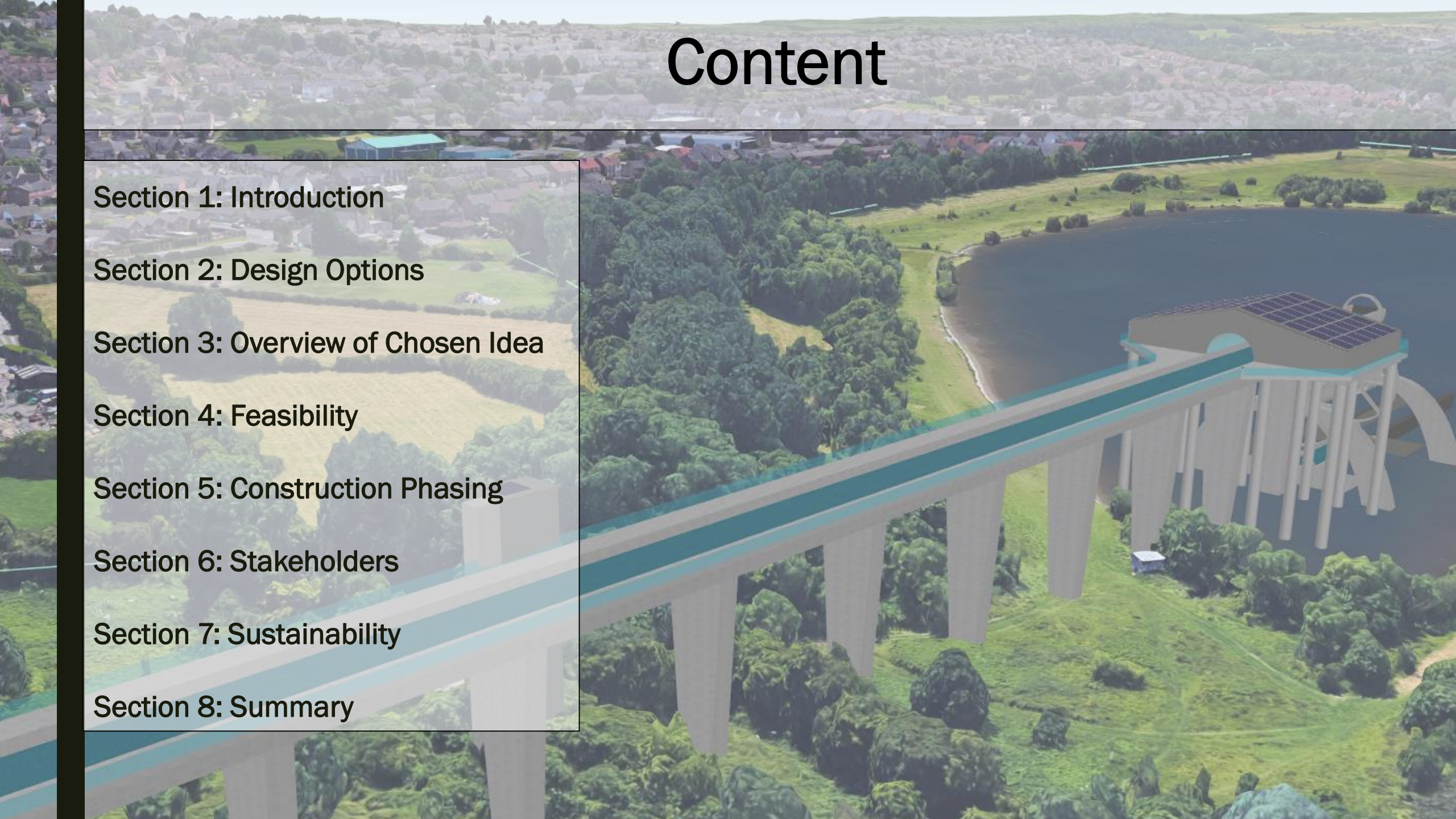
CHESTERFIELD CANAL BOAT LIFT: FINAL PRESENTATION

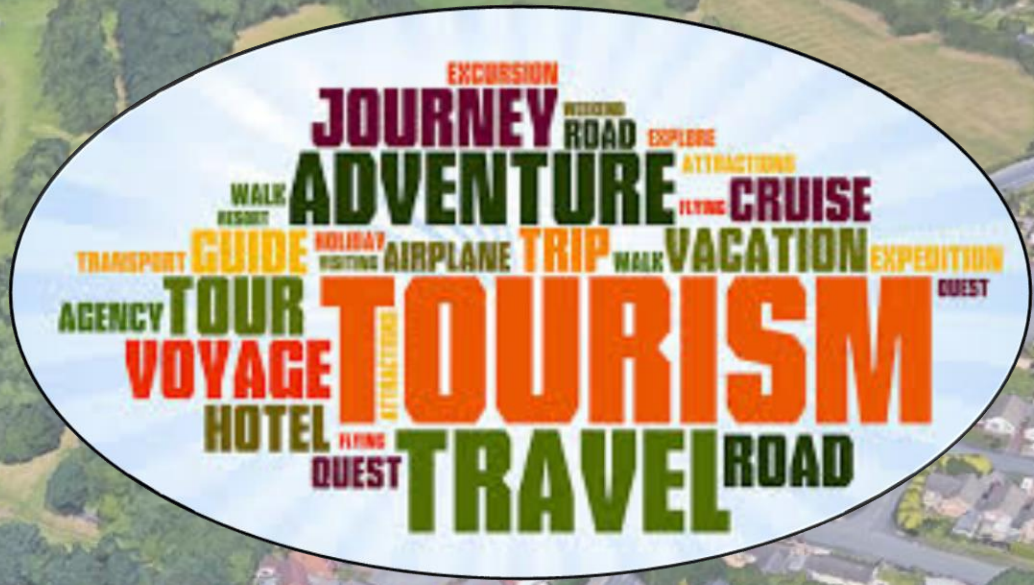
Engineers: Curtis Pearson, Harry Mark and Minhang Rai

Content



Section 1: Introduction to Project

- Site Location
  - *Nethermoor Lake Marina, Killamarsh*
- What's Required
  - *21.3m boat lift*
  - *Negligible amount of water transferred between marina and canal*
  - *Renewable Energy source*
  - *Ancillary Buildings*
- Budget of approx. £20 Million



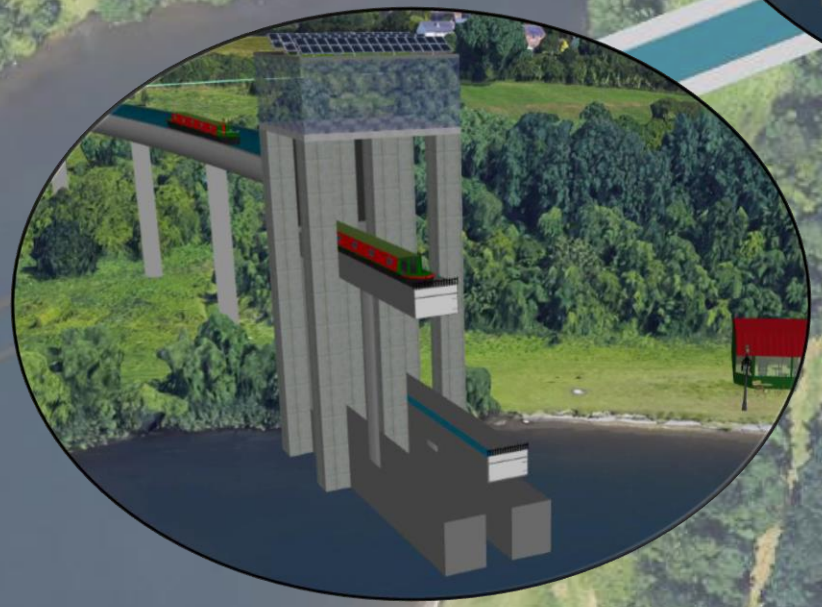
https://www.herald.co.zw/tourism-growth-projected-at-20pc-in-2-years/

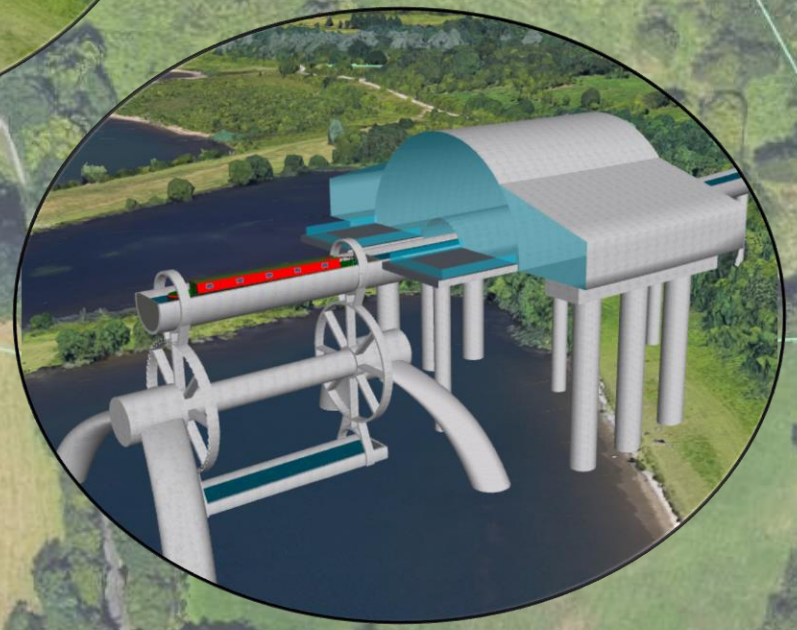
http://www.energy.soton.ac.uk/

Section 2: Design Options

Our Initial 3 ideas

- Conveyor
- Hydraulic
- Rotating Wheel





Section 2: Design Options

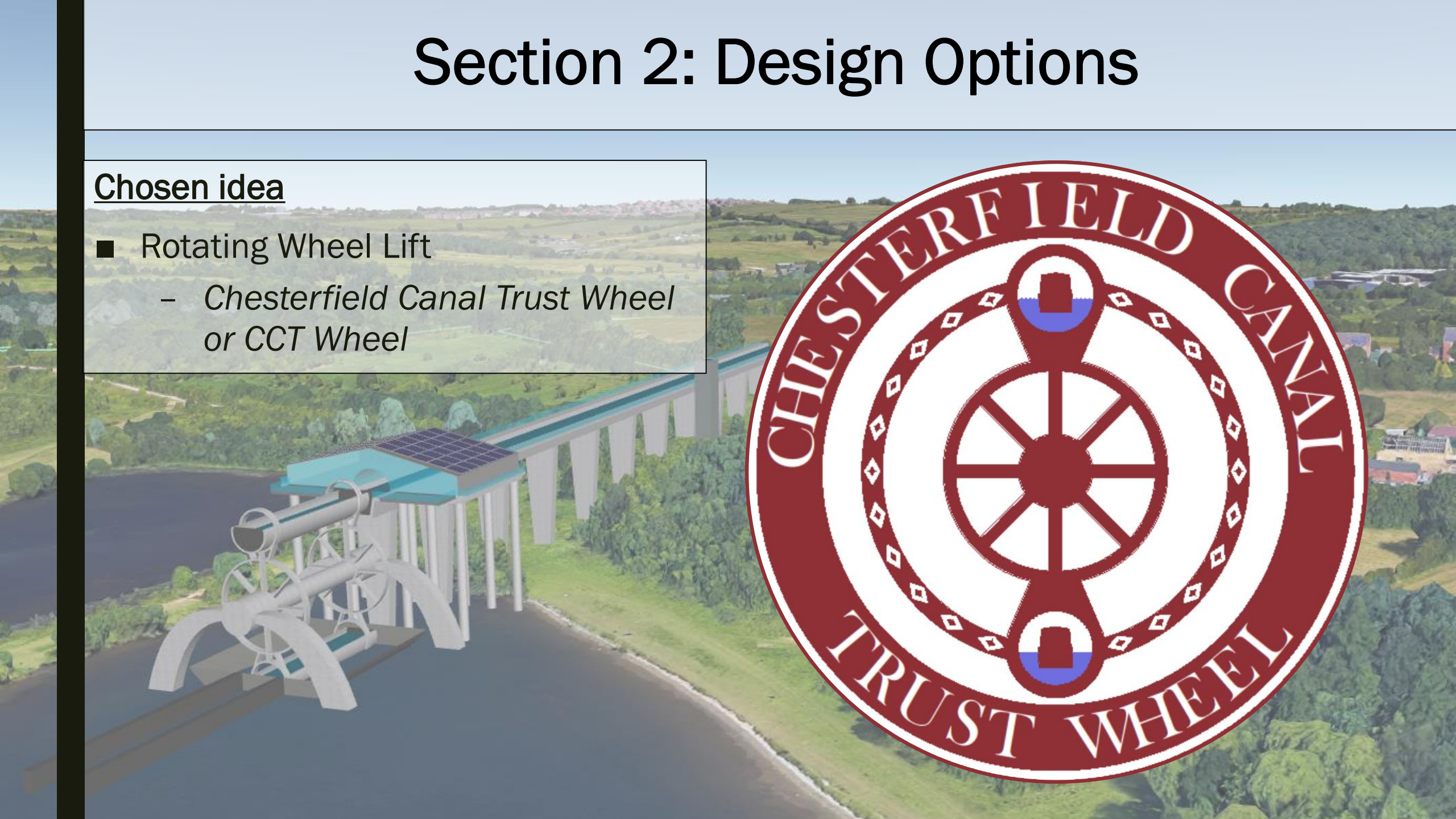
Decision Matrix

Criteria	Conveyor	Hydraulics	Wheel
Aesthetic/Tourism (25%)	20%	15%	25%
Buildability/Practicality (25%)	5%	10%	25%
Cost (25%)	25%	5%	15%
Impact of renewable energy (25%)	10%	20%	20%
Final Score	**60%**	**40%**	**85%**

Section 2: Design Options

Chosen idea

- Rotating Wheel Lift
  - *Chesterfield Canal Trust Wheel or CCT Wheel*

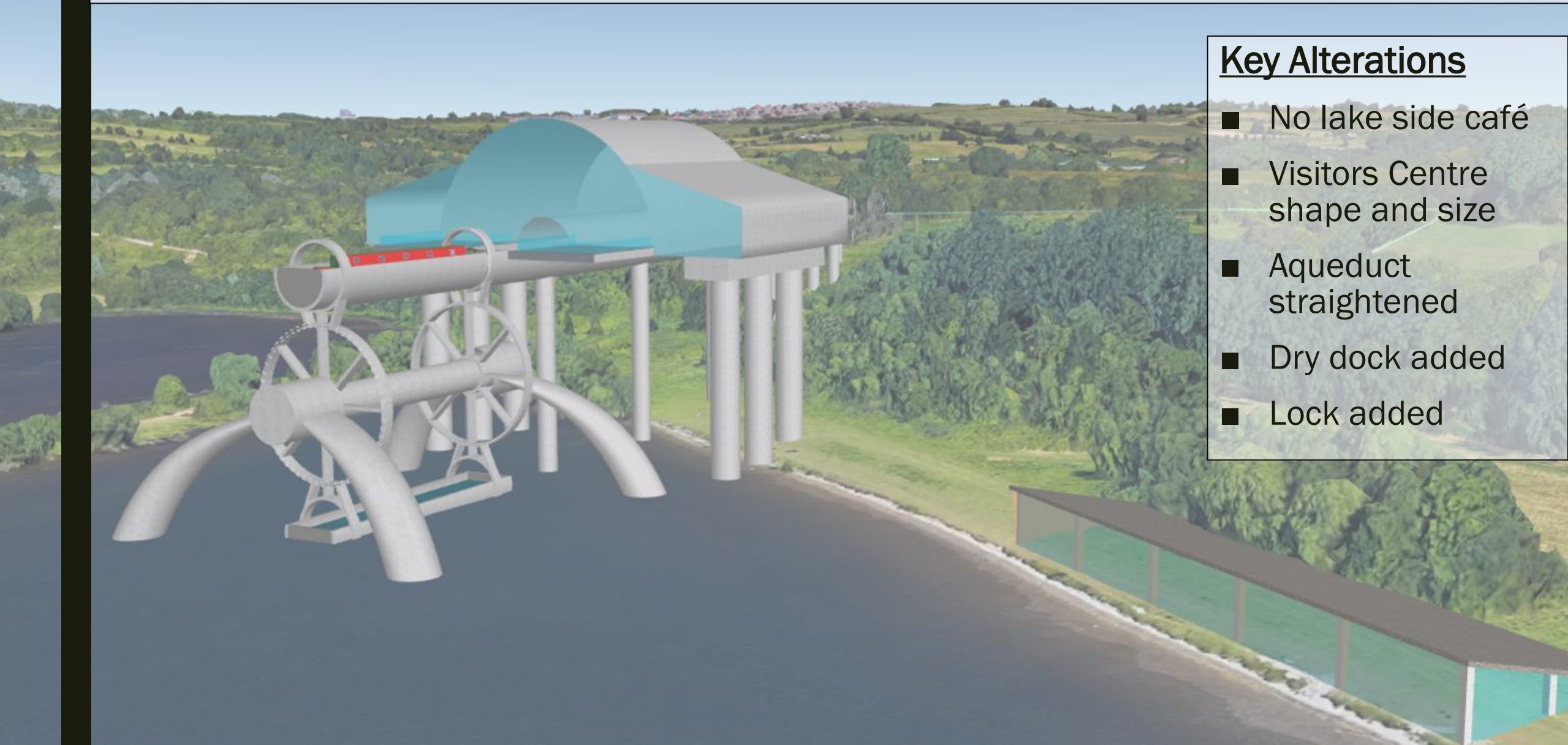


Section 3: CCT Wheel

Reason for going forward with this idea

- Tourism
- Aesthetics
- Renewable energy impact
- Low maintenance
- Reliability

Section 3: CCT Wheel



Key Alterations

- No lake side café
- Visitors Centre shape and size
- Aqueduct straightened
- Dry dock added
- Lock added

Section 3: CCT Wheel

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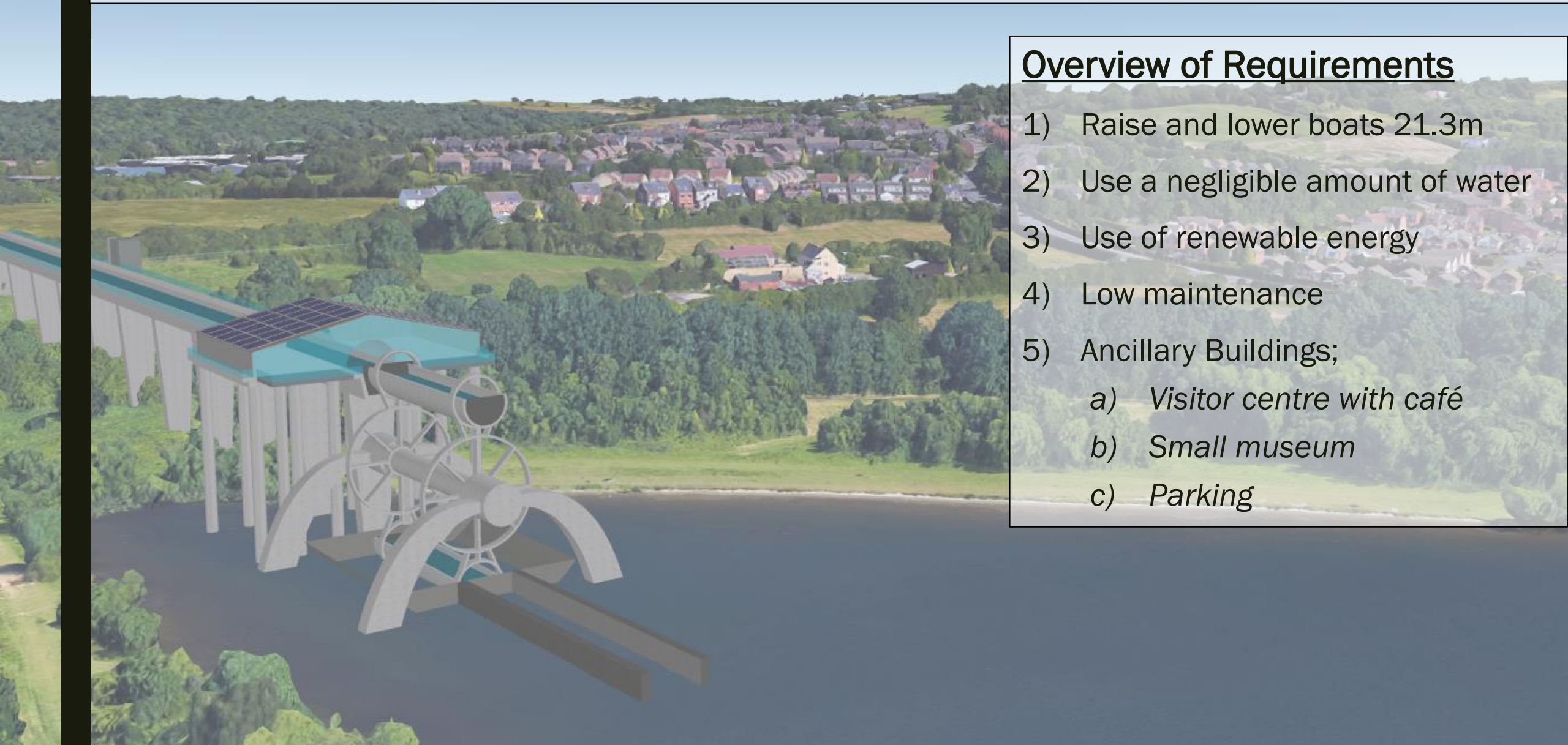
Section 3: CCT Wheel



Overview of Requirements

1) Raise and lower boats 21.3m
2) Use a negligible amount of water
3) Use of renewable energy
4) Low maintenance
5) Ancillary Buildings;
    a) *Visitor centre with café*
    b) *Small museum*
    c) *Parking*

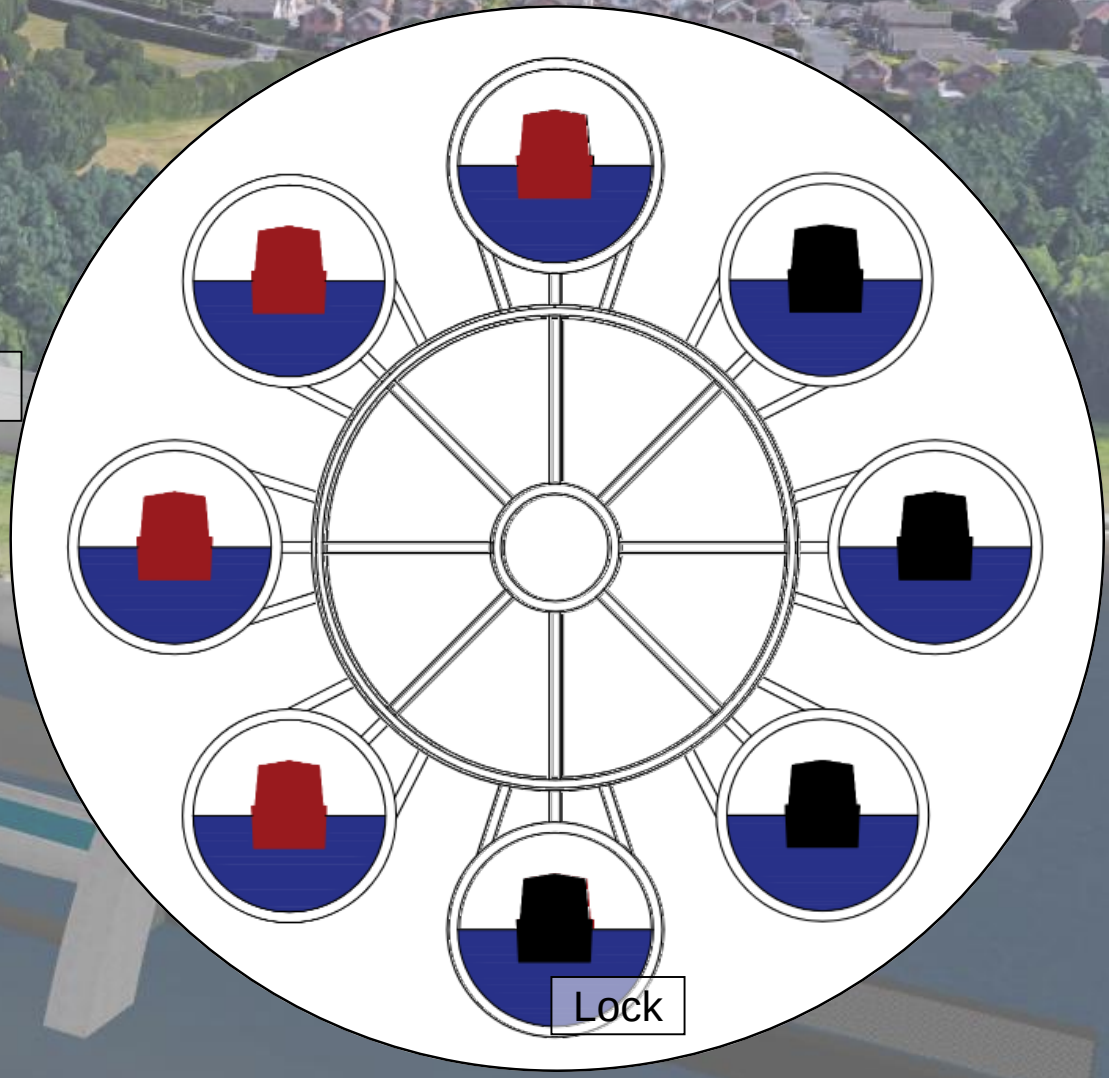
Section 3: CCT Wheel

Requirement 1: Raise and lower boats 21.3m

Aqueduct

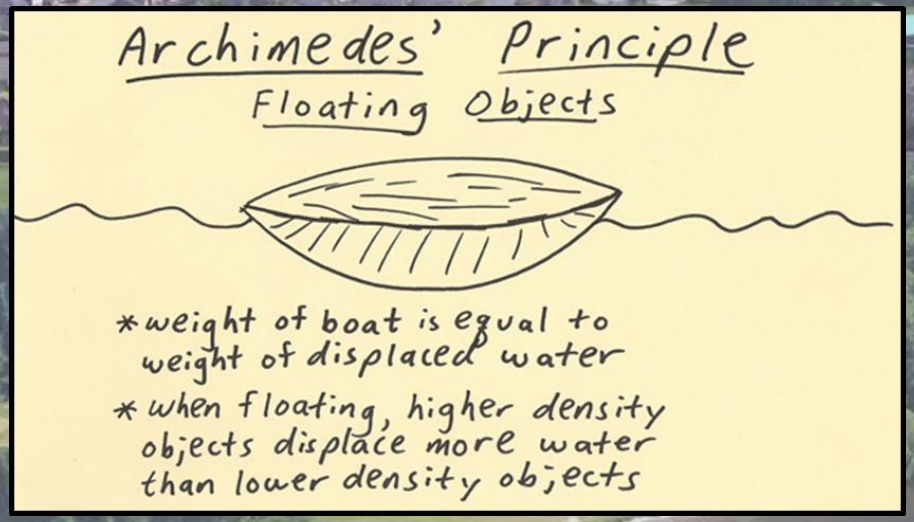
Wheel

Dry Dock



Section 3: CCT Wheel

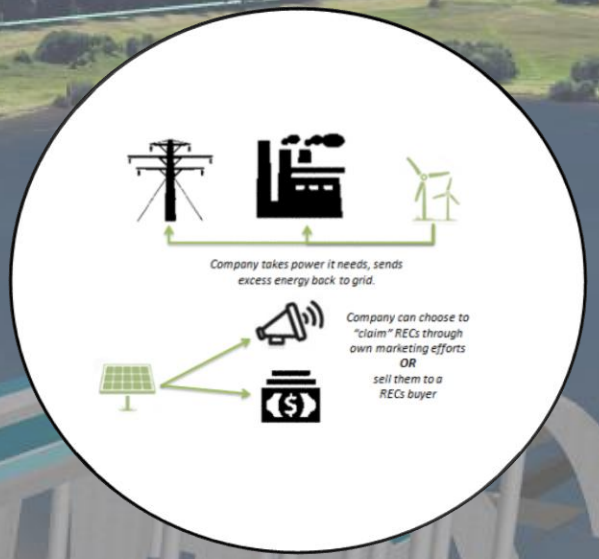
Requirement 2: Negligible amount of water used



Section 3: CCT Wheel

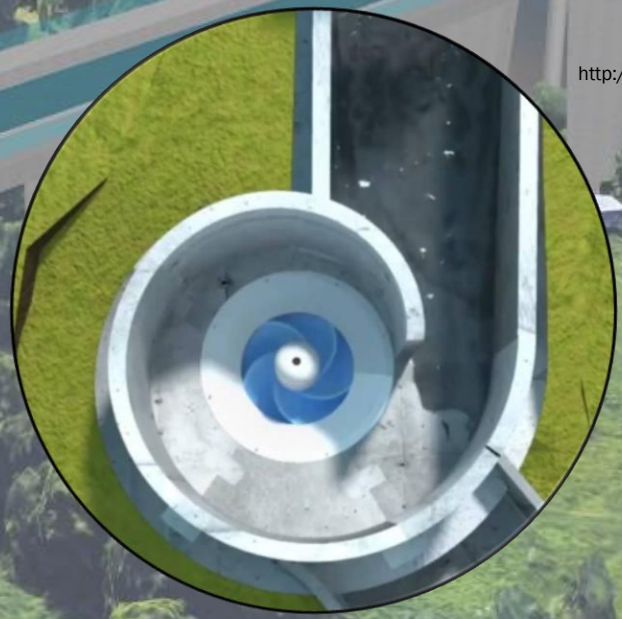
Requirement 3: Renewable energy source

- Two types of renewable energy employed
  - *Solar Power*
  - *Whirlpool Turbine (Turbulent Hydro)*



http://www.usourceenergy.com/energy-market-info

https://www.azocleantech.com/article.aspx?ArticleID=723



Section 3: CCT Wheel

Requirement 3: Renewable energy source

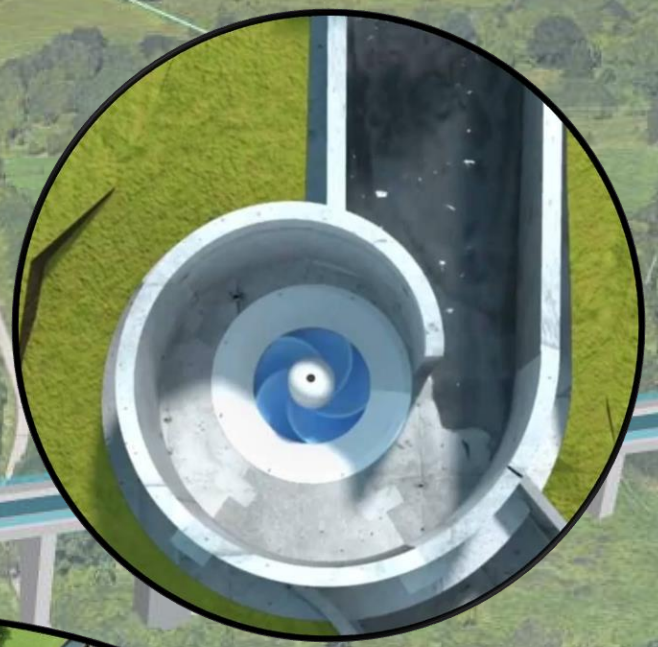
- Solar Power
  - *Monocrystalline solar panels on roof of visitor centre*

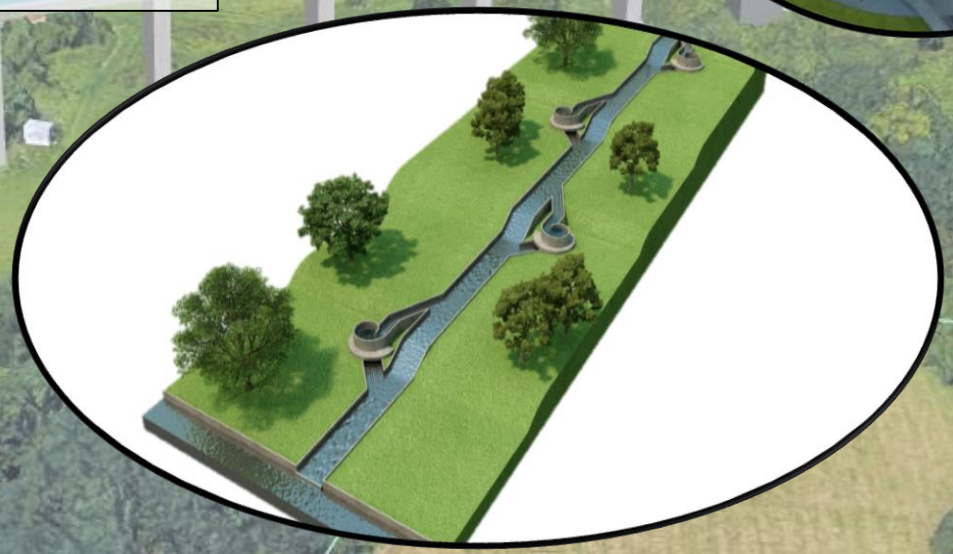
https://www.azocleantech.com/article.aspx?ArticleID=723

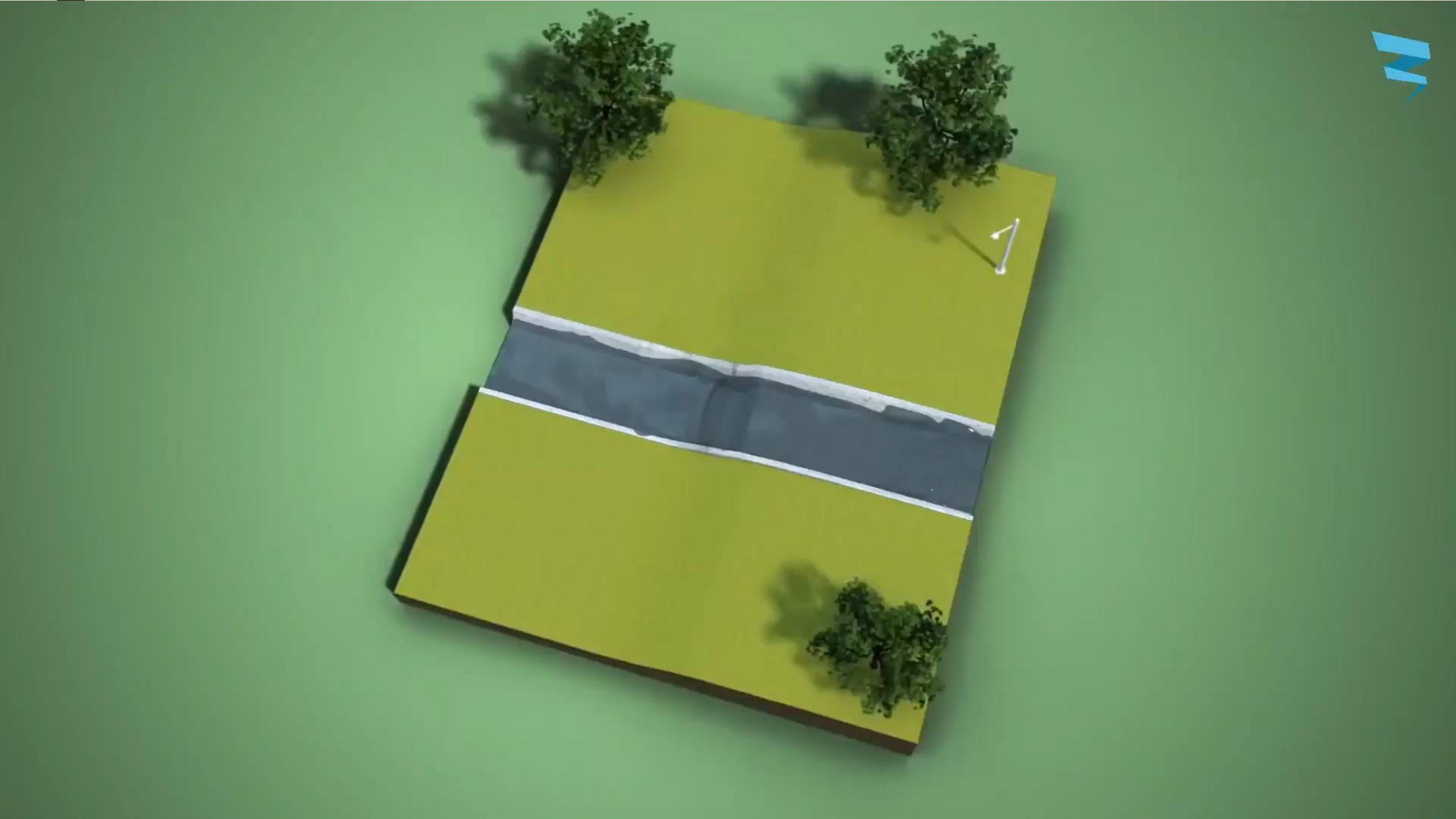
Section 3: CCT Wheel

Requirement 3: Renewable energy source

- Whirlpool Turbine
  - *Natural whirlpool*
  - *20 year working life*
  - *5 year return period*
  - *Low maintenance*
  - *Environmentally friendly*

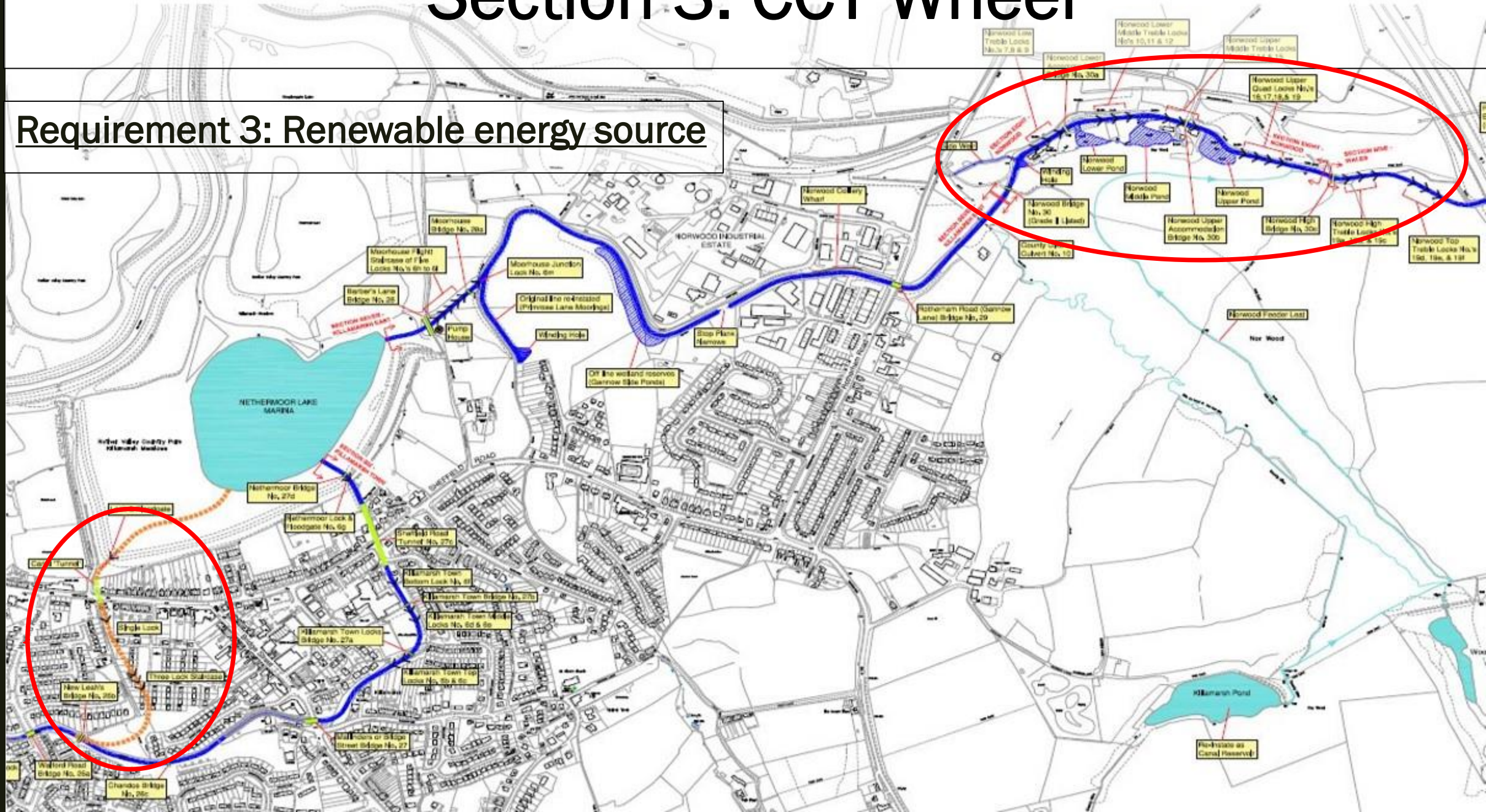






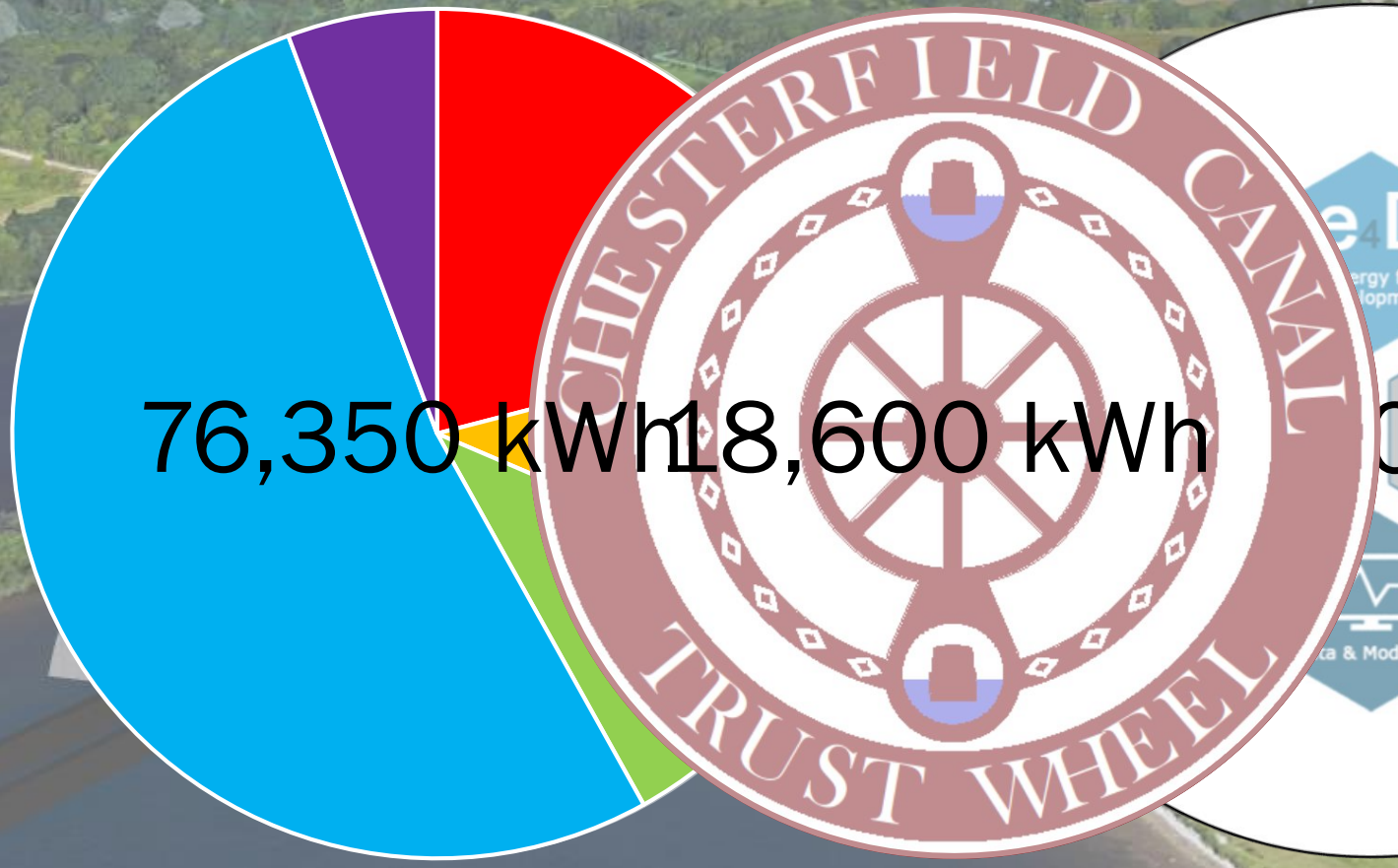
Section 3: CCT Wheel

Requirement 3: Renewable energy source



Section 3: CCT Wheel

Requirement 3: Renewable energy source



Estimated Energy Consumption

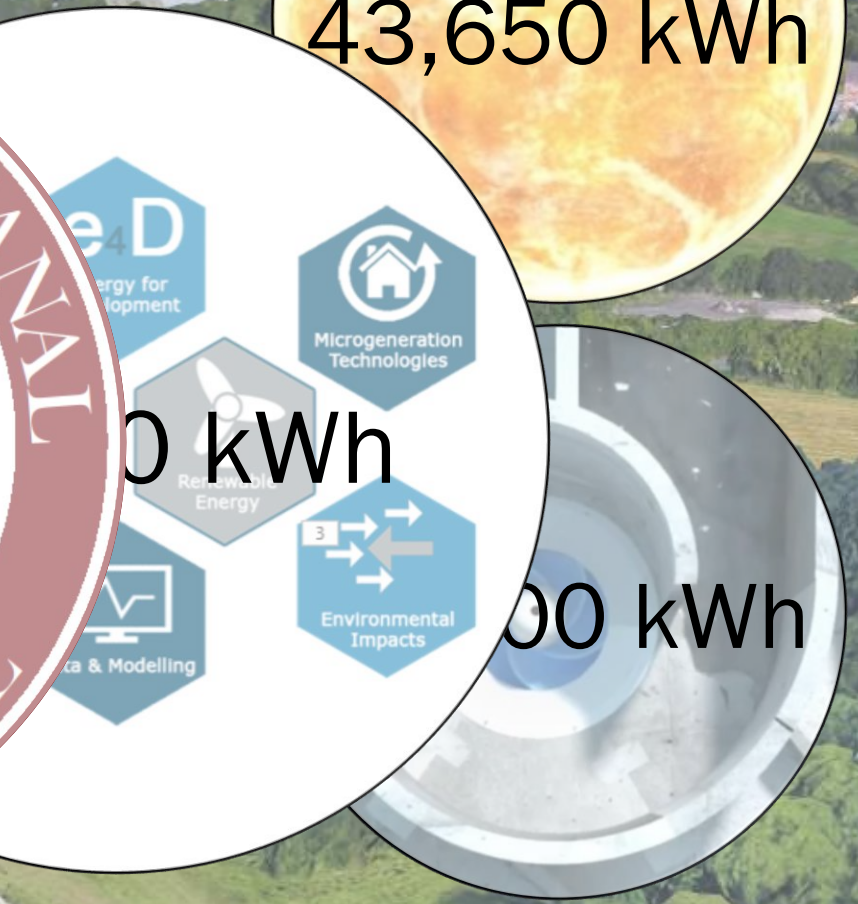
76,350 kWh

Estimated Excess Energy

18,600 kWh

Estimated Energy Generation

43,650 kWh



0 kWh

00 kWh

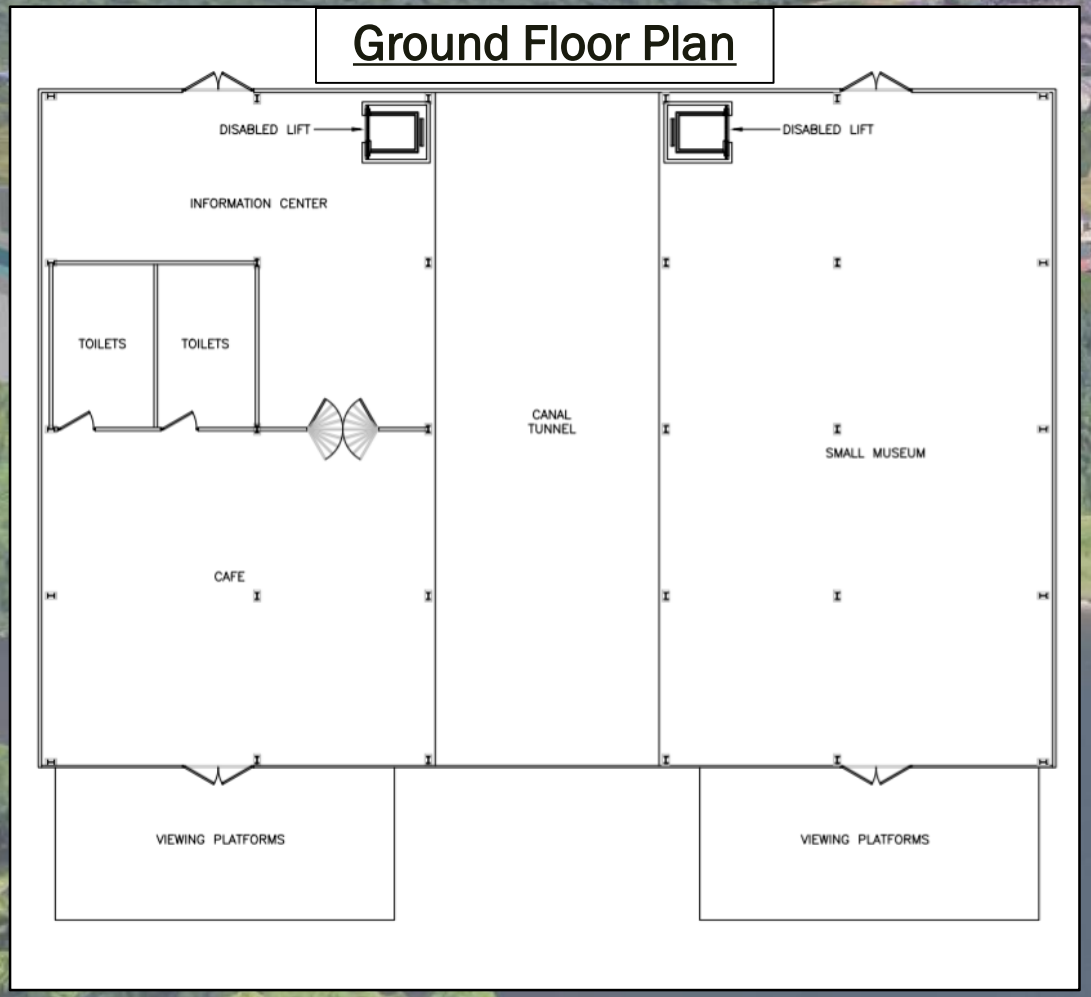
Section 3: CCT Wheel

Requirement 4: Low maintenance

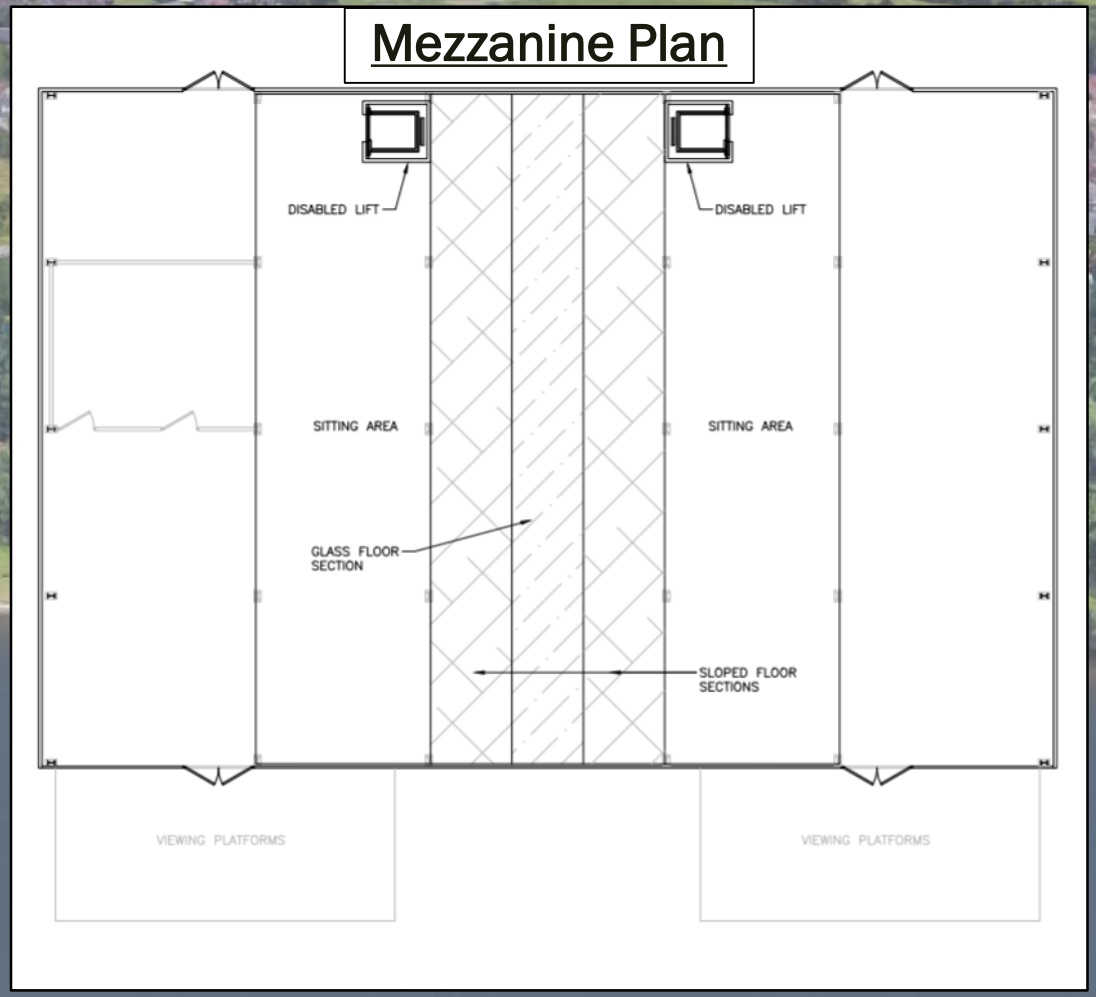
Section 3: CCT Wheel

Requirement 5a: Visitor Centre with Café

Ground Floor Plan



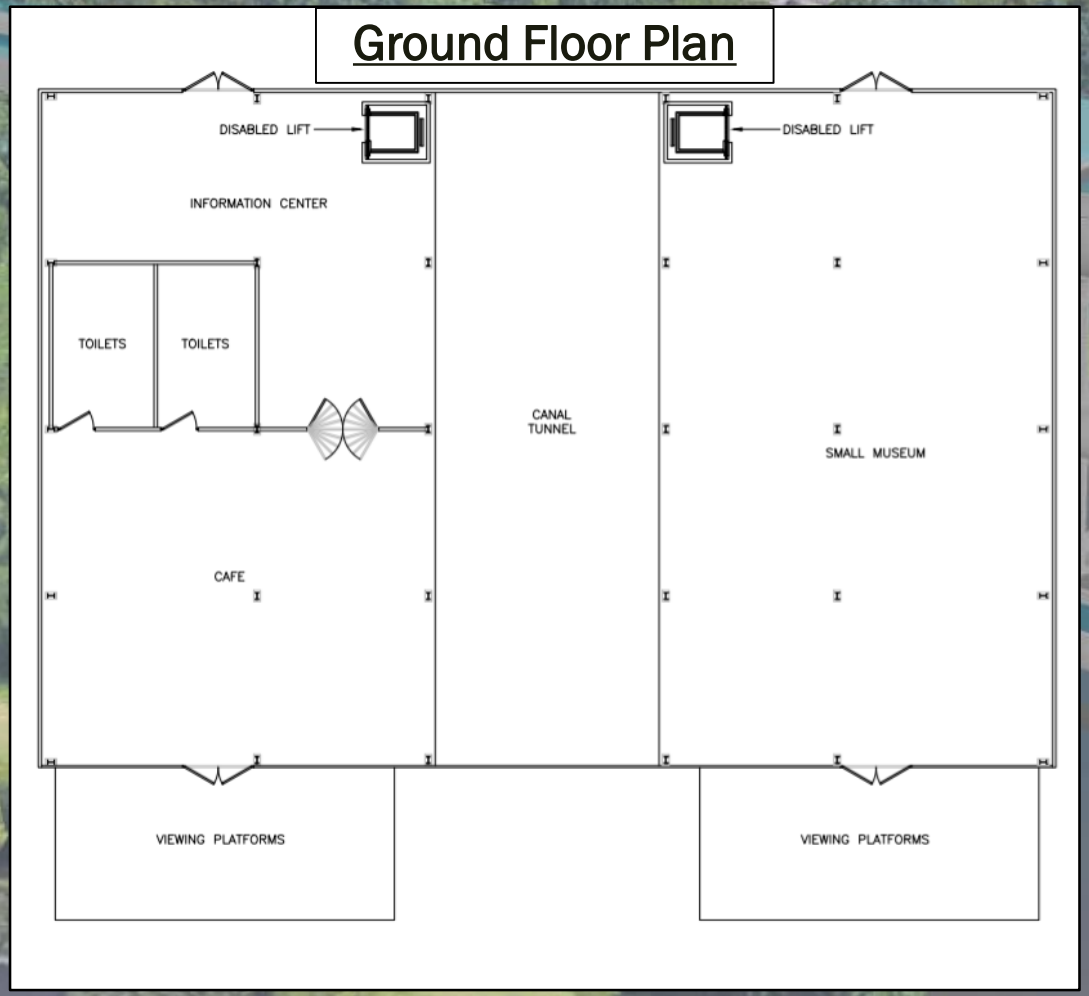
Mezzanine Plan



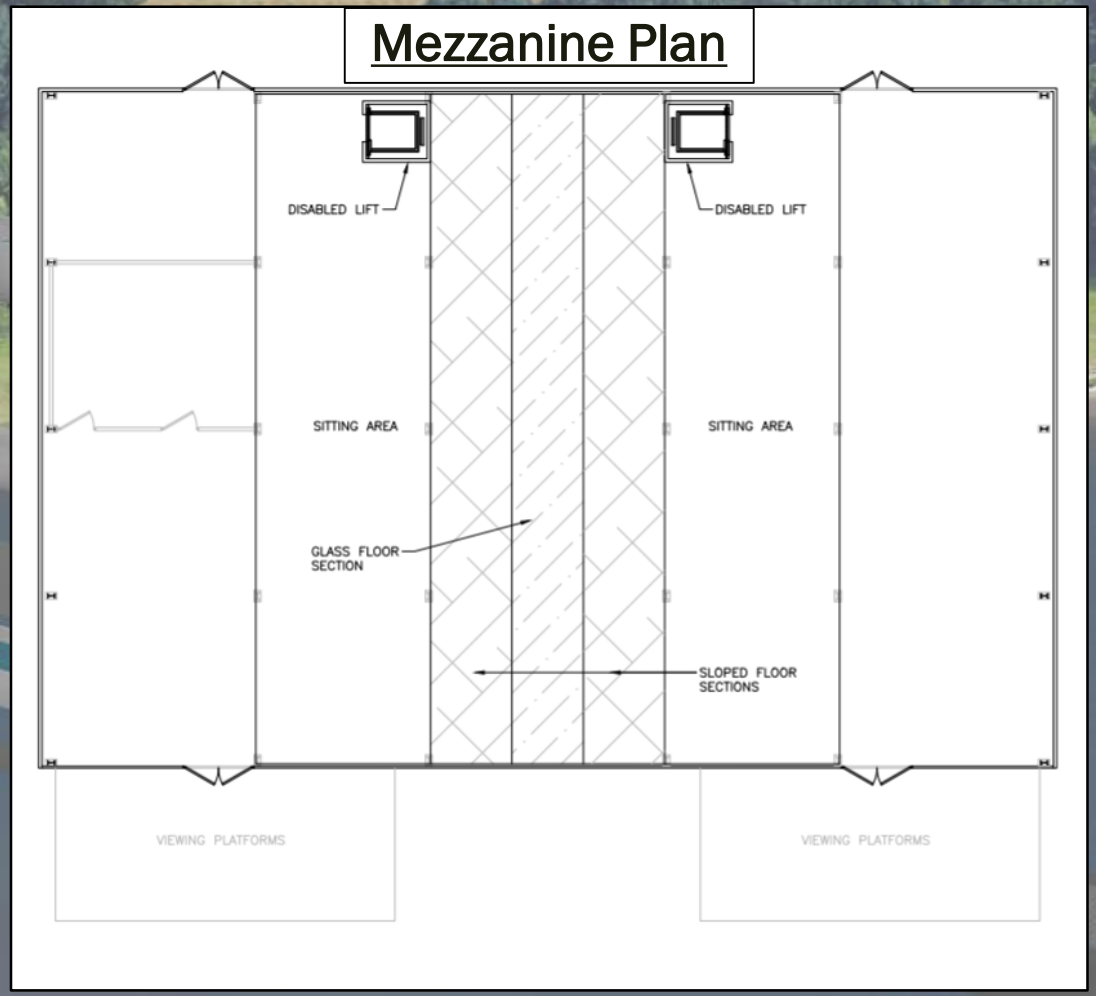
Section 3: CCT Wheel

Requirement 5b: A small museum attraction

Ground Floor Plan

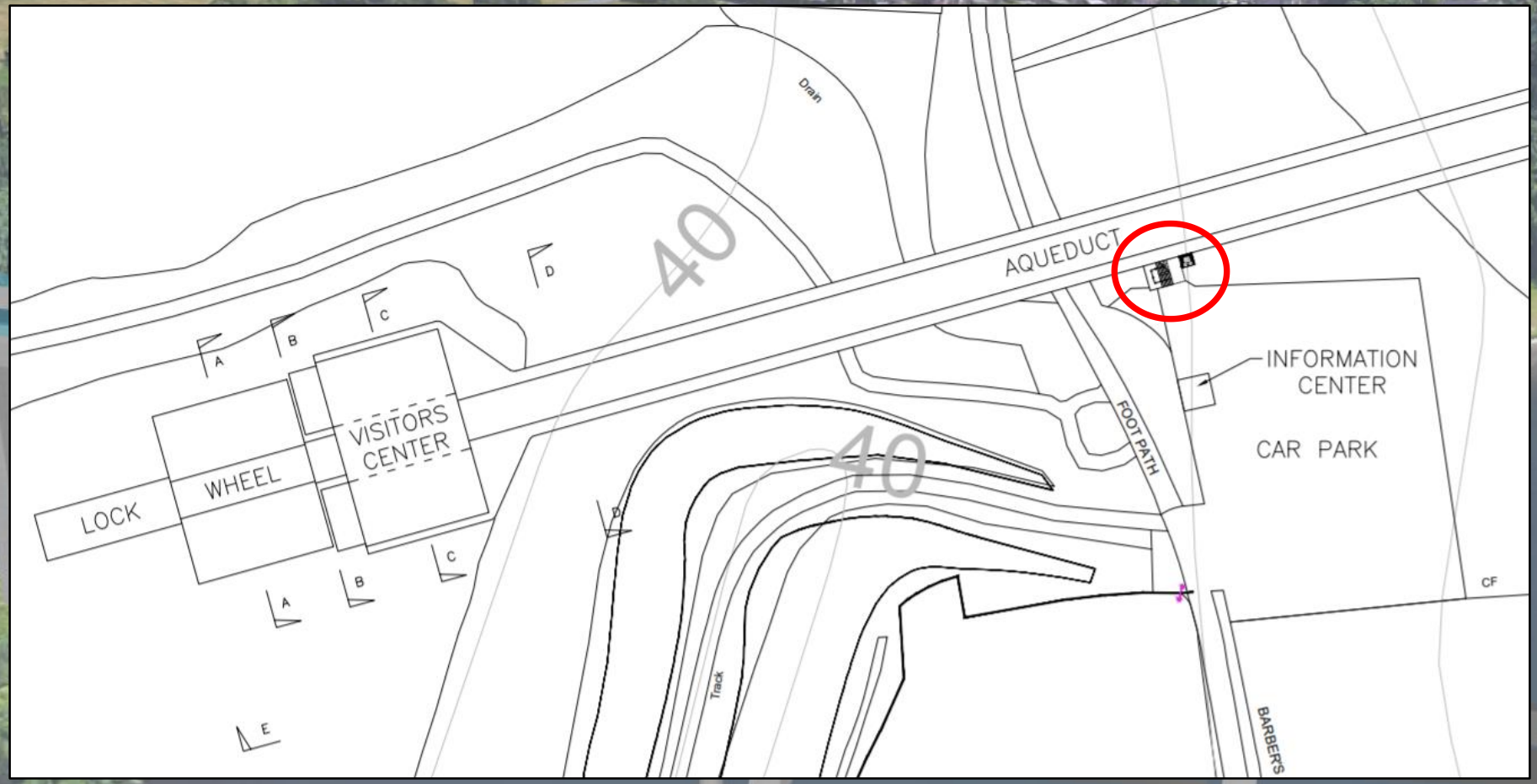


Mezzanine Plan

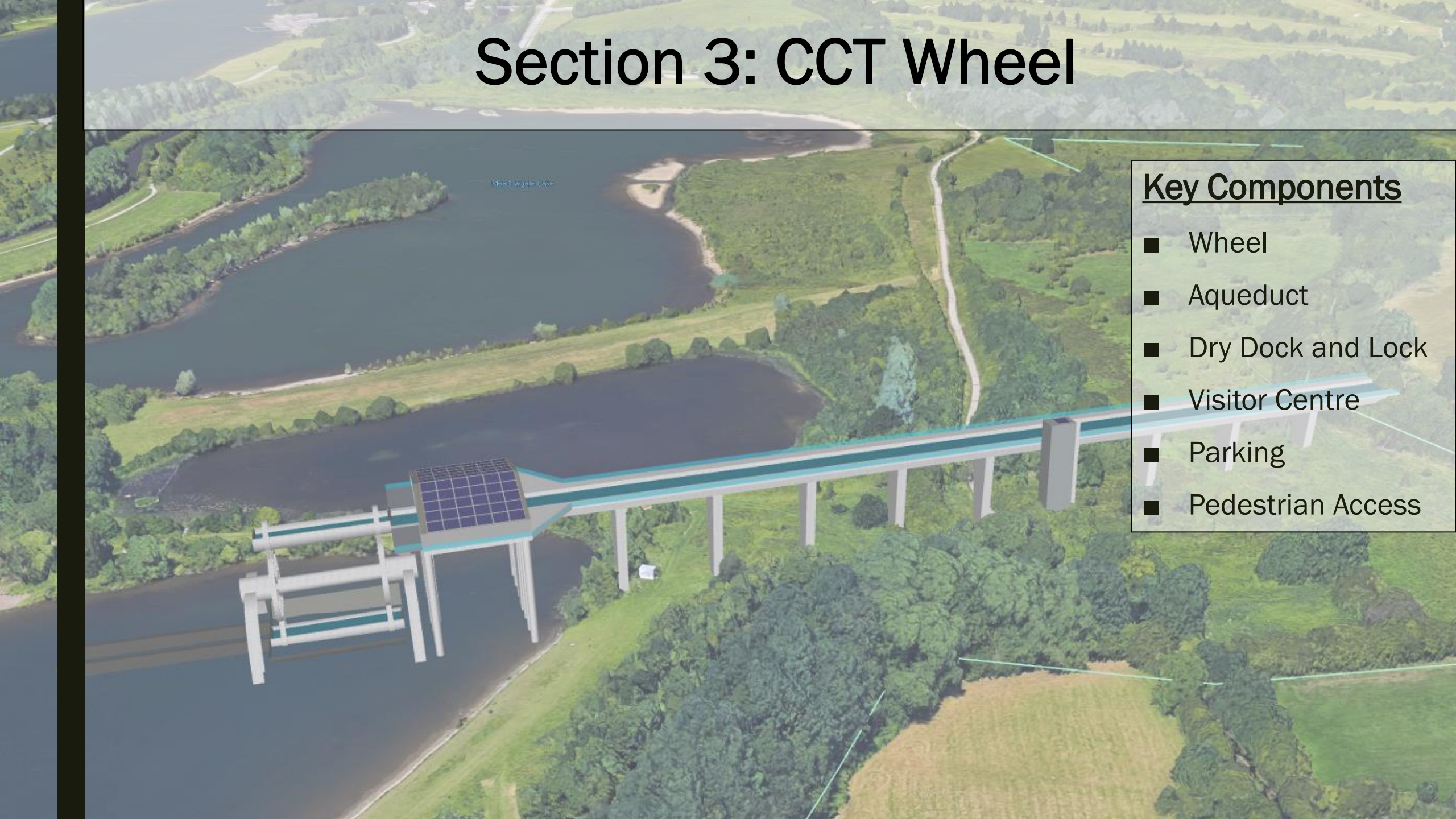


Section 3: CCT Wheel

Requirement 5c: Visitor car parking



Section 3: CCT Wheel



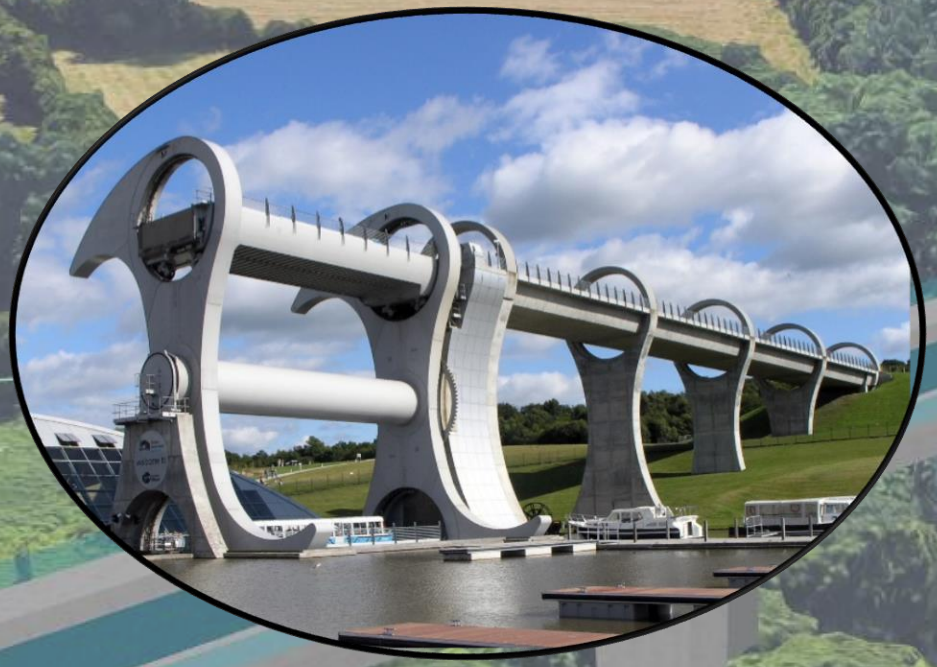
Key Components

- Wheel
- Aqueduct
- Dry Dock and Lock
- Visitor Centre
- Parking
- Pedestrian Access

Section 4: Feasibility

Case Studies

- Falkirk Wheel
- London Eye



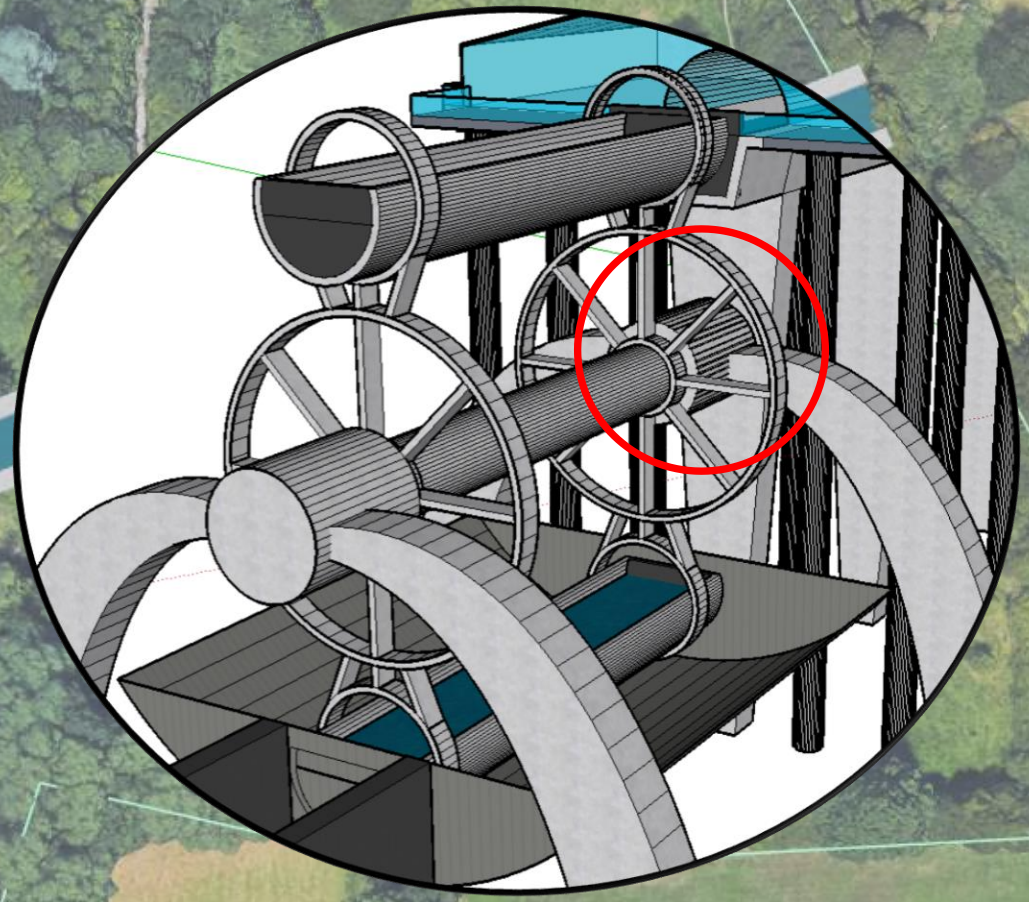
https://en.wikipedia.org/wiki/Falkirk_Wheel

https://en.wikipedia.org/wiki/London_Eye

Section 4: Feasibility

Rotating Mechanism

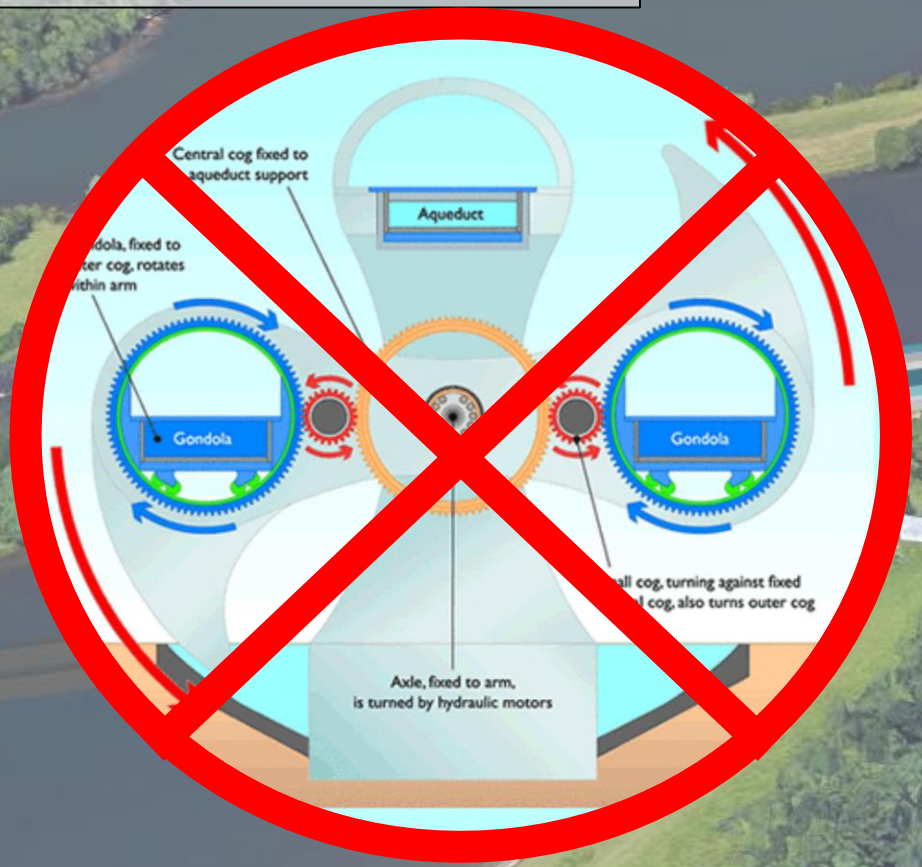
- Drive and engine room located at aqueduct end of wheel
- Caisson weight assists in keeping them upright
- Motorised bearings will ensure caissons rotate at correct speed

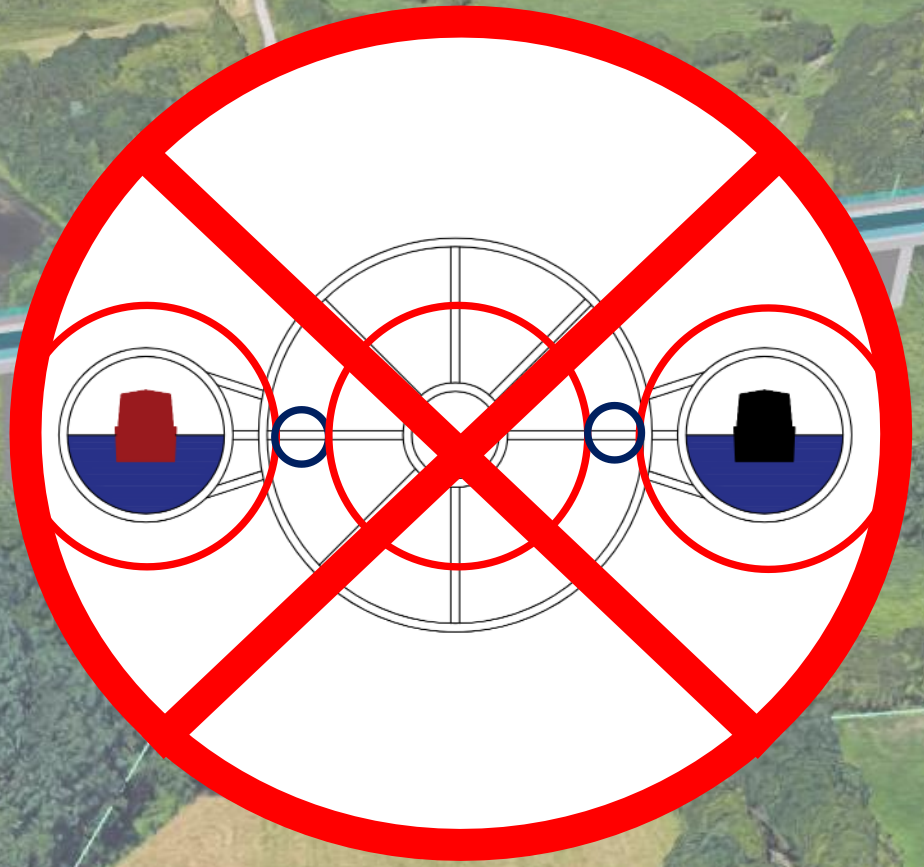


Section 4: Feasibility

Keeping Caisson Upright

- Gear System



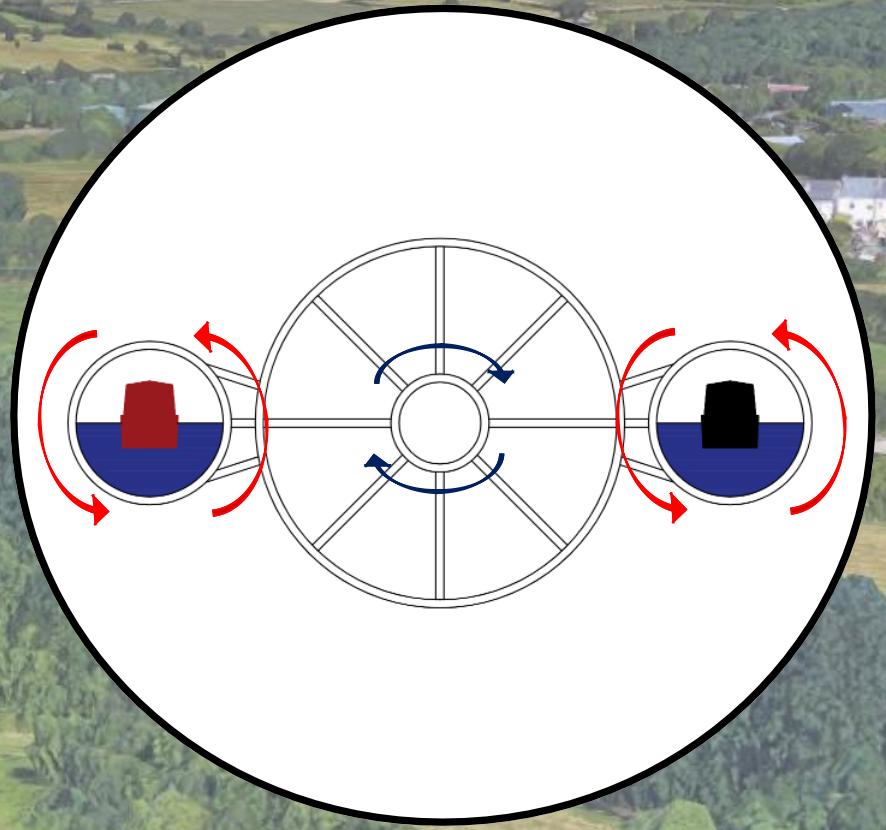


https://engineeringandarchitecture.weebly.com/the-falkirk-wheel.html

Section 4: Feasibility

Keeping Caisson Upright

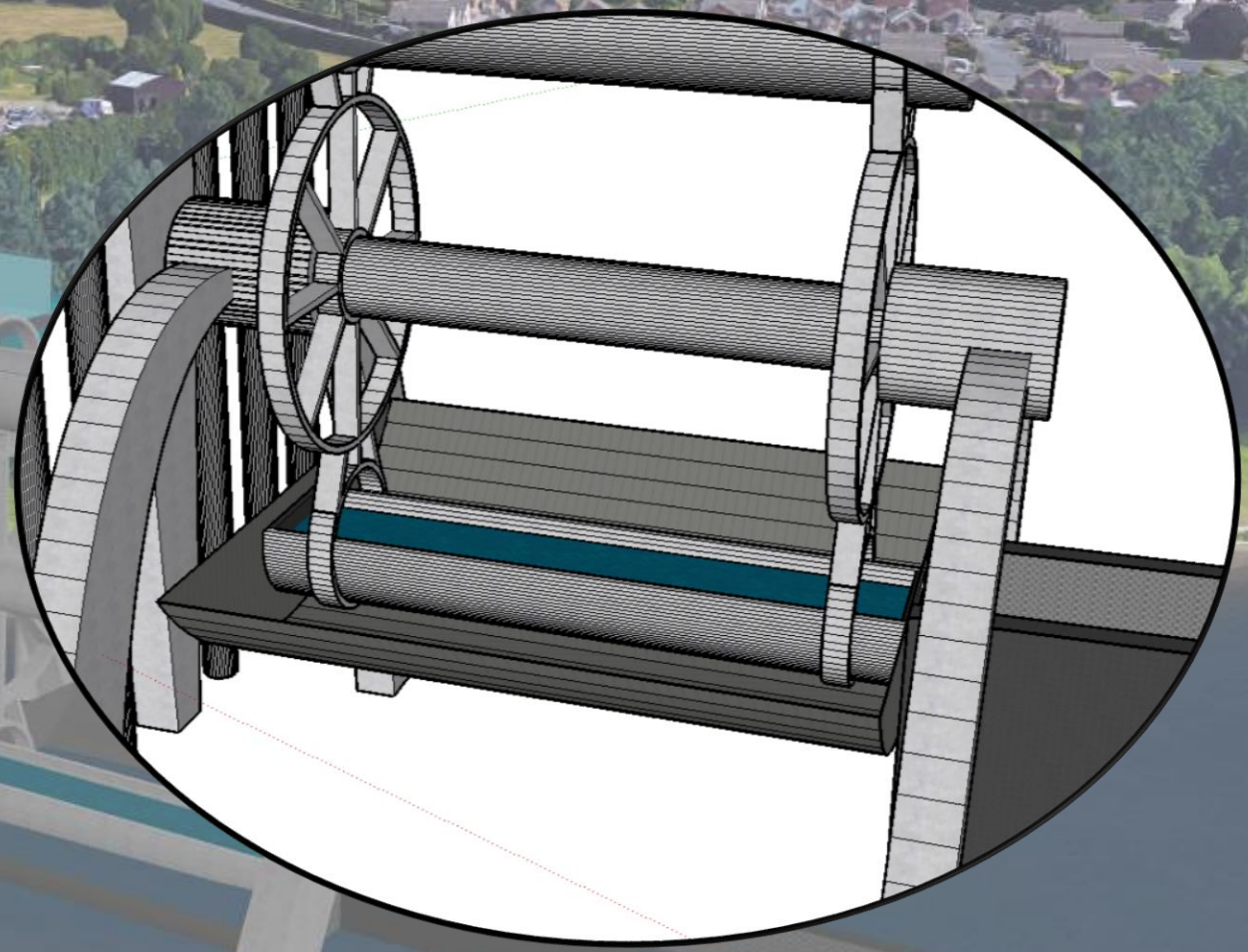
- Motorised bearings
- Turning in opposite direction to wheel
- Built in stability system to accommodate for uneven loading



Section 4: Feasibility

Dry Dock

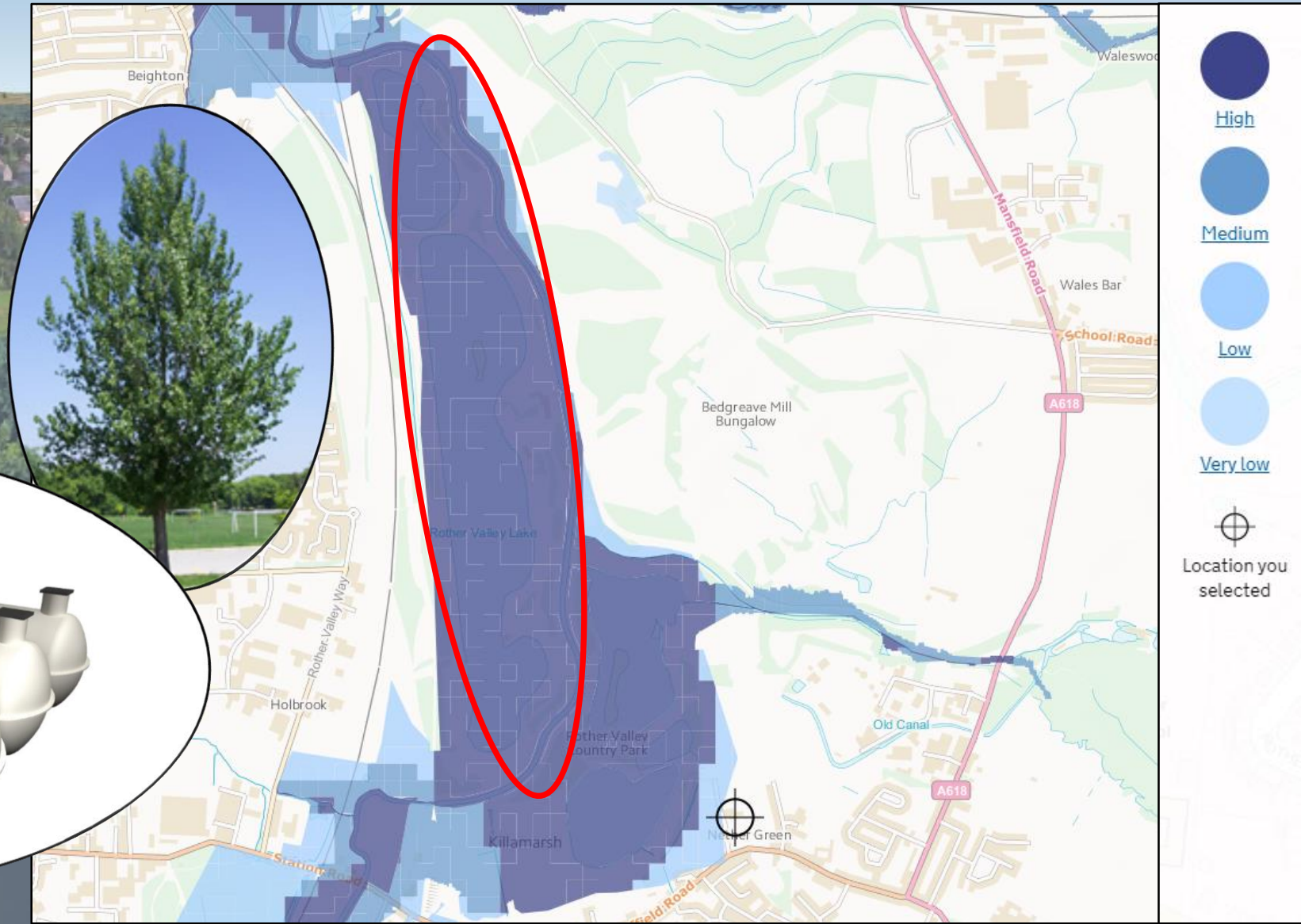
- Area below caisson kept dry
- Entrance controlled by water seal
- Wheel can turn more efficiently
- Keeps mechanical parts dry



Section 4: Feasibility

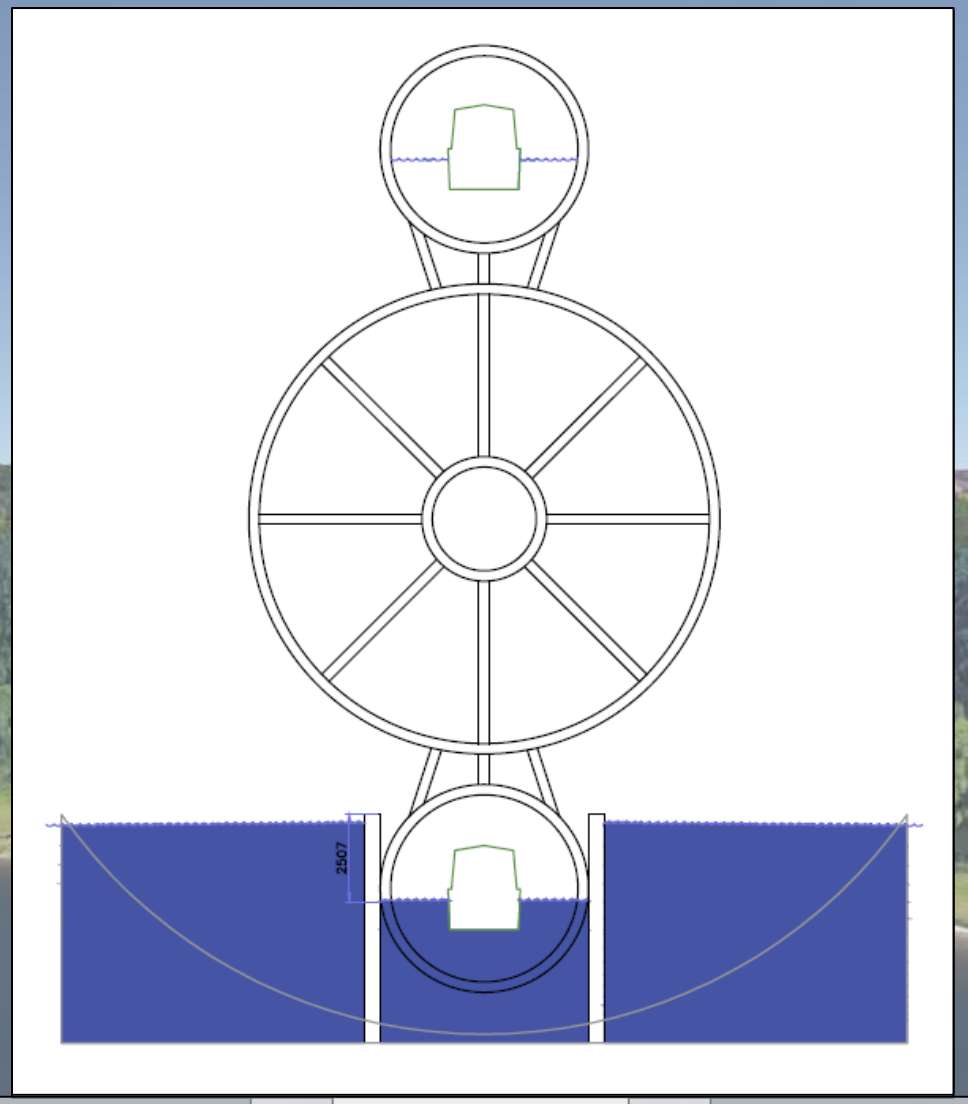
Flood Attenuation

- Strategically placed trees
- Water storage areas
- Improved soil conditions



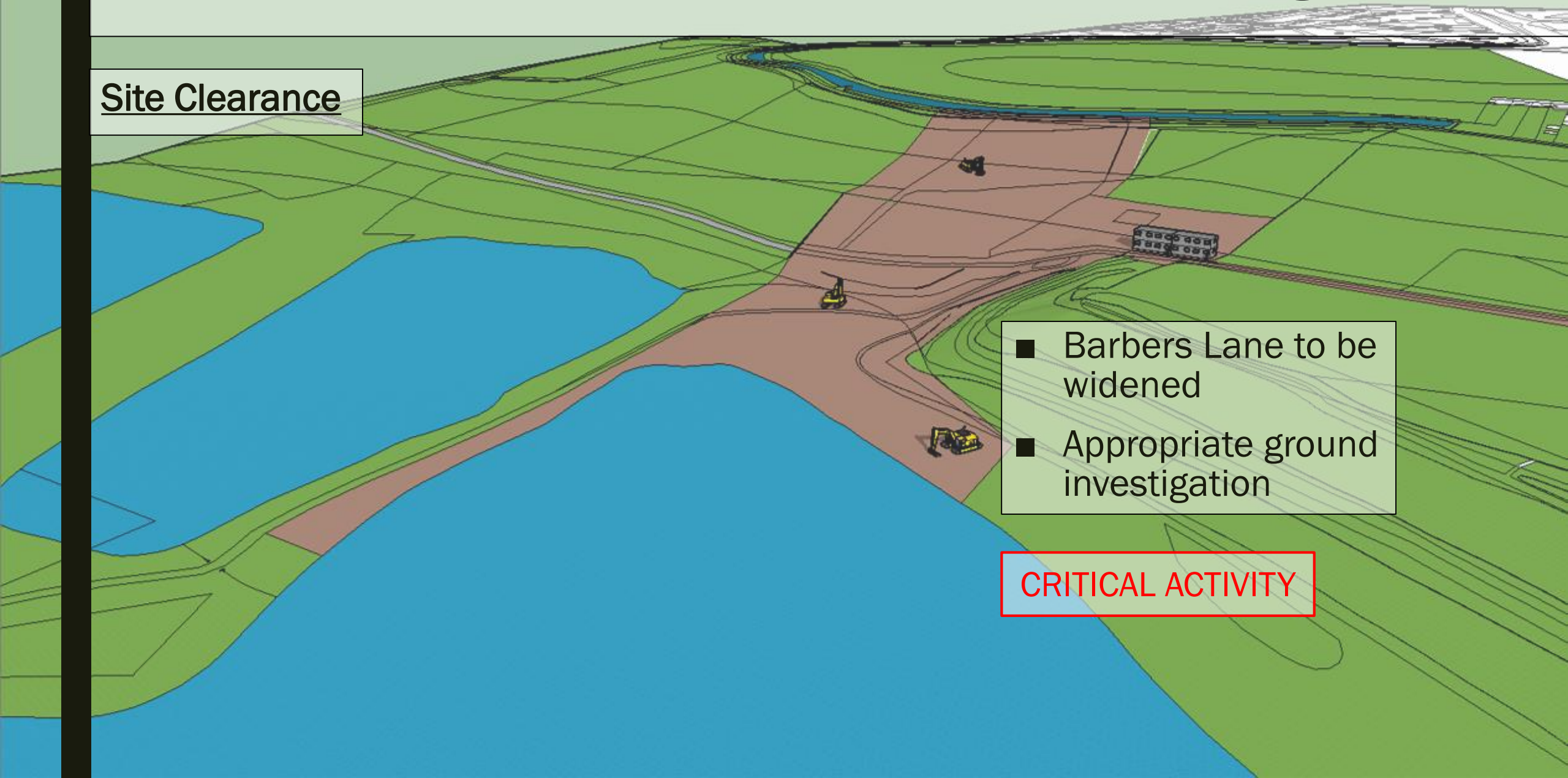
Section 4: Feasibility

Use of Lock



Lock brings water to original level

Section 5: Construction Phasing

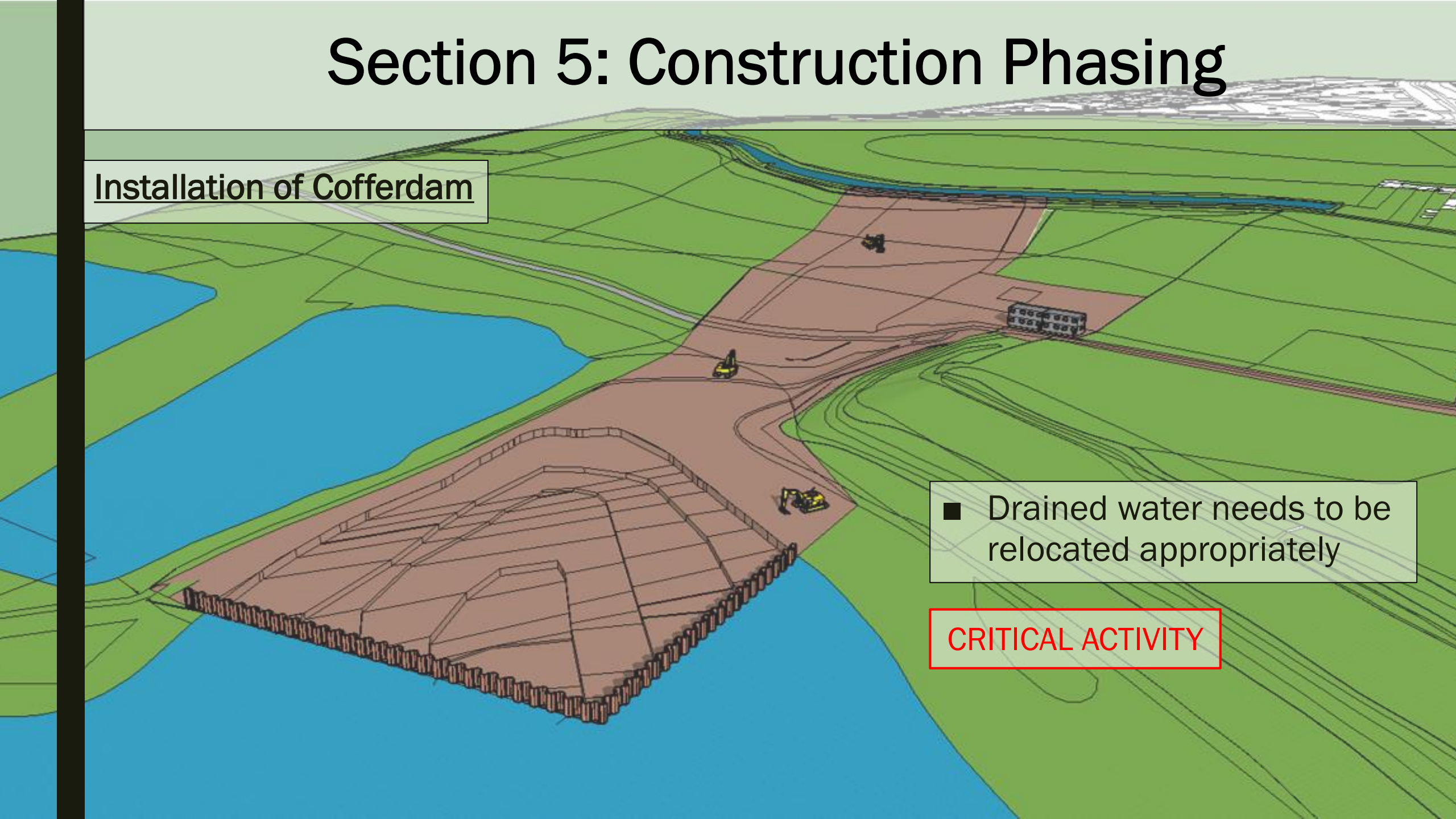


Site Clearance

- Barbers Lane to be widened
- Appropriate ground investigation

CRITICAL ACTIVITY

Section 5: Construction Phasing

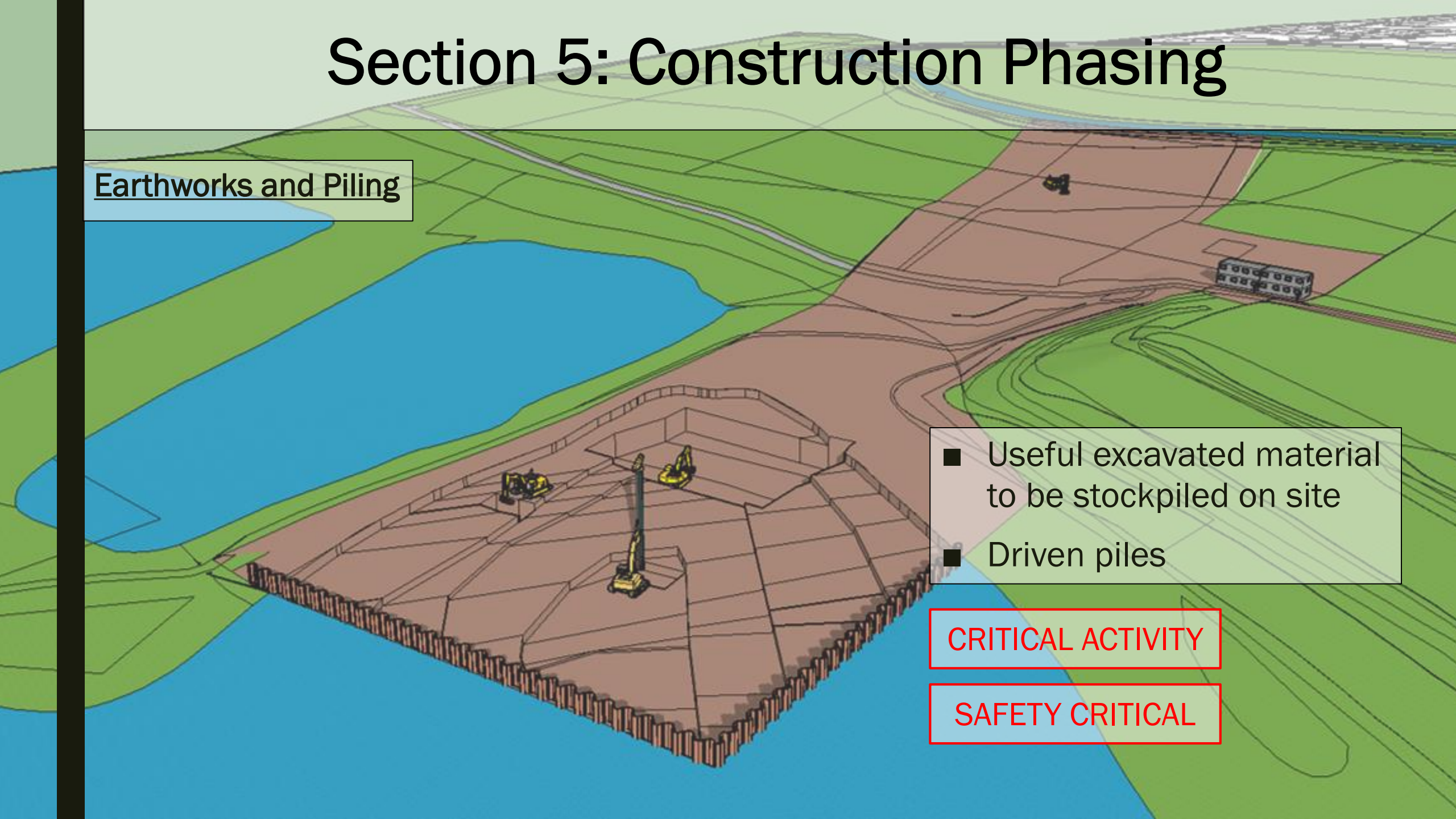


Installation of Cofferdam

- Drained water needs to be relocated appropriately

CRITICAL ACTIVITY

Section 5: Construction Phasing



Earthworks and Piling

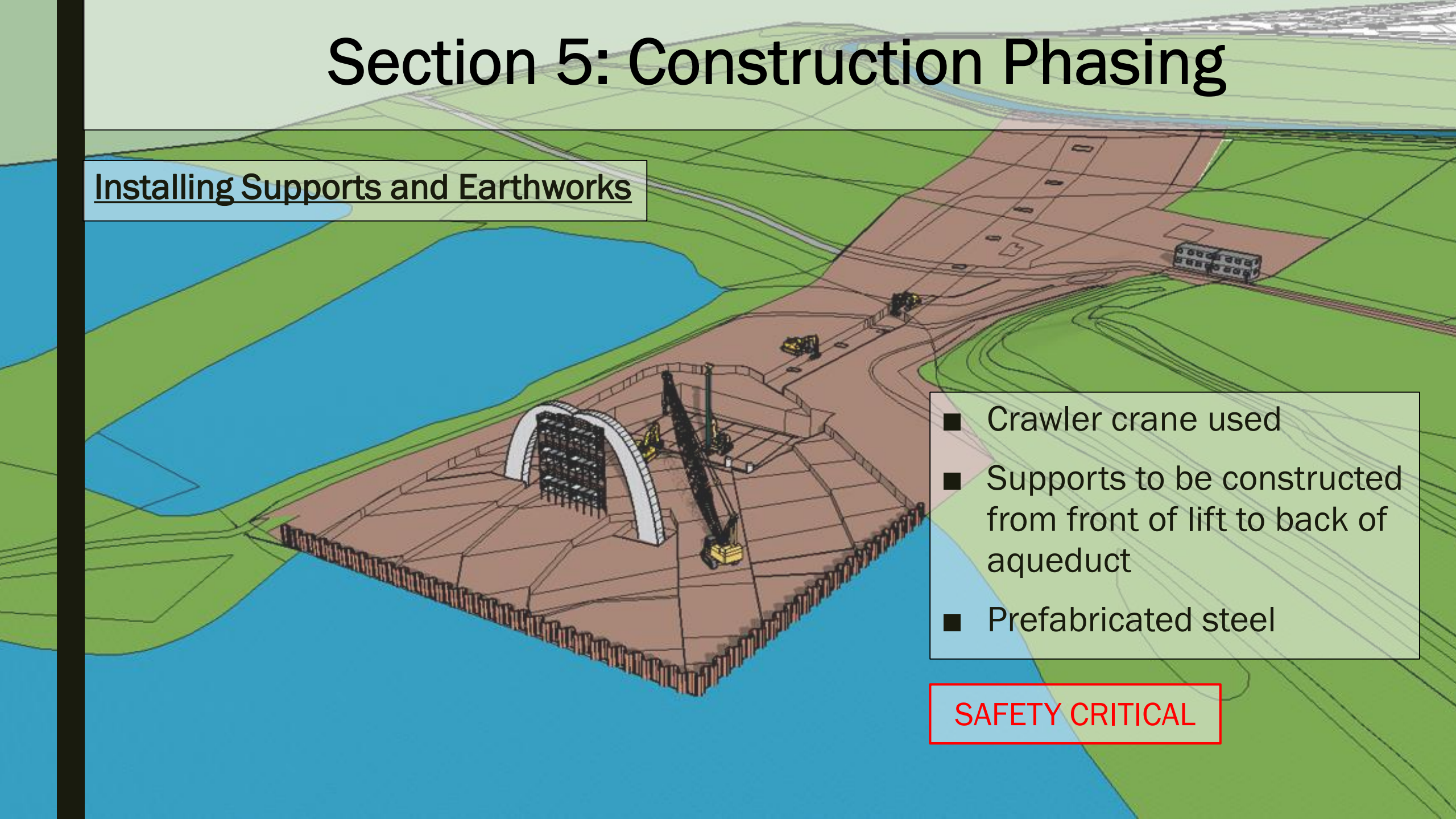
- Useful excavated material to be stockpiled on site
- Driven piles

CRITICAL ACTIVITY

SAFETY CRITICAL

Section 5: Construction Phasing

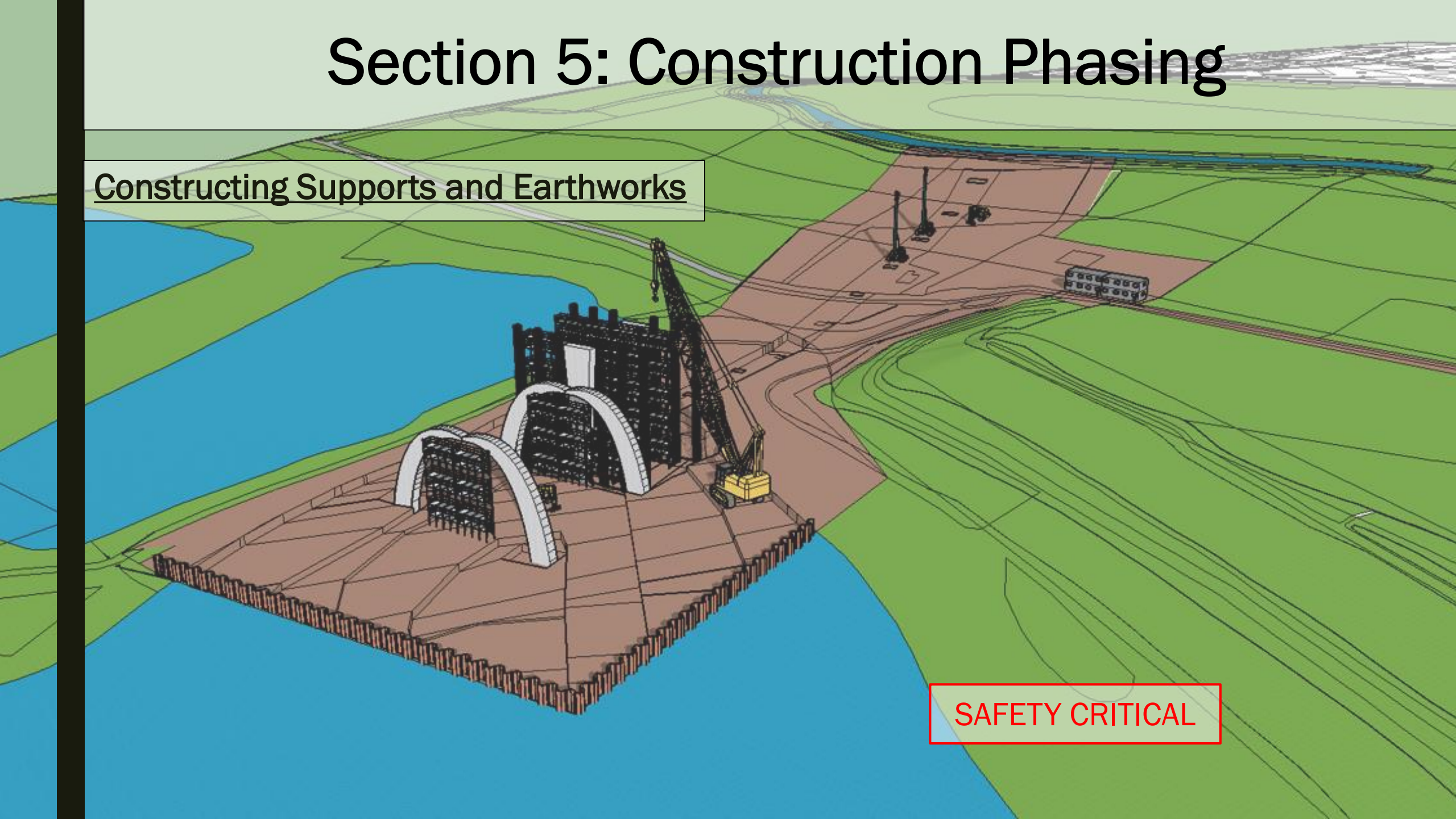
Installing Supports and Earthworks



- Crawler crane used
- Supports to be constructed from front of lift to back of aqueduct
- Prefabricated steel

SAFETY CRITICAL

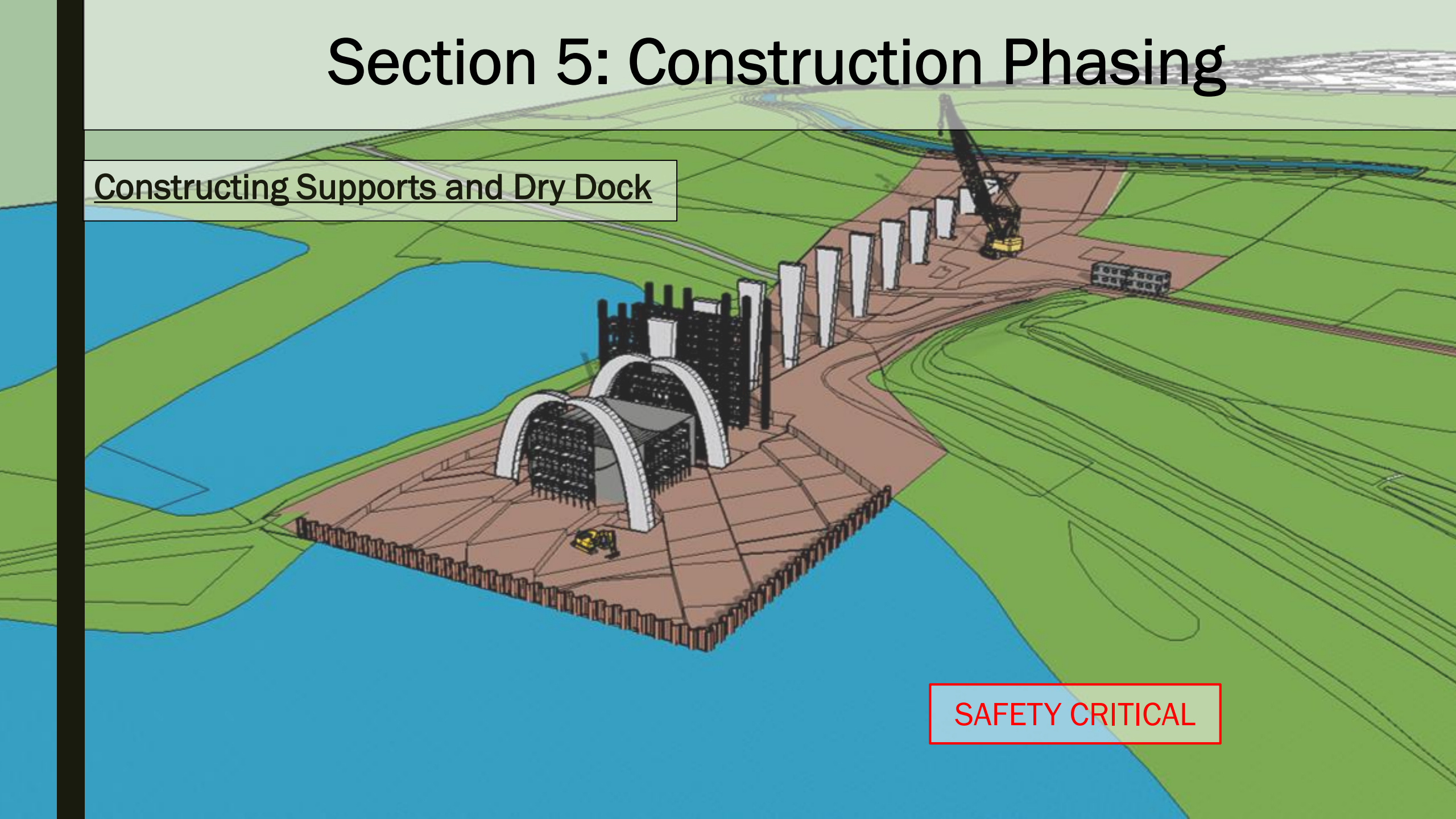
Section 5: Construction Phasing



Constructing Supports and Earthworks

SAFETY CRITICAL

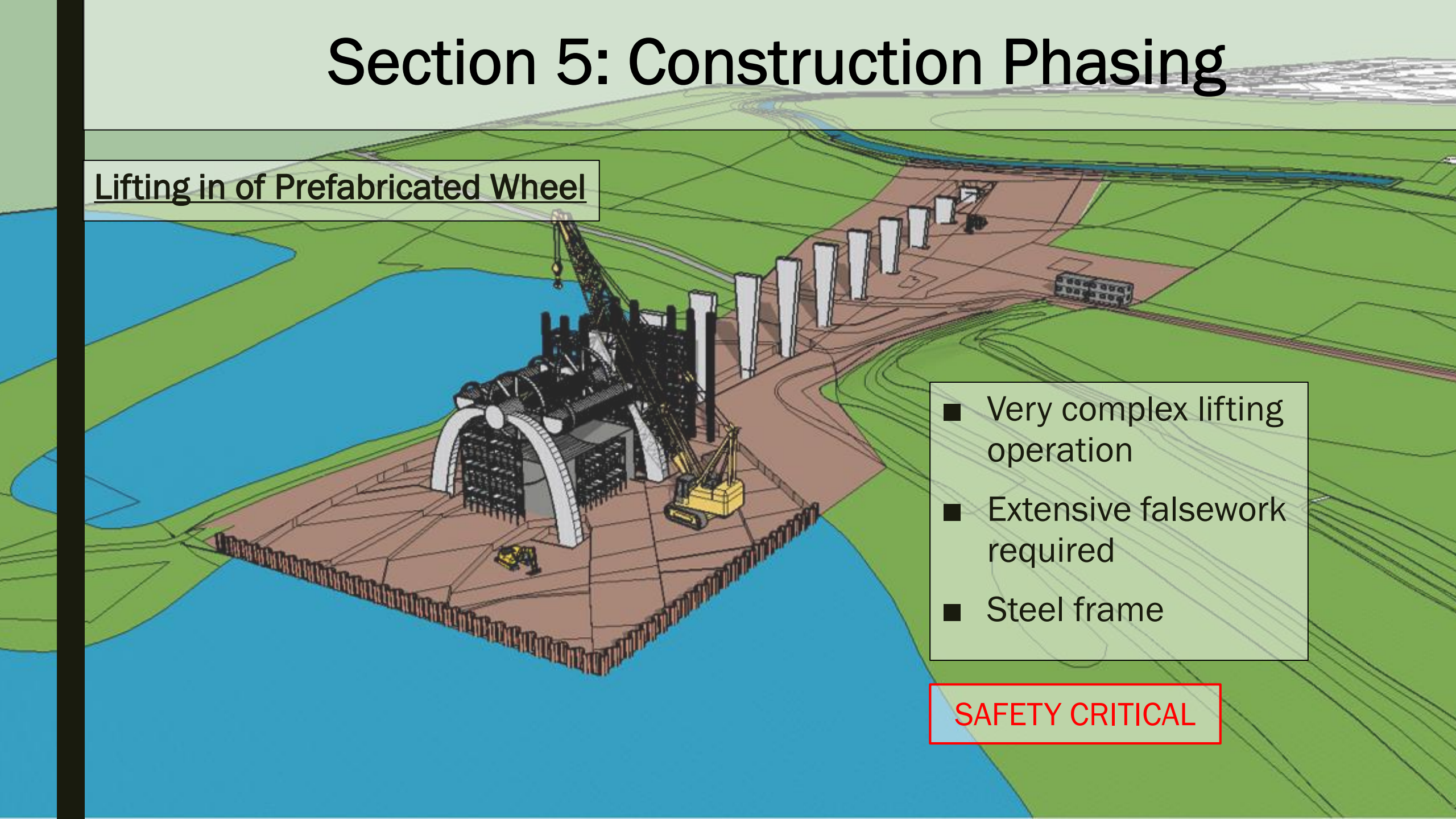
Section 5: Construction Phasing



Constructing Supports and Dry Dock

SAFETY CRITICAL

Section 5: Construction Phasing

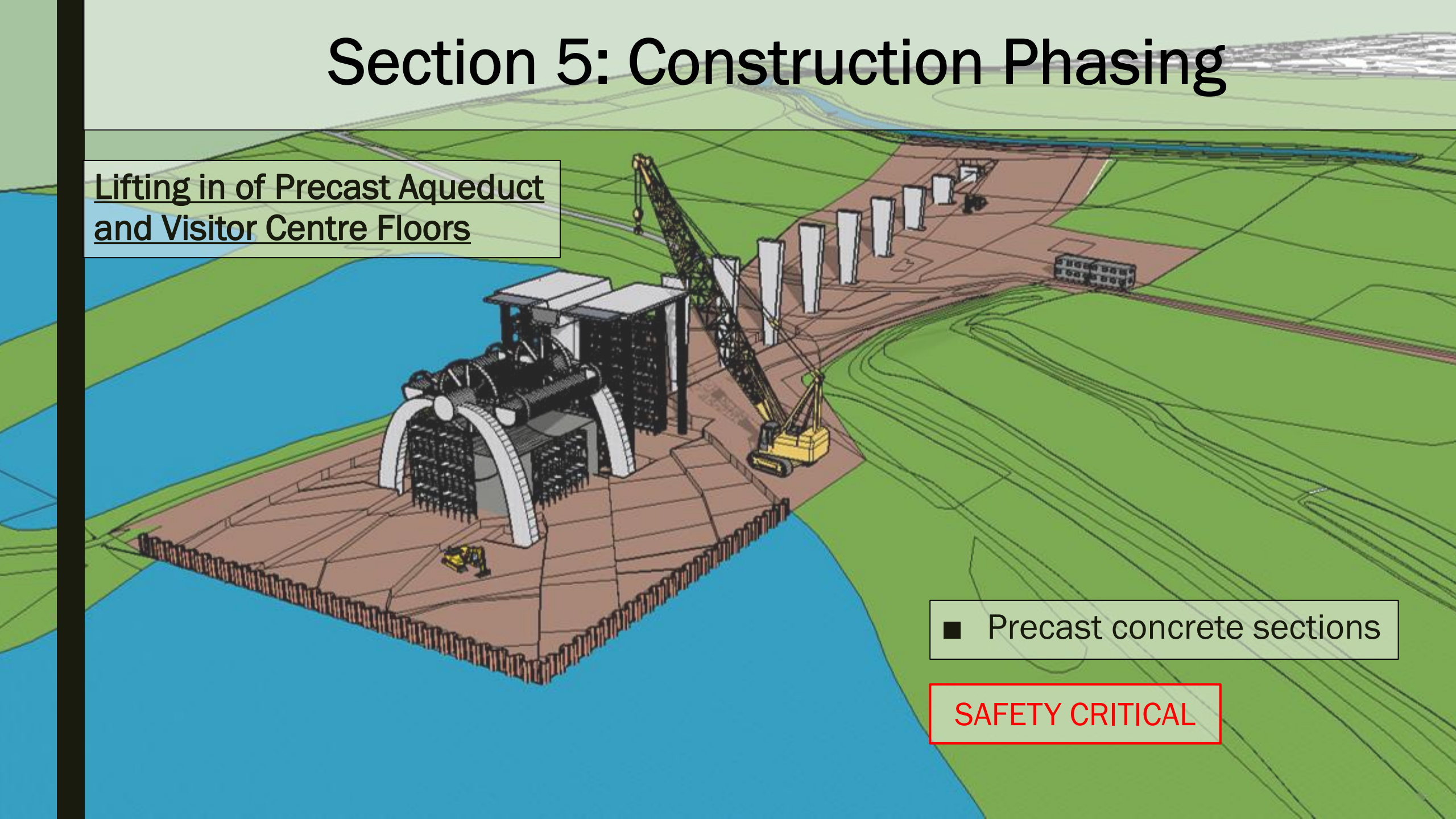


Lifting in of Prefabricated Wheel

- Very complex lifting operation
- Extensive falsework required
- Steel frame

SAFETY CRITICAL

Section 5: Construction Phasing

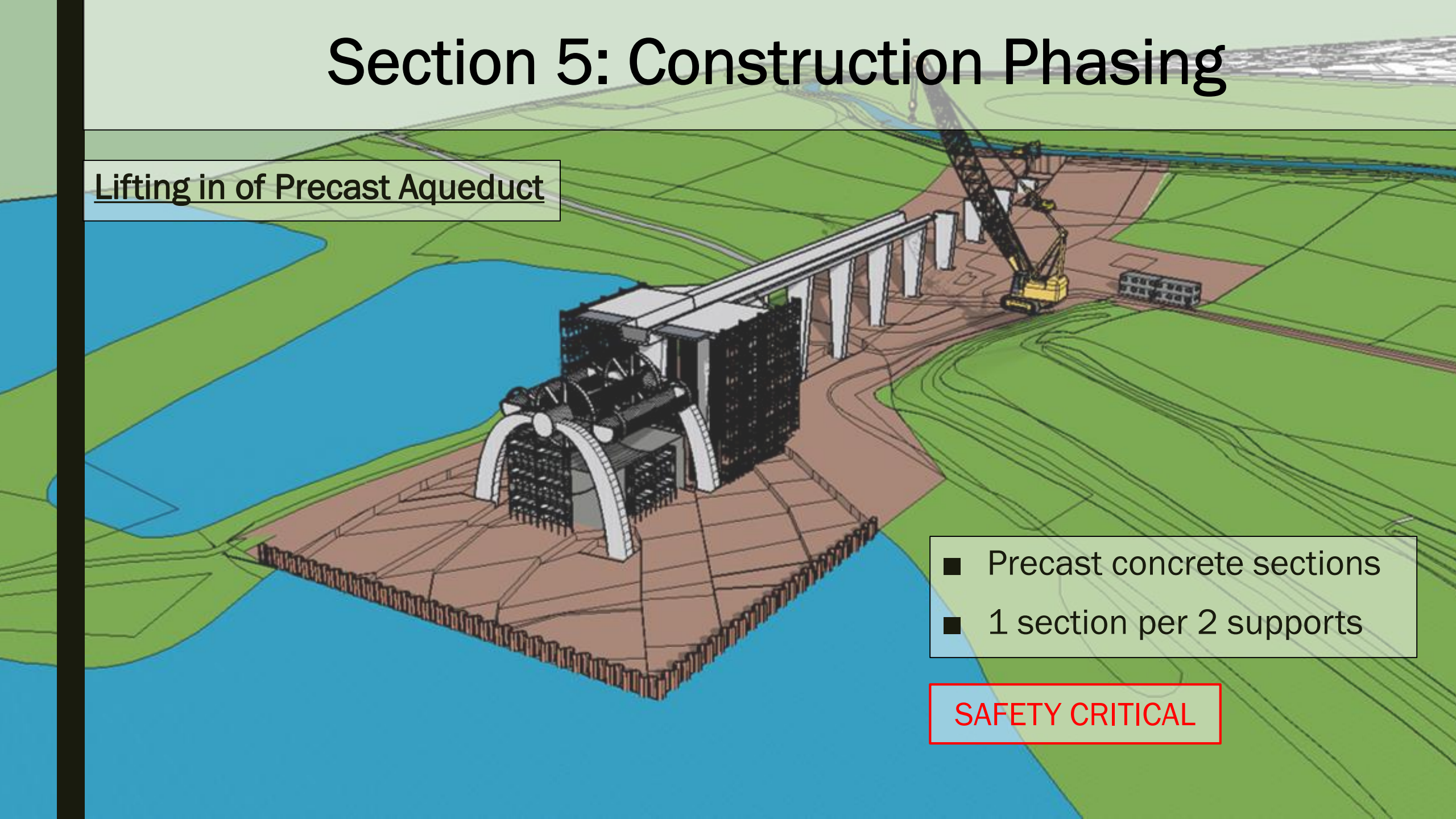


Lifting in of Precast Aqueduct and Visitor Centre Floors

- Precast concrete sections

SAFETY CRITICAL

Section 5: Construction Phasing

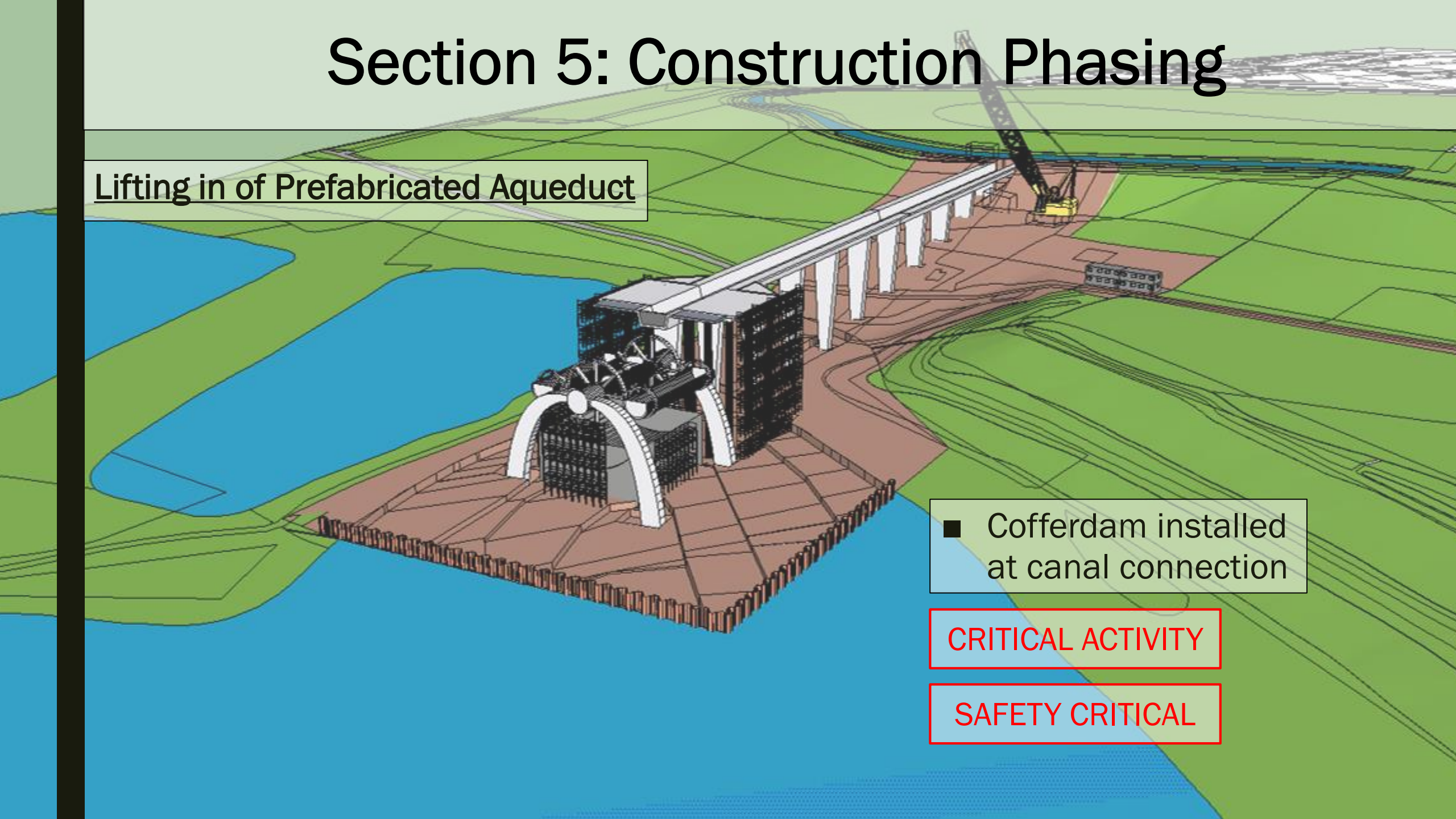


Lifting in of Precast Aqueduct

- Precast concrete sections
- 1 section per 2 supports

SAFETY CRITICAL

Section 5: Construction Phasing



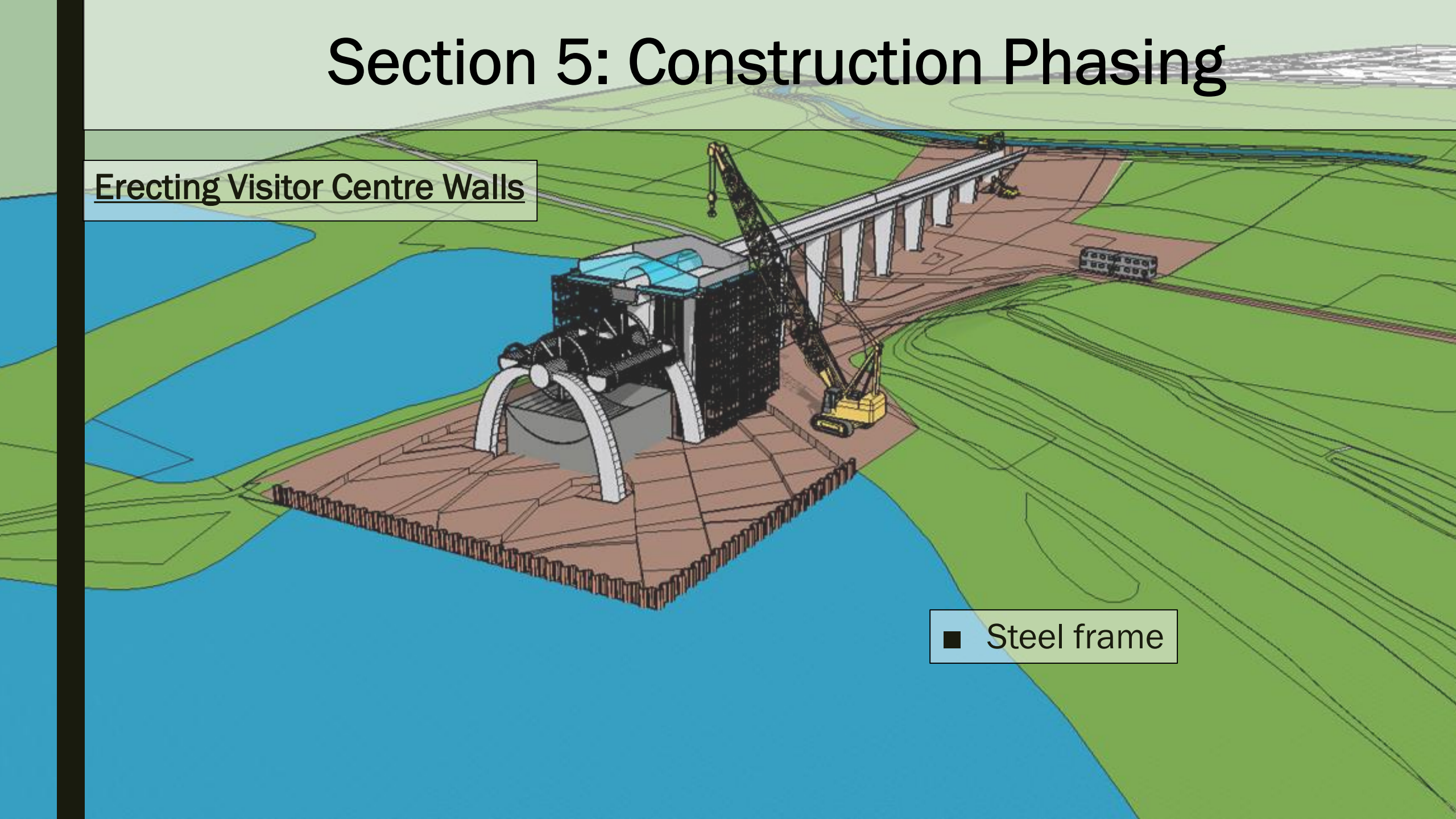
Lifting in of Prefabricated Aqueduct

- Cofferdam installed at canal connection

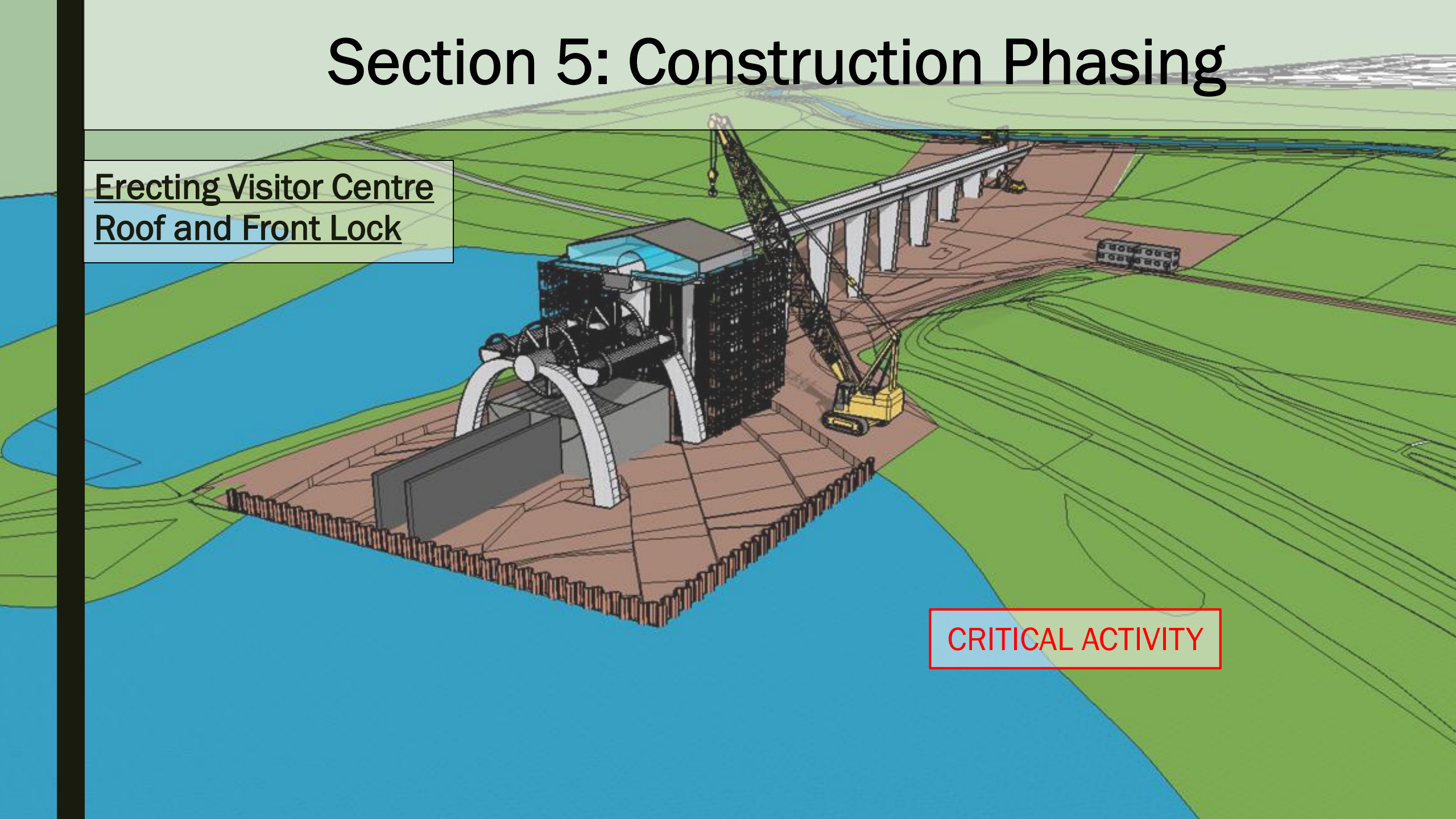
CRITICAL ACTIVITY

SAFETY CRITICAL

Section 5: Construction Phasing



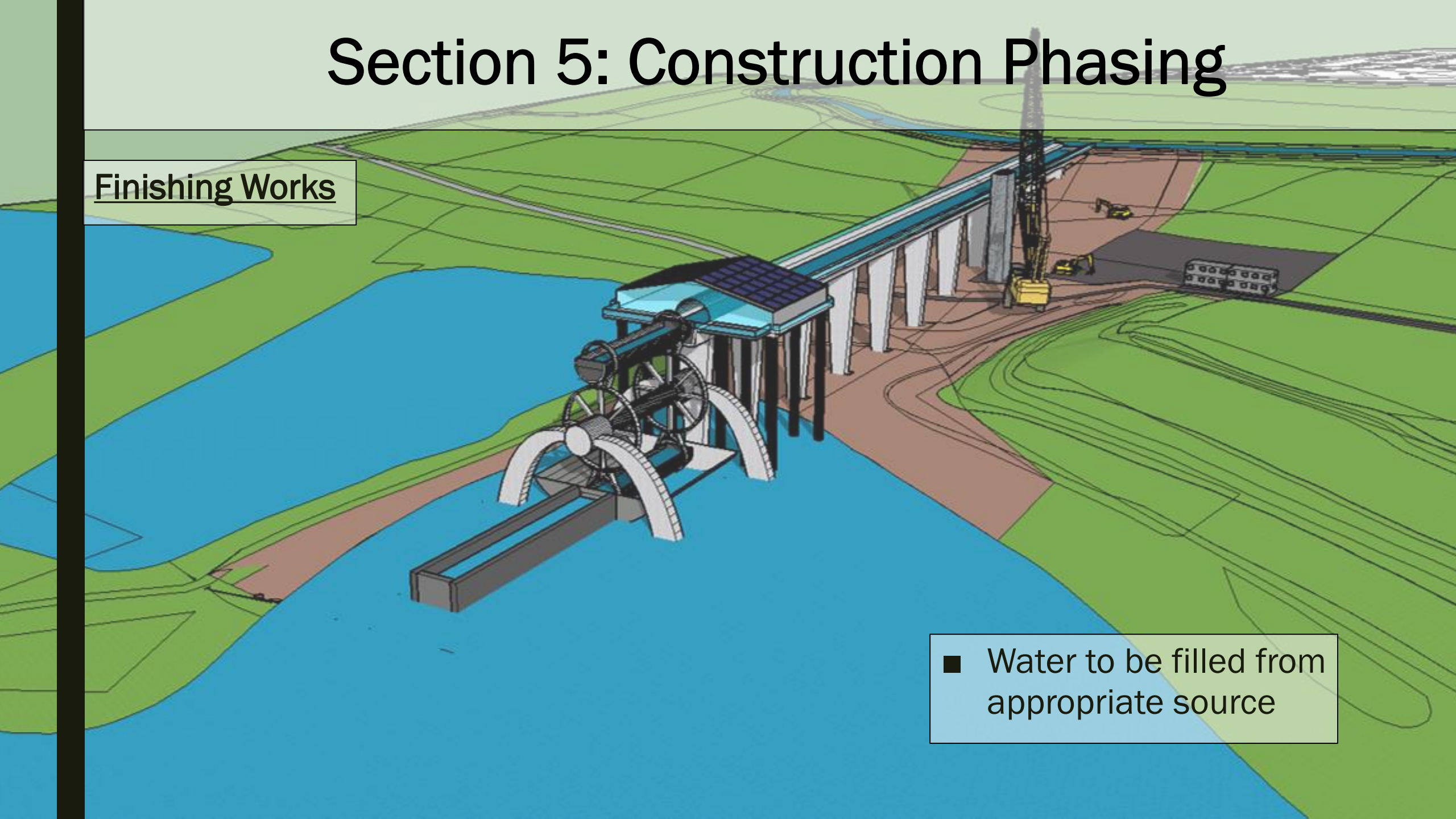
Section 5: Construction Phasing



Erecting Visitor Centre Roof and Front Lock

CRITICAL ACTIVITY

Section 5: Construction Phasing



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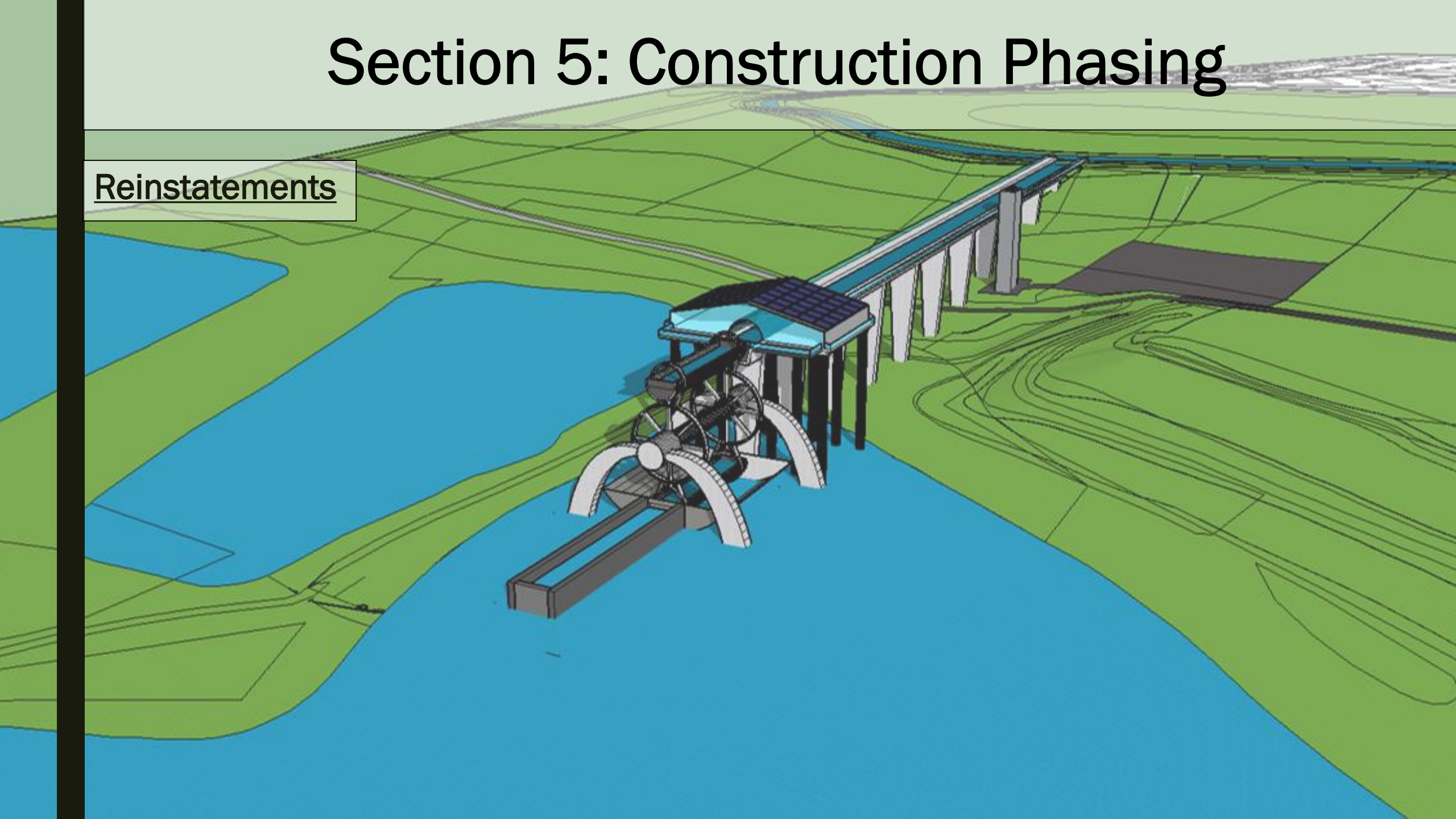

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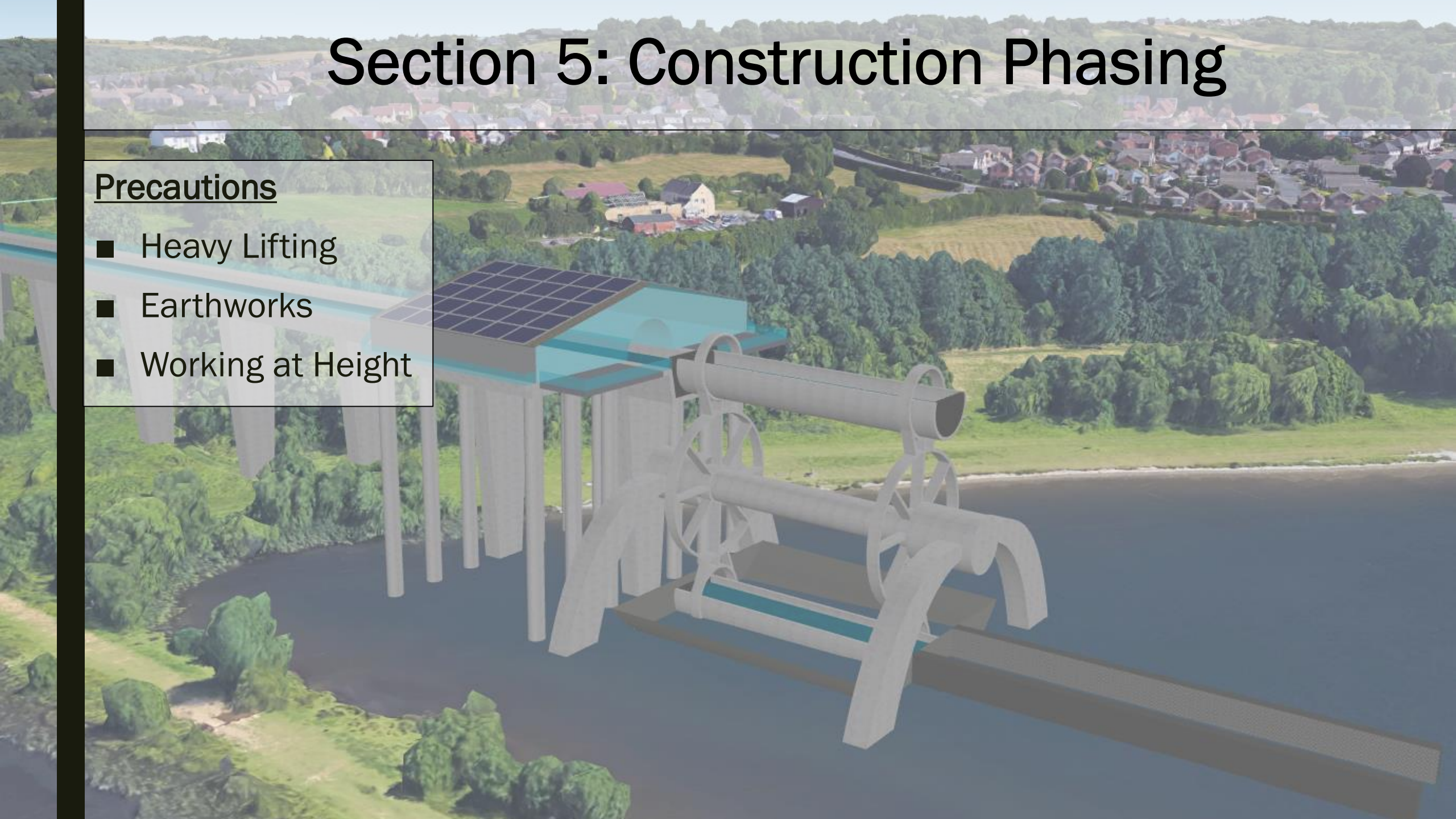
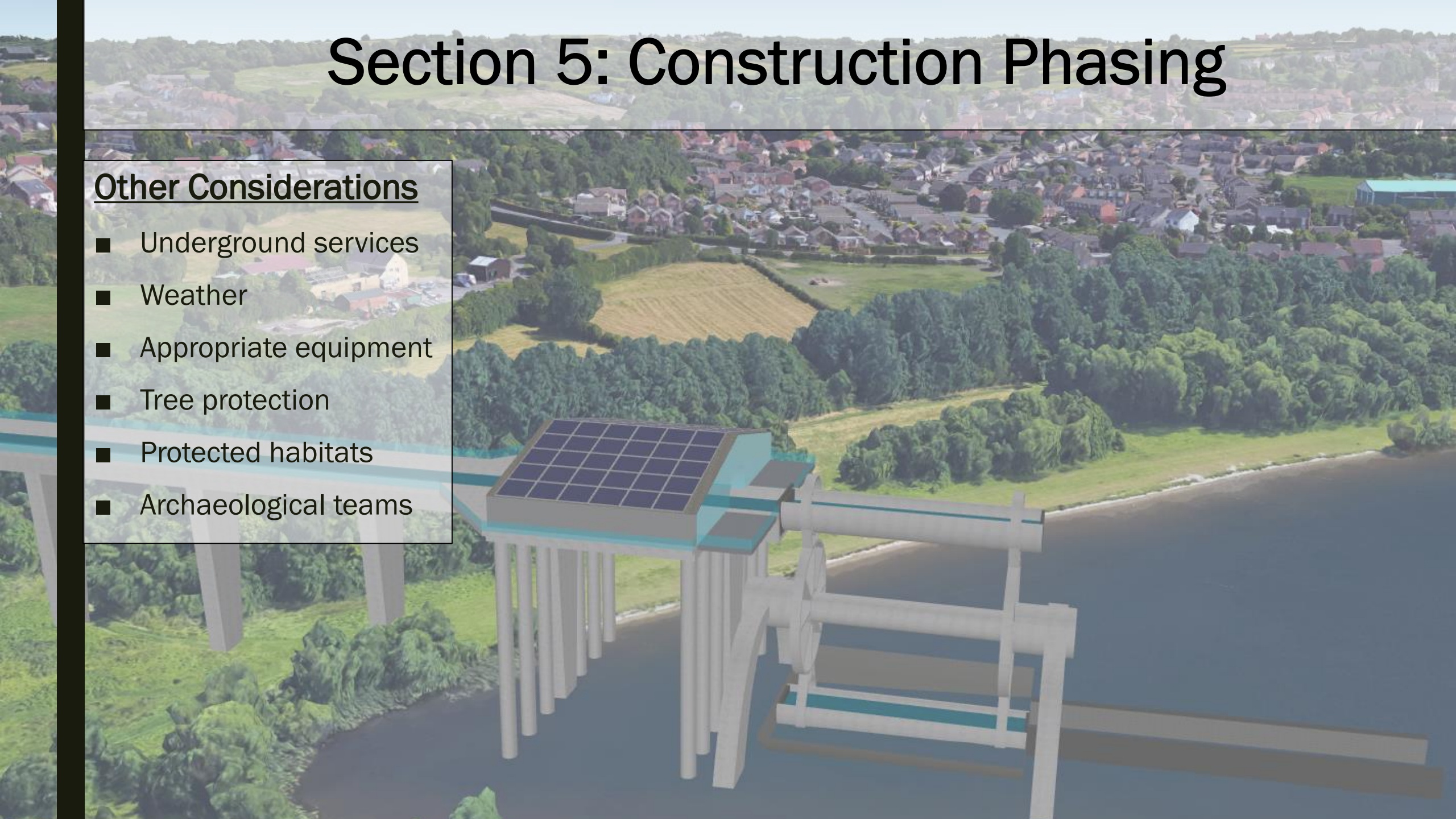


Precautions

- Heavy Lifting
- Earthworks
- Working at Height

Section 5: Construction Phasing



Other Considerations

- Underground services
- Weather
- Appropriate equipment
- Tree protection
- Protected habitats
- Archaeological teams

Section 5: Construction Phasing

Section 5: Construction Phasing

Section 6: Stakeholders

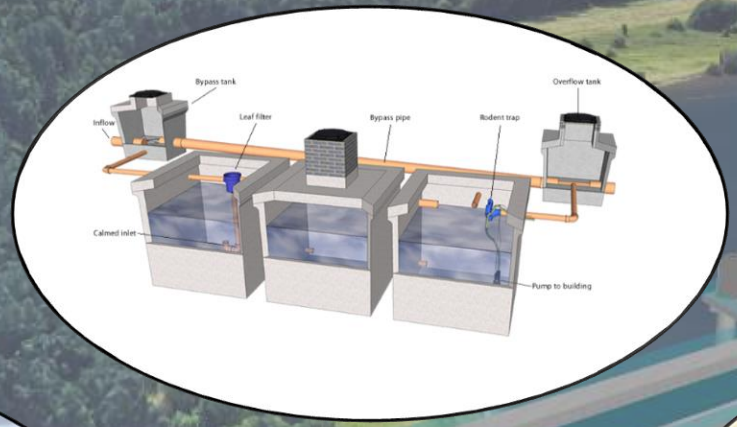
Section 7: Sustainability

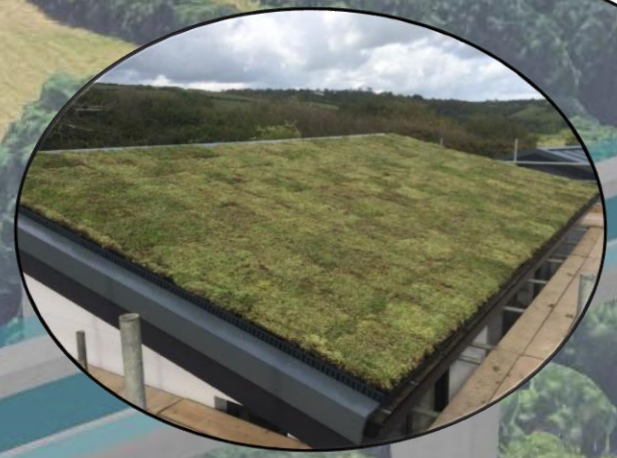
Rainwater Harvesting

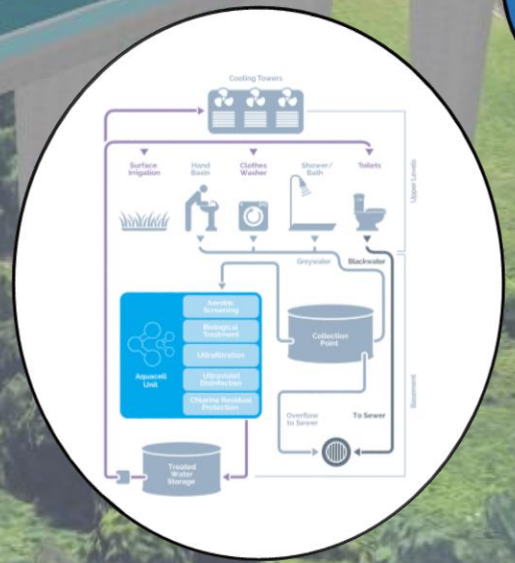
Electric Vehicle Charging Points

Green Roof

Greywater Recycling







Section 8: Summary

Extras

1) Optioneering Overview
2) Key Alterations
3) Attraction Logo
4) Before and After
5) Stakeholders
6) Sustainability

Client Requirements

1) Raise and lower boats 21.3m.
2) Use a negligible amount of water.
3) Potential use of renewable energy.
4) Low maintenance
5) Ancillary Buildings;
   a) *A visitor centre (possibly including a café)*
   b) *A small museum attraction*
   c) *Visitor car parking*

Feasibility

1) Case Studies.
2) Rotating Mechanisms.
3) Dry Dock and Lock.
4) Flood Attenuation
5) Water Level.

Construction Phasing

1) Site Clearance
2) Installation of Cofferdam
3) Earthworks and Pilling
4) Constructing Supports and Earthworks
5) Constructing Supports and Dry Dock
6) Lifting in of prefabricated Wheel
7) Lifting in of prefabricated Aqueduct and Visitors Centre Floors
8) Lifting in of prefabricated Aqueduct
9) Erecting Visitors Centre walls
10) Erecting Visitors Centre Roof and Lock
11) Finishing Works
12) Reinstatements

THANK YOU FOR LISTENING

Any Questions?