AQUARENA
The Coolest stadium in the world(cup)
Aquatecture

- Water-Architecture integration

Problem statement

Technical Research

- Scope
- Examples

Opportunity

- Qatar World Cup
- Celebrating Football
- Celebrating Water

Context

- Museum of Islamic Art
- Site Analysis

Climate

- Temperature
- Humidity
- Wind

Concept

- Form-Finding
- Climate and Water integration

Design

- Overview
- Access + Routing
- Drawings

Water-use

- Summer
- Winter
- All-year round

Detail Design

- Structural Principles
- Building Fragment
- Façade
- Drawings

Impressions
Aquatecture
Water-Architecture integration

Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

--- Fossil Fuels ---
--- Air-conditioning ---
--- Desalination ---
TECHNICAL RESEARCH
How can the design of a closed water cycle be optimized to integrate the consumption, climatization and architectural exposure of water in hot, arid regions?
Aquatecure
Water-Architecture integration
Problem statement

Technical Research

Scope

Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions
THE OPPORTUNITY
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
- Qatar World Cup
  Celebrating Football
  Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Facade
Drawings
--- Impressions ---

Doha Port Stadium

Cool Fan-zones

Cool stadiums

Colosseum
Football stadiums are places of emotion and fascination. Places where people celebrate football.” (FIFA)
Celebrating Water

Taj Mahal

Jeddah Fountain

MIA

national Assembly

Al Hambra

Water dispensers

Museum of Islamic Art

Site Analysis

Climate

Temperature
Humidity
Wind

Concept

Form-Finding
Climate and Water integration

Design

Overview
Access + Routing
Drawings

Water-use

Summer
Winter
All-year round

Detail Design

Structural Principles
Building Fragment
Façade
Drawings

Impressions
Aquatecture
Water-Architecture integration
Problem statement
Technical Research
Scope
Examples
Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water
Context
Museum of Islamic Art
Site Analysis
Climate
Temperature
Humidity
Wind
Concept
Form-Finding
Climate and Water integration
Design
Overview
Access + Routing
Drawings
Water-use
Summer
Winter
All-year round
Detail Design
Structural Principles
Building Fragment
Façade
Drawings
Impressions
**Aquatecture**
Water-Architecture integration

**Problem statement**

**Technical Research**
Scope
Examples

**Opportunity**
Qatar World Cup
Celebrating Football
Celebrating Water

**Context**
Museum of Islamic Art

**Site Analysis**

**Climate**
Temperature
Humidity
Wind

**Concept**
Form-Finding
Climate and Water integration

**Design**
Overview
Access + Routing
Drawings

**Water-use**
Summer
Winter
All-year round

**Detail Design**
Structural Principles
Building Fragment
Facade
Drawings

**Impressions**

---

MIA Entrance
1 km
Limited shading, Artificial Irrigation

MIA Park

---

1 km

MIA

---

Site

---

N

---

MIA Park

---

Limited shading, Artificial Irrigation

---

1 km

---

MIA

---

Site

---

N
--- Aquitecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art

--- Site Analysis ---
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Façade
Drawings
--- Impressions ---
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art

Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions
THE CLIMATE
Aquatecture
Water-Architecture integration

Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Mean high: 41°C
Mean low: 31°C
Coolest season from November – March
Hottest season from May - September
Mean sunshine hours / day: 10
Solar radiation: 1500 W/m²
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Relative Humidity

Mean daily high: 83% - 94% (Night)
Mean daily low: 18% - 49% (Day)
Fog days / year: approx. 20 (March + November)
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Average wind speed: 3-5 m/s
Daily max: 5-8 m/s
Wind speed increases in coastal area
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Prevailing wind direction NW - NNW
THE CONCEPT
--- Aquitecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
● Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Façade
Drawings
--- Impressions ---

Typical stadium design: symmetrical layout
No main facade
Public functions distributed evenly
Convex roof shape - large volume

Proposed design: Asymmetric layout
Main facade oriented towards prevailing wind
Public spaces and functions concentrated towards prevailing wind direction
Concave roof shape - less air volume to cool and more efficient radiant cooling
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding

Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions
---------- Aquatecture ----------
Water-Architecture integration

Problem statement

---------- Technical Research ----------
Scope
Examples

---------- Opportunity ----------
Qatar World Cup
Celebrating Football
Celebrating Water

---------- Context ----------
Museum of Islamic Art
Site Analysis

---------- Climate ----------
Temperature
Humidity
Wind

---------- Concept ----------
Form-Finding
Climate and Water integration

---------- Design ----------
Overview
Access + Routing
Drawings

---------- Water-use ----------
Summer
Winter
All-year round

---------- Detail Design ----------
Structural Principles
Building Fragment
Façade
Drawings

---------- Impressions ----------
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Facade
Drawings
--- Impressions ---
Aquatecture
Water-Architecture integration

Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Isometric view - circulation
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
- Scope
- Examples
--- Opportunity ---
- Qatar World Cup
- Celebrating Football
- Celebrating Water
--- Context ---
- Museum of Islamic Art
- Site Analysis
--- Climate ---
- Temperature
- Humidity
- Wind
--- Concept ---
- Form-Finding
- Climate and Water integration
--- Design ---
- Overview
  - Access + Routing
  - Drawings
--- Water-use ---
- Summer
- Winter
- All-year round
--- Detail Design ---
- Structural Principles
- Building Fragment
- Façade
- Drawings
--- Impressions ---

Isometric view - functions

3rd floor
- Public Toilets (Upper Tier)

2nd floor
- Media Center and TV Studios

1st floor
- VIP boxes
- VIP Restaurant
- VIP Toilets

Ground floor
- Public Cafe
- Kiosk
- Merchandising shop

-1 floor
- Public Toilets (Lower Tier)
- Kiosk
- First Aid + Security room
- Players + Match Officials
Aquatecture
Water-Architecture integration

Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions

Isometric view - functions
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
- Access + Routing
  Drawings
- Water-use
  Summer
  Winter
  All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Facade
Drawings
--- Impressions ---
--- Aquitecture ---
Water-Architecture integration
Problem statement

--- Technical Research ---
Scope
Examples

--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water

--- Context ---
Museum of Islamic Art
Site Analysis

--- Climate ---
Temperature
Humidity
Wind

--- Concept ---
Form-Finding
Climate and Water integration

--- Design ---
Overview

● Access + Routing

--- Water-use ---
Summer
Winter
All-year round

--- Detail Design ---
Structural Principles
Building Fragment
Facade
Drawings

--- Impressions ---
--- Aquitecture ---
Water-Architecture integration

Problem statement

--- Technical Research ---
Scope
Examples

--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water

--- Context ---
Museum of Islamic Art
Site Analysis

--- Climate ---
Temperature
Humidity
Wind

--- Concept ---
Form-Finding
Climate and Water integration

--- Design ---
Overview

● Access + Routing

--- Water-use ---
Summer
Winter
All-year round

--- Detail Design ---
Structural Principles
Building Fragment
Facade
Drawings

--- Impressions ---
--- **Aquatecture** ---
*Water-Architecture integration*

--- **Problem statement** ---

--- **Technical Research** ---
*Scope*
*Examples*

--- **Opportunity** ---
*Qatar World Cup*
*Celebrating Football*
*Celebrating Water*

--- **Context** ---
*Museum of Islamic Art*
*Site Analysis*

--- **Climate** ---
*Temperature*
*Humidity*
*Wind*

--- **Concept** ---
*Form-Finding*
*Climate and Water integration*

--- **Design** ---
*Overview*

*Access + Routing*
*Drawings*

--- **Water-use** ---
*Summer*
*Winter*
*All-year round*

--- **Detail Design** ---
*Structural Principles*
*Building Fragment*
*Façade*
*Drawings*

--- **Impressions** ---
---Aquatecture---
Water-Architecture integration
Problem statement

---Technical Research---
Scope
Examples

---Opportunity---
Qatar World Cup
Celebrating Football
Celebrating Water

---Context---
Museum of Islamic Art
Site Analysis

---Climate---
Temperature
Humidity
Wind

---Concept---
Form-Finding
Climate and Water integration

---Design---
Overview

● Access + Routing

---Water-use---
Summer
Winter
All-year round

---Detail Design---
Structural Principles
Building Fragment
Facade
Drawings

---Impressions---

Isometric view - functions
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview

Access + Routing

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Isometric view - circulation
Aquatecture

Water-Architecture integration

Problem statement

Technical Research

Scope
Examples

Opportunity

Qatar World Cup
Celebrating Football
Celebrating Water

Context

Museum of Islamic Art
Site Analysis

Climate

Temperature
Humidity
Wind

Concept

Form-Finding
Climate and Water integration

Design

Overview

Access + Routing
Drawings

Water-use

Summer
Winter
All-year round

Detail Design

Structural Principles
Building Fragment
Façade
Drawings

Impressions
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
• Access + Routing
  Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Facade
Drawings
--- Impressions ---
Aquatecture
Water-Architecture integration

Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions

Isometric view - stands
Stadium capacity: 35,334

Media stand
VIP Seating
Aquatecture
Water-Architecture integration

Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview

- Access + Routing
- Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions

---

Isometric view - stands

Stadium capacity: 35,334

Media stand
VIP Seating

---
--- Aquitecture
Water-Architecture integration
Problem statement
--- Technical Research
  Scope
  Examples
--- Opportunity
  Qatar World Cup
  Celebrating Football
  Celebrating Water
--- Context
  Museum of Islamic Art
  Site Analysis
--- Climate
  Temperature
  Humidity
  Wind
--- Concept
  Form-Finding
  Climate and Water integration
--- Design
  Overview
  ● Access + Routing
  Drawings
--- Water-use
  Summer
  Winter
  All-year round
--- Detail Design
  Structural Principles
  Building Fragment
  Façade
  Drawings
--- Impressions
**Aquatecture**
Water-Architecture integration

**Problem statement**

**Technical Research**

- **Scope**
- **Examples**

**Opportunity**

- **Qatar World Cup**
- **Celebrating Football**
- **Celebrating Water**

**Context**

- **Museum of Islamic Art**
- **Site Analysis**

**Climate**

- **Temperature**
- **Humidity**
- **Wind**

**Concept**

- **Form-Finding**
- **Climate and Water integration**

**Design**

- **Overview**
- **Access + Routing**
- **Drawings**

**Water-use**

- **Summer**
- **Winter**
- **All-year round**

**Detail Design**

- **Structural Principles**
- **Building Fragment**
- **Facade**
- **Drawings**

**Impressions**

---

**Site Plan**

- **Doha Museum of Islamic Art**
- **Site Analysis**
- **Weather**
- **Climate**
- **Temperature**
- **Humidity**
- **Wind**

---

**MIA**

- **Dhow harbour**
- **Ticket offices**
- **Vehicle access**
- **Security check**
- **Boat access**

---

1 - Public parking area
2 - Doha Museum of Islamic Art
3 - Stadium site
4 - Traditional Dhow harbor
5 - Doha corniche park
6 - Doha dry docks and industrial zone

---

**Water-use**

- **Summer**
- **Winter**
- **All-year round**

---

**Detail Design**

- **Structural Principles**
- **Building Fragment**
- **Facade**
- **Drawings**

---

**Impressions**

---
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions
**Aquatecture**
Water-Architecture integration

**Problem statement**

**Technical Research**
- Scope
- Examples

**Opportunity**
- Qatar World Cup
- Celebrating Football
- Celebrating Water

**Context**
- Museum of Islamic Art
- Site Analysis

**Climate**
- Temperature
- Humidity
- Wind

**Concept**
- Form-Finding
- Climate and Water integration

**Design**
- Overview
- Access + Routing
- Drawings

**Water-use**
- Summer
- Winter
- All-year round

**Detail Design**
- Structural Principles
- Building Fragment
- Façade
- Drawings

**Impressions**

---

![Ground Floor Plan](image-url)
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
● Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
● Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions

3rd Floor Plan
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

4th Floor Plan
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Roof Plan
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
• Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Facade
Drawings
--- Impressions ---
WATER USE
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
● Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions

Radiant cooling

- Refrigeration: 140,000 kW
- Solar energy: 56,000 kW
- Wind energy: 20,000 kW
- Water usage: 400,000 m³/day

Fan-coil units: 2,000 units
Solar collectors: 1,000 units
Wind turbines: 100 units
Water tanks: 10,000 m³

Temperature of water OUT: 12 °C
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions

---

Dew water collection

Dew collected (l/night)*

<table>
<thead>
<tr>
<th></th>
<th>Bahrain</th>
<th>Doha (KSA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Winter</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Mean precipitation [mm/month]: 11
Mean inflow for Dew collection [m³]: 31.23
Summer days: 164
Winter days: 145

Dew water collection potential [m³/year]: 7,065.7
Rain water collection potential [m³/year]: 4,130
Total water collection potential [m³/year]: 12,097

---

Dew water collection

Dew collection

Dew collection

Dew collection

Dew collection

Dew collection
**Aquatecture**

Water-Architecture integration

**Problem statement**

**Technical Research**

- Scope
- Examples

**Opportunity**

- Qatar World Cup
- Celebrating Football
- Celebrating Water

**Context**

- Museum of Islamic Art
- Site Analysis

**Climate**

- Temperature
- Humidity
- Wind

**Concept**

- Form-Finding
- Climate and Water integration

**Design**

- Overview
- Access + Routing
- Drawings

**Water-use**

- Summer
  - Winter
- All-year round

**Detail Design**

- Structural Principles
- Building Fragment
- Façade
- Drawings

**Impressions**

---

**Rule sheet**

- Raschel mesh (woven acrylic fabric yarn)
- Facade area (m²): 12,170
- Wind (l/min): 1
- Fog hours Doha (h/yr): 4
- Fog days Doha (d/yr): 70

Fog harvesting potential (m³/yr): 960.6

---

**Fog harvesting**
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
● All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

---

Waste-water treatment

- Stadium capacity: 35,334
  - Estimated stadium water demand (m³/y): 16,084
  - Daily stadium water demand (m³/d): 311.67
  - Grass field water demand (m³/y): 7,590

Capacity of wastewater treatment cells
Width (m) | Length (m) | Depth (m) | Volume per unit (m³) | # of units
---|---|---|---|---
2.45 | 9.4 | 0.8 | 18.42 | 18

Total volume capacity (m³): 331.63

---
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
- All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Membrane distillation works with temperatures <90°C
Current small production plants can produce 100 m³/day using residual heat (300-400 kW) or 64.111 kWh

Daily water production (m³/day): 100
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
● All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Summary – water use
70% savings in water-use

31,291 m² Aluminium Roof
Deep water potential: 2,108,7 m³
Solar panel potential: 4,516,8 m³
9,537 m² Solar-thermal collectors
Solar energy conversion: 11.13 MW
12,120 m² Evaporative cooling facade
4°C temperature drop
Envelopes cooling: 5°C temperature drop
Heat energy potential: 90 GJ / y

1.25 MW Absorption Chillers
Each unit 1.0 MW
Membrane Desalination Unit
Water from thermal energy to produce 100 GJ / y freshwater

TES (Thermal Energy Storage) Reservoir
Stores thermal energy (partially underground)

Total flow wastewater treatment capacity: 375,000 m³
One hour with water drawn off salads of the required for desalination 42% water savings
BUILDING TECHNOLOGY
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design

● Structural Principles

Building Fragment
Façade
Drawings

Impressions
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
● Structural Principles
Building Fragment
Façade
Drawings
--- Impressions ---
--- Structural composition ---
Steel roof structure
Massive concrete reinforced columns
Reinforced concrete Floor beams
Massive concrete reservoir shells
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
- Structural Principles
- Building Fragment
- Façade
- Drawings

Impressions

Structure: stands

Massive concrete beams transfer loads from the stands to the columns.

Concrete columns transfer loads from the beams evenly to the foundations.

Some tensile bracing (steel cables) required to resist structural rotation against live loads e.g., wind.
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions
Structure: roof
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
- Building Fragment
  Façade
  Drawings

Impressions
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles

Building Fragment
Façade
Drawings

Impressions
Aquitecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
• Building Fragment
  Façade
  Drawings

Impressions
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
   Scope
   Examples
--- Opportunity ---
   Qatar World Cup
   Celebrating Football
   Celebrating Water
--- Context ---
   Museum of Islamic Art
   Site Analysis
--- Climate ---
   Temperature
   Humidity
   Wind
--- Concept ---
   Form-Finding
   Climate and Water integration
--- Design ---
   Overview
   Access + Routing
   Drawings
--- Water-use ---
   Summer
   Winter
   All-year round
--- Detail Design ---
   Structural Principles
   ● Building Fragment
   Façade
   Drawings
--- Impressions ---
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade
Drawings

Impressions

Building fragment

Insulated Aluminium panels
Extruded Aluminium gutter
Hollow tube steel purins
Aluminium roof cladding panels
Concrete column segment (finished with mortar joints)
Evaporative cooling facade
Concrete stand segment
Reinforced concrete beams
Reinforced concrete slab (cast in situ)
Concrete column footings
Foundation tie-beam network
Pile foundations
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade

Drawings

Impressions
Interior Climate

--- Aquatecture ---
Water-Architecture integration
Problem statement

--- Technical Research ---
Scope
Examples

--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water

--- Context ---
Museum of Islamic Art
Site Analysis

--- Climate ---
Temperature
Humidity
Wind

--- Concept ---
Form-Finding
Climate and Water integration

--- Design ---
Overview
Access + Routing
Drawings

--- Water-use ---
Summer
Winter
All-year round

--- Detail Design ---
Structural Principles
Building Fragment
Façade
Drawings

--- Impressions ---
Aquitecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Façade

Drawings

Impressions
--- Aquatecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
Façade
• Drawings
--- Impressions ---
### Plans

---

**Aquatecture**

Water-Architecture integration

---

**Problem statement**

---

**Technical Research**

Scope

Examples

---

**Opportunity**

Qatar World Cup

Celebrating Football

Celebrating Water

---

**Context**

Museum of Islamic Art

Site Analysis

---

**Climate**

Temperature

Humidity

Wind

---

**Concept**

Form-Finding

Climate and Water integration

---

**Design**

Overview

Access + Routing

Drawings

---

**Water-use**

Summer

Winter

All-year round

---

**Detail Design**

Structural Principles

Building Fragment

Façade

- Drawings

---

**Impressions**
Façade design

Aquitecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment

• Façade
Drawings

Impressions

Raschel Mesh
Façade design

Distance from attractor point dictates density of circles

Raschel Mesh

--- Aquitecture ---
Water-Architecture integration
Problem statement
--- Technical Research ---
Scope
Examples
--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water
--- Context ---
Museum of Islamic Art
Site Analysis
--- Climate ---
Temperature
Humidity
Wind
--- Concept ---
Form-Finding
Climate and Water integration
--- Design ---
Overview
Access + Routing
Drawings
--- Water-use ---
Summer
Winter
All-year round
--- Detail Design ---
Structural Principles
Building Fragment
• Façade
Drawings
--- Impressions ---
--- Aquitecture ---
Water-Architecture integration

--- Technical Research ---
Scope
Examples

--- Opportunity ---
Qatar World Cup
Celebrating Football
Celebrating Water

--- Context ---
Museum of Islamic Art
Site Analysis

--- Climate ---
Temperature
Humidity
Wind

--- Concept ---
Form-Finding
Climate and Water integration

--- Design ---
Overview
Access + Routing
Drawings

--- Water-use ---
Summer
Winter
All-year round

--- Detail Design ---
Structural Principles
Building Fragment

Façade
Drawings

--- Impressions ---
**Facade design**

**Facade Exploded**
- Corrugated Aluminium plates
  - to seal facade and for wind protection
- Steel compression beams
- Insulated PVC Water supply pipe
- Steel connectors to concrete columns
- Steel tension cables
- Reshel mesh
- Hollow steel compression member
- Steel compression beam
  - (span between concrete columns)
- Polycarbonate gutter
  - fixed to underside of facade
- Water from facade falls through gutter into a 'water mist' flowing around stadium perimeter

---

**Technical Research**
- Scope
- Examples

**Opportunity**
- Qatar World Cup
- Celebrating Football
- Celebrating Water

**Context**
- Museum of Islamic Art
- Site Analysis

**Climate**
- Temperature
- Humidity
- Wind

**Concept**
- Form-Finding
- Climate and Water integration

**Design**
- Overview
- Access + Routing
- Drawings

**Water-use**
- Summer
- Winter
- All-year round

**Detail Design**
- Structural Principles
- Building Fragment
  - Façade Drawings

**Impressions**
Facade

---

Aquatecture

Water-Architecture integration

Problem statement

---

Technical Research

Scope

Examples

---

Opportunity

Qatar World Cup

Celebrating Football

Celebrating Water

---

Context

Museum of Islamic Art

Site Analysis

---

Climate

Temperature

Humidity

Wind

---

Concept

Form-Finding

Climate and Water integration

---

Design

Overview

Access + Routing

Drawings

---

Water-use

Summer

Winter

All-year round

---

Detail Design

Structural Principles

Building Fragment

Façade

• Drawings

---

Impressions

---

Facade
Aquatecture
Water-Architecture integration
Problem statement

Technical Research
Scope
Examples

Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water

Context
Museum of Islamic Art
Site Analysis

Climate
Temperature
Humidity
Wind

Concept
Form-Finding
Climate and Water integration

Design
Overview
Access + Routing
Drawings

Water-use
Summer
Winter
All-year round

Detail Design
Structural Principles
Building Fragment
Facade
Drawings

Impressions
Aquatecture
Water-Architecture integration
Problem statement
Technical Research
Scope
Examples
Opportunity
Qatar World Cup
Celebrating Football
Celebrating Water
Context
Museum of Islamic Art
Site Analysis
Climate
Temperature
Humidity
Wind
Concept
Form-Finding
Climate and Water integration
Design
Overview
Access + Routing
Drawings
Water-use
Summer
Winter
All-year round
Detail Design
Structural Principles
Building Fragment
Façade
Drawings
Impressions
THE RESULT
View of the Arabian Gulf
Thank you for your attention

Questions?