also was a part of the big international Landscape architecture competition. I also found the other case, Red Ribbon Park, which was very relevant for my design. The same would also be with the brownfield cases but the selection of an older and a newer design was chosen to get some range of perspective. The brownfield cases gave me an understanding of how small changes

of the sites could have major effect to the surroundings. Existing elements could be preserved and remediation of the soil created safety environments for healthier life styles. Though my selected areas for redesign were brownfields I considered these examples when designing. Since there were no existing buildings or hardly any built structures to consider my redesign had to be operose to create new structures.

### ***The competition:***

The competition helped to form the proposal and choose the approach of ecological design. The competition gave me the opportunity to work in the largest scale I have ever worked together with the intermediate and a fine, detailed scale. The final result was presented in: large scale – the city-green infrastructure connection, medium - the riverfront and fine scale – the sites. Working in three different scales were demanding but gave me a good understanding of how the specific sites along the riverfront was connected in the city but impede the detailness of the fine scale.

### ***Reflection of chosen method***

The method has helped me to find the design of my work by an organized structure of inventorying, analyzing and designing. Selections of features when inventorying and analyzing have been made, LaGro argues that only relevant information for the specific project is necessary and time saving. In the final phase of his method design development, the construction drawings are left out though the competition requires a vision and not specific detailed design. This method has helped me to find the core of the site's design solutions.

### ***Design proposal, site selection:***

The sites were already given by the competition, Toledo as a city and the smaller sites along the riverfront: Penn7, Penn8, Riverside, Edison Park and International Park. The selection of this was quite easy to just confine myself of three sites to be able to handle the work within the given timeframe. In retrospect I think I would have done myself a favor if I had chosen just one site to design in the fine scale to be able to really keep up all details and constructions. Instead the proposal was more conceptual and envisioning, which on the other hand, I believe (was not really appointed), the competition wished for.

### ***Design proposal, inventory & analysis:***

Since my inventory and analysis was based on aerial pictures and photographs without visiting the place my design decisions were affected by this “virtual” reality. I couldn't get the full picture of the place, and some features of the inventory had to be left out. When I'm not at site when inventorying and analyzing I miss aspects such as smell, sightlines and views from specific angles, feelings, the true genius loci, odor and noise. Existing vegetation couldn't be determined as well.

### ***Design proposal, designing & presentation:***

Though the aim of the competition was to create a vision of Toledo Riverfront in the large scale I decided to keep the proposal a bit conceptual. In the perspective showing how it looks like in the park and also showing the feeling of the atmosphere. Afterwards I see other solutions how it could have been designed and presented. One way could have been to design it more detailed with specific vegetation species and furniture but due to the decision of working with three sites and the vision that would have been too time-demanding and detailed with the timeframe.

### ***Conclusion***

Ecological design in landscape architecture is only a small part of that effort that is needed from the worlds' citizens for creating a better climate one earth, hence it creates enhance quality of our living environment. I think it is necessary to think of all these aspects when designing to create a sustainable future for our next generations. The message I bring from the thesis work is that reducing small ecological footprints will contribute to change also in the large scale. I could definitely use the approach of ecological design again.

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**Figure 103. Perspective; Prairie hill with the research center and terrace. This picture is created by © Sara Henriksson and references picture built upon:** “2010 June, Butterfly” [https://www.flickr.com/photos/gardener41/4688968111] by Lee Ruk [https://www.flickr.com/photos/gardener41/](CC BY-SA 2.0)[https://creativecommons.org/licenses/by-sa/2.0/], “Monarch butterfly” [https://www.flickr.com/photos/hhoyer/4244185337] by Harald Hoyer [https://www.flickr.com/photos/hhoyer/](CC BY-SA 2.0),

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**Figure 104. Siteplan Riverside. Created by © Sara Henriksson and built upon map © Courtesy of the North Coast Design Competition 2014.....p.50**

**Figure 105. Squirrel.** Reference: “squirrel” [https://www.flickr.com/photos/43158397@N02/5340357828/in/photolist-5QjZw-8opXVG-91qx9Q-6qpJih-7SrRAw-7sMyvU-3dTtJR-4Jhwqr-9jKJEN-5HFN2P-2NEN]w-588UEb-7ThZA-8uqimY-54e3RM-98UJjY-5BGQ6S-7krF7N-esbQZ-4zkgm9-5njTJ-7EVAWL-52gGcs-8omhkX-8UZ4kP-98RBSv-97gbbG-2TU7ke-7kW3k9-4ZrZtV-9A3fb1-8omKcF-98RcTP-8q3f9z-7KsvpC-55zFXe-98UHNh-4ecFop-6YwCq-

4ReNE3-4YXd1n-xPgMq-7UgYi-psqWE-4gay6a-4drctG-DbyUq-qhu1M-3fHa1Q-f2tMqL]by jans canon [https://www.flickr.com/photos/43158397@N02/](CC BY 2.0)[https://creativecommons.org/licenses/by/2.0/].....**p.51**

**Figure 106. Frog.** Reference: “Frog” [https://www.flickr.com/photos/25553993@N02/4926915211/in/photolist-mKKug-ePSFk-4bYsRG-6cWQtN-6jQEur-8vnJeZ-9kDRgK-9kDRcg-2SZpCo-6LojPt-d9XSc-8wyP2W-93qw6]-8vuU5G-9bdUhq-9xmiCf-6y1nAb-9CnsyA-8eaGqf-9baKav-8ww91P-3Yp3z-9bdTRf-9bdSsq-odCp]-8vnGTg-fjPFh-9bdPmd-9bdPuh-7xiGGh-8KvLp-fhMnWv-9bdSqs-9ba]9t-7xizfo-84BEjK-9bdQMY-8kS7T5-eR2fDK-73vBf6-9baEVD-4rfz6j-9biV9b-4rFBk7-fjPFz-7xiyUC-6hnBkm-4YQAYz-8wyV37-9pRUze] by Kev Chapman [https://www.flickr.com/photos/25553993@N02/](CC BY 2.0) [https://creativecommons.org/licenses/by/2.0/].....**p.51**

**Figure 107. Fishing in the lake.** Reference: “34/365” [https://www.flickr.com/photos/emilyrachelhildebrand/5802723625] by Emily Hildebrand [https://www.flickr.com/photos/emilyrachelhildebrand/](CC BY 2.0)[https://creativecommons.org/licenses/by/2.0/].....**p.51**

**Figure 108. Fishing.** Reference: “Fishing at Sunset” [https://www.flickr.com/photos/mikecogh/8298661206] by Michael Coghlan [https://www.flickr.com/photos/mikecogh/](CC BY-SA 2.0)[https://creativecommons.org/licenses/by-sa/2.0/].....**p.51**

**Figure 109. Perspective; Walking path in the oakforest. Picture created by © Sara Henriksson** Picture built upon: “Sessile Oak forest” [https://www.flickr.com/photos/grahamwell/159962010/] by Graham [https://www.flickr.com/photos/grahamwell/](CC BY-SA 2.0) [https://creativecommons.org/licenses/by-sa/2.0/],

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**Figure 110. Dickcissel.** Reference: “Dickcissel (Spiza americana)” [https://www.flickr.com/photos/wackybadger/9387563889/in/photolist-815tET-6kwp4Q-fin7YS-cprTt-fin1of-fixAqt-4Zs1jy-52EFT6-fixHFP-egqZXH-egr1nx-egr1ZP-egr46R-egr5Ki-egr8W6-egrqoF-egwLUy-egwMYY-egwNio-egwNXG-eHL3RV-fixCdT-fixRFx-fin3Co-fin9JS-egxhY7-fixKwv-fiMT7W-fiMUU3-fU8qGt-eGcZix-d4XFyE-eiqxcZ-epghD1-a4j9Fn-a4n3jw-eTdV2q-a4ndhq-a4neXU-8p2Q79-a4jx3M-f8baAi-f8qCSC-f8r6C]-cprVx-a7ewHk-f8r49E-f8bER6-f8bmnX-f8qpfS] by Joshua Mayer [https://www.flickr.com/photos/wackybadger/](CC BY-SA 2.0) [https://creativecommons.org/licenses/by-sa/2.0/].....**p.51**

**Figure 111. Blue jay.** Reference: “Blue Jay Fluff” [https://www.flickr.com/photos/31064702@N05/4667977924/in/photolist-87uBd1-8kkDYj-e8WJG6-9B4Y8L-e8WKAz-ae9xr-Y5YT-fjbuR4-7u5vvpF-bAKKqf-7TFEhV-6QXkbT-f4n97w-7TtWxj-97xLzP-kmEyPo-fh8HLQ-9B4VFF-fsjKnM-6wHwY3-edwDLw-9B4VFF-fsjKnM-6wHwY3-edwDLw-kmCatk-f1mnWf-f1mnJL-82FZ9X-97xubD-agqQ4o-566HSy-76Fgag-9M2gF8-6qeret-7Rd3vD-fgTpbT-9dt1V7-8EWHUHu-9FHmXD-8sFoxY-6qepzc-e93ntE-e8WHvK-e93ngE-e8WKKz-aamAdx-edZ5vU-e8WKKX-e93ndf-e8W]se-e93nyd-e93pij-e93q9u] by Dawn Huczek [https://www.flickr.com/photos/31064702@N05/](CC BY 2.0)[https://creativecommons.org/licenses/by/2.0/].....**p.51**

**Figure 112. Redheaded woodpecker.** Reference: “Memphis Pecker Wood!” [https://www.flickr.com/photos/noelpenn/3410145015/in/photolist-7jHbD-jEYK47-6ckTiH-6v788P-ezzvWZ-8GEToX-81Hnat-873zjF-yLthv-31bzWh-6MrMYX-eRFPJ]-8hDQgW-6ujHKq-gzKs6P-bTSzPa-bEXQc9-bTSzRp-a24ab7-4pG2Fr-eRUDXq-59jDmv-a5CX44-4pL5Xq-bUcUPy-bUcV2G-bUcVYf-bCe8Ms-bUcT7Y-4pL5Kq-4pL6x7-4pL5mh-4pG3hg-a5FPQ3-a5CY8F-a5CTGc-a5CVZB-a5FM5L-a5CUug-a5CU6F-a5CWop-a5FKZS-a5CVyT-a5FMrq-a5CFQaG-a5CXog-a5CWHP-79nCX1-a21g9T-67qizF] by Noel Pennington [https://www.flickr.com/photos/noelpenn/](CC BY 2.0) [https://creativecommons.org/licenses/by/2.0/].....**p.51**

**Figure 113. Northern cardinal.** Reference: “The Red Bird” by spisharam [https://creativecommons.org/licenses/by-sa/2.0/].....**p.51**

**Figure 114. Prairie warbler.** Reference: “Prairie Warbler” [https://www.flickr.com/photos/noelpenn/]by Mike's Birds [https://www.flickr.com/photos/pazzani/](CC BY-SA 2.0)[https://creativecommons.org/licenses/by-sa/2.0/].....**p.51**

**Figure 115. Bobolink.** Reference: “Bobolink” [https://www.flickr.com/photos/seabamirum/2765915403/in/photolist-c1XYsm-7VEaGr-c1XyHl-g7mRo6-7Wci9G-5dzj3g-5dq3hB-7WbYdn-5dq3rM-5dpV1R-514W]K-514WVv-5198K7-6GgBrw-5dq3FH-89vZj]-bv26YT-d4XFCW-9gQbUy-eiBwjf-h9PtNQ-jMQ4ek-ahzFip-a4nuu7-mCuf1C-bng7Mi-fWSWBq-6cUPub-6ciBNH-eadaezG-epttm2-9Bk]PM-bnbiD2-g4MukQ-fYAf3Q-5dunZQ-hjV]Pte-i7om3P-bnaSDB-2Va11-a7hnhS-axbBZt-5BzgC]-hh94Q1-cdRBny-eMYoHH-eBeHYB/ekR]kq-eUNW]j-9EyD45]by Seabamirum [https://www.flickr.com/photos/

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**Figure 116. Section G<sub>1</sub>-G<sub>2</sub> Riverside Park. Scale: 1:100 feet/A1. Section created by © Sara Henriksson** Reference: prairie built upon “Prairie” [https://www.flickr.com/photos/wackybadger/9387528435] by Joshua Mayer [https://www.flickr.com/photos/wackybadger/](CC BY-SA 2.0)[https://creativecommons.org/licenses/by-sa/2.0/].....**p.51**

**Figure 117. Dredged material is being used to construct the hills in the oakforest. Section H<sub>1</sub>-H<sub>2</sub>. © Sara Henriksson.....p.52**

**Figure 118. Dredged material is being used to construct the prairie slope. Section I<sub>1</sub>-I<sub>2</sub>. © Sara Henriksson.....p.52**

# APPENDIX - Competition Submission



Vision plan of new Toledo Riverfront. The Riverfront will be a green corridor that linking the sites along Maumee River. The visitor can experience a variety of local habitats and wildlife. The green corridor improves the environment for pedestrians and bicyclist moving along the Maumee River Trail. The highlighted areas are the Wetland Park, Urban Ecological Park and Riverside Park.

## VISION OF TOLEDO RIVERFRONT

### From industrial past to sustainable biodiverse future

#### Project description

The objective of the vision of Toledo Riverfront is to redesign the Maumee River from industrial brownfields to a green corridor with natural habitats which include recreation activities for the inhabitants of Toledo. The development will enhance public life of Toledo by creating an attractive, active and accessible riverfront.

The design is based on the respect of ecological principles. It introduces new habitats with dominance of native Ohio plants which will enhance biodiversity (plants, insects, birds etc.). Maumee River will be resurrected and man will be reconnected with nature.

The new riverfront is inviting people for outdoor activity and will be a new icon for Toledo City. Toledo Riverfront Vision is built upon 3 areas; The Wetland, Ecological Urban Park and Riverside Park. They all have different attraction points and a range of activities suitable for all inhabitants of Toledo. The Wetland Park has walking trails, bird watching huts and the lake for kayaking and exploration of wetland wildlife. Ecological Urban Park is the most activity intense area which contains botanical garden exhibition, green theatre and weekend market. Finally the Riverside Park contains the visitor/research building with a green roof which offers a view over the site and the riverfront.

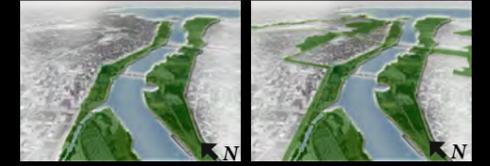


#### Location of Toledo

Toledo Riverfront is located south of Lake Erie in the state of Ohio, US and is ranked 7th of the ports of the Great Lakes. The vision transforming the riverfront from today's industrial areas to a sustainable biodiverse environment.



Wetland Park, Urban Ecological Park and Riverside Park are allocated on the north side of Maumee River close to the river mouth and Lake Erie.

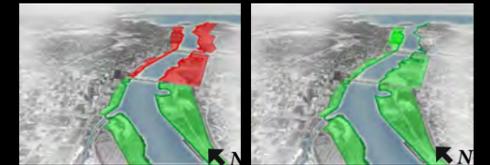


#### The Green Corridor

The Green Corridor is a part of Vision of Toledo Riverfront (left). These green areas are connected to the Green Corridor project of Toledo City (right). Together the projects will connect a green network within the city of Toledo.



The project shows how the vision can be applied in the areas; Riverside Park, Wetland Park and Urban Ecological Park. The sites are designed on the respect of ecological principles.



#### A public riverfront

Toledo Riverfront to the left showing the public access today and to the right the riverfront of the vision and the future.

#### A public riverfront

Transform industrial and non-accessible riverfront to accessible and walkable ecological parks.



Toledo city is based on both sides of the Maumee River and the riverfront access for the inhabitants are highly restricted. The areas along the riverfront are industrial facilities. By giving the citizens of Toledo the chance to use the riverfront will enhance the quality of the city though water has a positive influence on human health and life.

#### Enhance green urban infrastructure and social outdoor life

River parks will be an important green corridor connector to other green patches within urban matrix of Toledo.



The parks along the river will be connected and a part of the green corridor project of Toledo city. The new riverfront is inviting people for outdoor activity and will be a new icon for Toledo City. The vision will contribute to a more sustainable and healthier life for the people in Toledo due to its enhancement of green public areas.

#### Enhance the biodiversity

By using native vegetation and wildlife lost local habitats typical for the region of Ohio will be reconstructed.



Riverside Park, Urban Ecological Park and Wetland Park are connected in the green network of Toledo. Different habitats are designed to offer a possible chance to enjoy the local habitats and their wildlife of Ohio within the city of Toledo. Habitats to be explored are: grasslands, prairies, oak forests, dunes, mixed forest and wetlands.

#### Improve the connections between Maumee River and the city

Pedestrian paths and bike lines will increase the connections along the river and the surroundings.



More entrances and walk paths increases the accessibility to the parks and riverfront. Paths inside the parks will also be connected to the Maumee River Trail, MRT. The green corridor improves the environment for pedestrians and bicyclist moving along the MRT.

#### Consider the dredged material from Maumee River

The vision will show how dredged material can be reused in landscape by changing the topography and creating new habitats.

# APPENDIX - Competition Submission



Siteplan Wetland Park. Scale: 1:100 feet.  
The Wetland Park offers wildlife in the city.



1 Perspective; birdwatching and the wooden boardwalk.

## VISION OF TOLEDO RIVERFRONT

*From industrial past to sustainable biodiverse future*

### Wetland Park

Losses of natural wetlands occurred due to the industrialization and expansion of the city. A constructed wetland is being designed in Penn 7 closest to the mouth of Maumee River. The site has two types of habitats. The northern part with higher wetland vegetation and closest to the river lower wetland vegetation to enhance the biodiversity. To construct the wetland native species are used which also are a natural cleanser of the water. The bird watching towers and hiding huts let birdwatchers observe wildlife closely. The site can be explored through kayaking in the channel passing through the Wetland Park or the pedestrian paths and platforms.



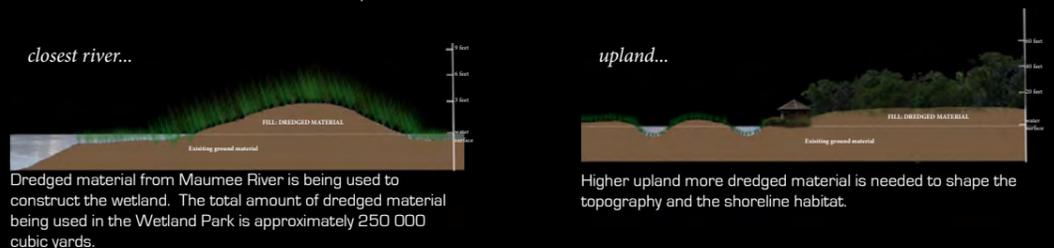
2 Perspective; kayaking in one of the channels in the higher part of the wetland.



3 Perspective; birdwatching tower.

### DREDGED MATERIAL USE

Together the areas show how dredged material can be used in changing the landscapes topography, enhance the experience and create a variety of local natural habitats of Ohio; Oak forest, dunes, prairies and wetlands.



# APPENDIX - Competition Submission

## Dredged material use

### Riverside Prairie slope



Dredged material is being used to construct the prairie slope. The total amount of dredged material being used in the Riverside Park is approximately 200 000 cubic yards. Section E<sub>1</sub>-E<sub>2</sub>.

### Riverside Oakforest hills



Dredged material is being used to construct the hills in the oakforest. Section F<sub>1</sub>-F<sub>2</sub>.

## Dredged material use

### Urban Ecological Park Grassland hill



Dredged material is being used to construct the grassland hill and the topography of the Urban Ecological Park. The total amount of dredged material being used in the Urban Ecological Park is approximately 250 000 cubic yards. Section G<sub>1</sub>-G<sub>2</sub>.

*“Inhabitants of Toledo will see how dredge material can be reused and create beautiful places to enjoy nature”*

## Riverside Park

There are chances to see birds, squirrels, hares or fishes in the lake while visiting Riverside Park. The site exists of an oak forest, recreational prairies, dunes, a lake and the research & visitor center.

Riverside Park has an accessible waterfront and offers recreational activities such as fishing in the lake, prairie walks and picnic possibilities in the forest.

Riverside Park Research center, located on the top of the prairie hill, is an educational building with a green roof and a big terrace offering a view over the different habitats and the riverfront. From the visitor center a skywalk connects Riverside and Urban Ecological Park. Riverside Park makes inhabitants of Toledo see how dredge material can be reused and create beautiful places to enjoy nature.



Siteplan Riverside. Scale: 1:100 feet.

Siteplan Urban Ecological Park. Scale: 1:100 feet.

## Urban Ecological Park

Urban Ecological Park is a city park with wildlife where ecosystems and human activities occur side by side. Birds have nest in the forest, butterflies can be observed in the grasslands and ecological weekend market is taking place. Botanical gardens and a café are located on the grassland hill. The skywalk passes through all habitats in the park; the mixed forest, the pond, grasslands and birch forest.

Along the riverfront, totally accessible for human, sunbathing platforms makes a natural rest stop for the visitor. Urban Ecological Park is a meeting point for outdoor activity and enhances social life in Toledo city.



Fishing in the lake



Botanical gardens



Fishing



Butterfly gardens



Hare



Frog



Butterflies



Squirrel

# VISION OF TOLEDO RIVERFRONT

*From industrial past to sustainable biodiverse future*



1 Perspective; Prairie hill with the research center and terrace.



2 Perspective; Walking path in the oakforest.



3 Perspective; The walk path in the birch forest.



4 Perspective; Skywalk in Urban Ecological Park.



Dickcissel



Blue jay



Redheaded woodpecker



Northern cardinal



Prairie warbler



Bobolink



Great horned owl



Redstart



Baltimore oriole



Carolina wren



Northern bobwhite



Sedge wren



American kestrel



Red-bellied woodpecker



Section C<sub>1</sub>-C<sub>2</sub> Riverside Park. Scale: 1:100 feet/A1.



Section D<sub>1</sub>-D<sub>2</sub> Urban Ecological Park. Scale: 1:50 feet/A1.