THE URBAN BAYOU
Balancing Natural Processes and Urban Development in New Orleans

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CONTEXT: Global Relevance

Opportunities
- Mississippi Delta
- California Bay
- Po Delta
- Rhine Delta
- Niger Delta
- Savannah Delta

Challenges
- Yangzi Delta
- Tone Delta
- Pearl River Delta
- Mekong Delta
- Coliwung River Delta

Map showing various global deltas and their challenges and opportunities.
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   Understanding the City in the Delta

2. CITY SCALE
   Allowing Natural Processes

3. DISTRICT SCALE
   A Neighborhood Living with Water

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   Cultural Learning Center
HURRICANE KATRINA

A Man-Made Disaster

Legend:
- Earth Levee
- Levee + Flood Wall
- Breached Levee
- Topped Levee
- Main Storm Surge
- Flood Depth
  - 0-1 meter
  - 1-2 meters
  - 2-3 meters
  - 3-4 meters

Storm Surge
Rise in lake water
level-entered canals,
poorly constructed
levee walls failed

London Ave Canal
Levee Breaches
17th Street Canal
Levee Breach
Industrial Canal
Levee Breaches
40-Apent Canal
Levee Breach

Mississippi River-Gulf
Outlet (MR-GO)

Primary Storm Surge
Funneled &
strengthened through
man-made canals

Intercoastal Waterway

MR-GO
Levee Breaches

Lake Pontchartrain

Flood Depth

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DELTA SCALE
3x3x3 LAYER ANALYSIS: Understanding the Situation

DELTA SCALE

1700
1900
2010

Landscape

Infrastructure

Occupation

CITY SCALE

1722
1855
2010

DELTA SCALE
NATURAL LEVEES: In the Delta

Landscape + Occupation Layers

DEVELOPMENT OF NATURAL LEVEES

1) Before Flood

2) During Flood

3) After Many Floods

LEGEND

Natural Levee
Urbanization on Natural Levee
Urbanization outside Natural Levee

0 20 km

DELTA SCALE
NATURAL LEVEES: In New Orleans

LEGEND
Natural Levees
Historic Wetlands

Development Timeline
1722
1788
1817
1855
1985
1949
2010

0 2 km

DEVELOPMENT TRENDS
Historical Development
Building only on natural levees & high ground

Recent Development
Infrastructural improvements enable expansion

SECTION
Levees
Natural Levees
Gentilly Ridge
Artificial Fill
Sea Level
The Bowl
City Park

Landscape + Occupation Layers

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DELTA SCALE
SINKING LAND: In New Orleans

LEGEND
Total settlement of soils as of 1989

- 10 - 50 cm
- 50 - 130 cm
- >130 cm

CONSEQUENCES OF URBANIZATION OF WETLANDS

1) Natural Situation: wetlands, peat soils, high water table

Wetlands
Water Table
Peat Soils

2) Effects of Drainage & Urbanization = Soil Subsidence

Urbanization
Drainage

DELTA SCALE

0 km
2 km
LAND LOSS: In the Delta

LEGEND
- Dike
- Canal
- Former Shoreline (1900)
- New Open Water

0 20 km

DECREASING SEDIMENT LOADS
ca. 1700
1980-1990

CONSEQUENCES OF THE LEVEE SYSTEM
1) Common Regular Flooding = Sedimentation

2) Levee System = Controlled Flooding = Lack of Sedimentation

3) Lack of Sedimentation = Land Loss

Landscape + Infrastructure Layers
INCREASING INFRASTRUCTURE

Occupation + Infrastructure Layers

infrastructural improvements
(pumps & canals)

ALLOWED
development beyond the natural levee

development beyond the natural levee
REQUIRED
need for additional infrastructure
(surge barriers & flood walls)

Legend:
- River Dike
- Dike
- Pump Station
- Sluice / Lock
- Floodgate
- Outfall Canal
- Open Canal
- Underground Canal
- Minor Underground Canal
- Drainage Basin Boundary

0 2 km

DELTA SCALE
Bayou = water typically found in flat, low-lying areas, either a very slow moving stream with poorly defined shoreline or a marshy lake or wetland
EXISTING CANALS

Disconnection from & Concealing of Water System

Outfall Canals

Typical Outfall Canal Section
OUTFALL CANAL OPTIONS

Re-Connecting City & Water

Existing Situation
- canals create barriers to neighborhoods
- canals prone to flooding
- poorly constructed flood walls

Option 1: Raise Land
+ direct at-grade connection from canal to lake
- closest resemblance to historic conditions, potential to re-introduce natural processes of bayou
- immense amount of fill required
- land needed to be raised is already highly urbanized

Option 2: Lower Canals
- no longer direct at-grade connection from canal to lake
+ canals no longer barrier to neighborhoods
+ existing neighborhoods can remain

Option 1B: Raise Land Along Canal
+ direct at-grade connection from canal to lake
+ closest resemblance to historic conditions, potential to re-introduce natural processes of bayou
+ vast majority of existing neighborhoods can remain
PROPOSED CANALS

Height of “Super Levee” Living with Water
Things to Consider:

Storm Surge - Hurricane Katrina (+/- 100 year storm) west shore of Lake Pontchartrain = +1.5 to +3m

Tidal Changes - New Canal USCG Measuring Station = max +.3m / min -.12m

Sea Level Rise - IPCC Report by 2100 = max +1m / mid +.5m / low +.2m

Proposed Outfall Canal Section
URBAN WATER CYCLE

Separating the Threats: Rain Water / Storm Surge

THREAT:
heavy rains, storm water flooding, lack of storage capacity

THREAT:
storm surges & sea level rise via the lake

vascular network
street swales, canals & ponds to store and infiltrate rain water

strategic overflow channels
during peak storm surges bayous can overflow and be accommodated in vascular network

open connection to lake
natural marsh and swamp environments including tides and water fluctuations

soft edge along lake front
swamps, cypress forests
A NEW CITY STRUCTURE

Typical Hierarchy

1. Urban Bayou
2. Boulevard Canal Street
3. Neighborhood Swale Street

2. Boulevard Canal Street

3. Neighborhood Swale Street
MASTER PLAN

Hinge
Connecting Key Community Buildings

Concepts

School
Cultural Center
Retail
Dillard University
MASTER PLAN

Water Network

LEGEND

Bayou Corridor
Tidal Zone
Max Flood Level

District Drainage
Agriculture Water Garden
Bayou Inlet
Bayou Overflow
Super Levee

Boulevard Canal
Canal Overflow
Neighborhood Swale
Water Storage Area

Canal Overflow
Water Storage Park

Super Levee
Bayou Overflow

Water Garden
Drainage

Water Storage Park

Boulevard Canal
Swale Street

Tidal Zone
Typical Water Level
Peak Flood Level

DISTRICT SCALE
BLOCK TYPOLOGIES: THE EXISTING URBAN FABRIC OF NEW ORLEANS

Key Map

01 French Quarter

02 Mid-City

03 Dillard A

04 Dillard B

05 St Bernard

[Images of maps and photographs]
BUILDING TYPOLOGIES: THE HISTORIC URBAN FABRIC OF NEW ORLEANS

Two-Bay Shotgun

Two-Bay Creole Cottage

Three-Bay Creole Townhome

Four-Bay Shotgun

Four-Bay Creole Cottage

Four-Bay Creole Townhome
CASE STUDIES (Districts & Water)

AMSTERDAM, Steigereiland
- medium density development
- primarily fixed water level, floating houses can respond to water changes

HAMBURG, HafenCity
- high density mixed-use development
- barrier buildings and operable doors can respond to fluctuating river levels

ROTTERDAM, Nesselande
- medium and low density development
- individual parcels responsible for addressing water storage, variety of responses: elevated, floating, on land
BLOCK & BUILDING TYPES

Barrier Buildings
Water Edge Block (Creole Townhouses)

Typical Water

Max Water
**Elevated Buildings**

Elevated Alley Loaded Block (Shotgun & Creole Cottages)

**Typical Water**

**Max Water**
BLOCK & BUILDING TYPES

Floating Buildings
Floating Block (Creole Cottage Hybrid)

Typical Water

Max Water
THE URBAN BAYOU: Fluctuating Water

Key Map

Typical Water Level

Peak Water Level
THE URBAN BAYOU: Neighborhood Views

Front Door vs Back Yard / Hard vs Soft Edge

Community Gardens
KEY BUILDING IN THE DISTRICT: Cultural Center

OBJECTIVES, FUNCTIONS & CONCEPTS

1) COMMUNITY

A place to gather for educational, social and recreational activities

Respect local New Orleans traditions and values: Music & Food

2) WATER EDUCATION

Information center showcasing new district and allowing residents to experience water

Building highlights ways of living with water & the bayou landscape

- Ability to tolerate dynamic water levels
- Rain water harvesting / gray water re-use
- Water for passive cooling

Key Map

01 Ridge Grid Approach

02 Lake Grid Approach

03 Community Side

BUILDING SCALE
SITE PLAN

Key Map

01 Boat Dock
02 Community Gardens
03 Parking Entrance
04 Nature Bridge
05 Landscape Terrace
06 Cafe Seating
07 Floating Stage
08 Cypress Forests
09 Typical Water Level
10 Tidal Zones
11 Peak Flood Level
12 High Ground
13 Bayou Corridor Trail

0 500 m
BUILDING CONCEPTS

TECTONICS

MOVEMENT & VIEWS
BUILDING CONCEPTS

LANDSCAPE

ZONES

Landscape terrace

Nature Pier

Embracing Community (Edible Gardens)

Embracing Nature (Passive)

Embracing Nature (Active Leisure)
BUILDING CONCEPTS

ATRIUM
Central Circulation & Pivot Point

PROGRAM DISTRIBUTION

- Cafe + Exhibition
- Sports + Theater
- Multi-Purpose Rooms
- Interior Circulation
- Exterior Circulation
- Parking
BUILDING CONCEPTS

- Angled Columns
- Facade Line
- Masses

Connecting Element
Inside vs Outside
Solid vs Void

Atrium (Transparent Pivot Point)

Gymnasium (Semi Transparent)

Theater (Solid)

Cafe (Open vs Closed)

Facade & Building Composition

A NORTHEAST FACADE

B SOUTHWEST FACADE

C SOUTHEAST FACADE

D NORTHWEST FACADE
FACADE OUTSIDE

+16.5m

+12.5m

+8.5m

+4.5m

BUILDING SCALE
ELEVATIONS

A NORTHEAST FACADE

B SOUTHWEST FACADE

BUILDING SCALE
ELEVATIONS

C SOUTHEAST FACADE

D NORTHWEST FACADE
THE CLOSEABLE CAFE

MAX WATER LEVEL

Adapting to Water

Top of Dike +4.5m

100 Year Flood +3.5m

Ground Level +1.0m

Tidal Zone +0.5m

Sea Level +0.0m

Roof +12.5m

Second Floor +8.5m

First Floor +4.5m

Ground Floor +0.5m

0 4 m
THE CLOSEABLE CAFE

Bayou Context
CONSTRUCTION

01) FOUNDATIONS & FRAME

02) BEAMS & COLUMNS

03) WALLS & FLOORS

04) ROOF & FACADE

MATERIALS

Concrete Footings: 500x1000mm Reinforced Concrete
Foundation Walls: 300mm Reinforced Concrete
Piles: 300x300mm Reinforced Concrete
Angular Columns: 500x500x8000mm Steel
Frame Beams: HEA 500x300mm Steel

Typical Columns: IPE 500x300mm Steel
Typical Beams: IPE 500x300mm Steel

Typical Walls: Steel Frame / Insulation / Vapor Barrier / Finish
Typical Floors: Concrete Slab / Insulation / Vinyl Flooring
Typical Ground Floor: Concrete Plinth / Insulation / Waterproofing / Concrete Slab / Vinyl Flooring

Glass Facade: Steel Frame / Double Glazing Glass
Aluminum Facade: Steel Frame / Insulation / Aluminum Panels

Typical Roof: Concrete Slab / Vapor Barrier / Thermal Insulation / Filter Map / Drainage Layer / Top Soil / Vegetation
THE CENTRAL ATRIUM

WATER CYCLE
1) Rooftop Catchment
2) Water Wall
3) Atrium Pool
4) Waste Water
5) Settling Tank
6) Tidal Flow Wetlands
7) Horizontal Flow Wetlands
8) Vertical Flow Wetlands
9) Reuse

+02 Floor

+01 Floor

+00 Floor

-010 Floor

0 16 m

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BUILDING SCALE
THE CENTRAL ATRIUM
THE PORCH & LANDSCAPE TERRACE

FLUCTUATING WATER LEVELS

Top of Dike +4.5m
100 Year Flood +3.5m
Ground Level +1.0m
Tidal Zone +0.5m
Sea Level +0.0m
THE PORCH
GREEN ROOF: Detail

1) Top Soil 100mm
   Drainage Layer 50mm
   Protective Roof Resistant Matting 10mm
   Waterproof Membrane 10mm
   Thermal Insulation 160mm
   Vapor Barrier 10mm
   Reinforced Concrete slab 300mm
   IPE Steel Beam 500x300mm

2) Aluminum Panel Cladding 20mm
   Steel Battens / Ventilated Cavity 60mm
   Weather Proofing 10mm
   Steel Frame / Thermal Insulation 200mm
   Vapor Barrier 10mm

3) HEA 500x300x14mm

4) Intake Air & Exhaust Air Pipes 125mm

5) Steel Window Frame Footing

6) Double Glazing 8mm glass + 16mm Cavity
   In Steel Frame 200mm

7) Angled Steel Column RHS 500x300x14mm
1) Internal Wall:
   Steel Frame w/ Thermal Insulation 120mm
   Exterior Sheeting 15mm
   Vapor Barrier 10mm
   Plaster Board Finish 15mm
2) Double Glazing 8mm glass + 16mm Cavity
   In Steel Frame 200mm
3) Angled Steel Column RHS 500x300x14mm
4) Vinyl Composite Flooring 30mm
   Thermal Insulation 120mm
   Reinforced Concrete Slab 300mm
   IPE Steel Beam 500mm x 300mm
5) Aluminum Panel Cladding 20mm
   Steel Battens / Ventilated Cavity 60mm
   Weather Proofing 10mm
   Steel Frame / Thermal Insulation 200mm
   Vapor Barrier 10mm
6) Steel Beam HEA 500x300x14mm
7) Intake Air & Exhaust Air Pipes 125mm
8) Ceiling Mounted Decentralized Air Ventilation Unit
9) Hot & Cold Water Pipes 100mm / Insulation 25mm
10) Supply Air & Intake Air Pipes 125mm
CLIMATE SYSTEMS

COOLING STRATEGY
- Individually Climatized Rooms
- Pipe Routes for Cold / Hot Water

WATER STRATEGY
- Rain Water Runoff
- Rain Water Storage
THE URBAN BAYOU

Typical Water Level
EVALUATION / CONCLUSIONS

Project uses existing theory (working with nature) and applies it to a specific site.

The “fight against water” doesn’t have to be a fight when urban development and architecture are initially integrated with natural processes.

Site specific design is always better than generic technically engineered solutions.

Water challenges need to be addressed at all scales (region, city, district, building) to ensure integrated results.
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Thank You!