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Optimising Operational Planning and Pipeline Design in England

Delivering planning and development better than ever before.

Presenter: Jon Tong

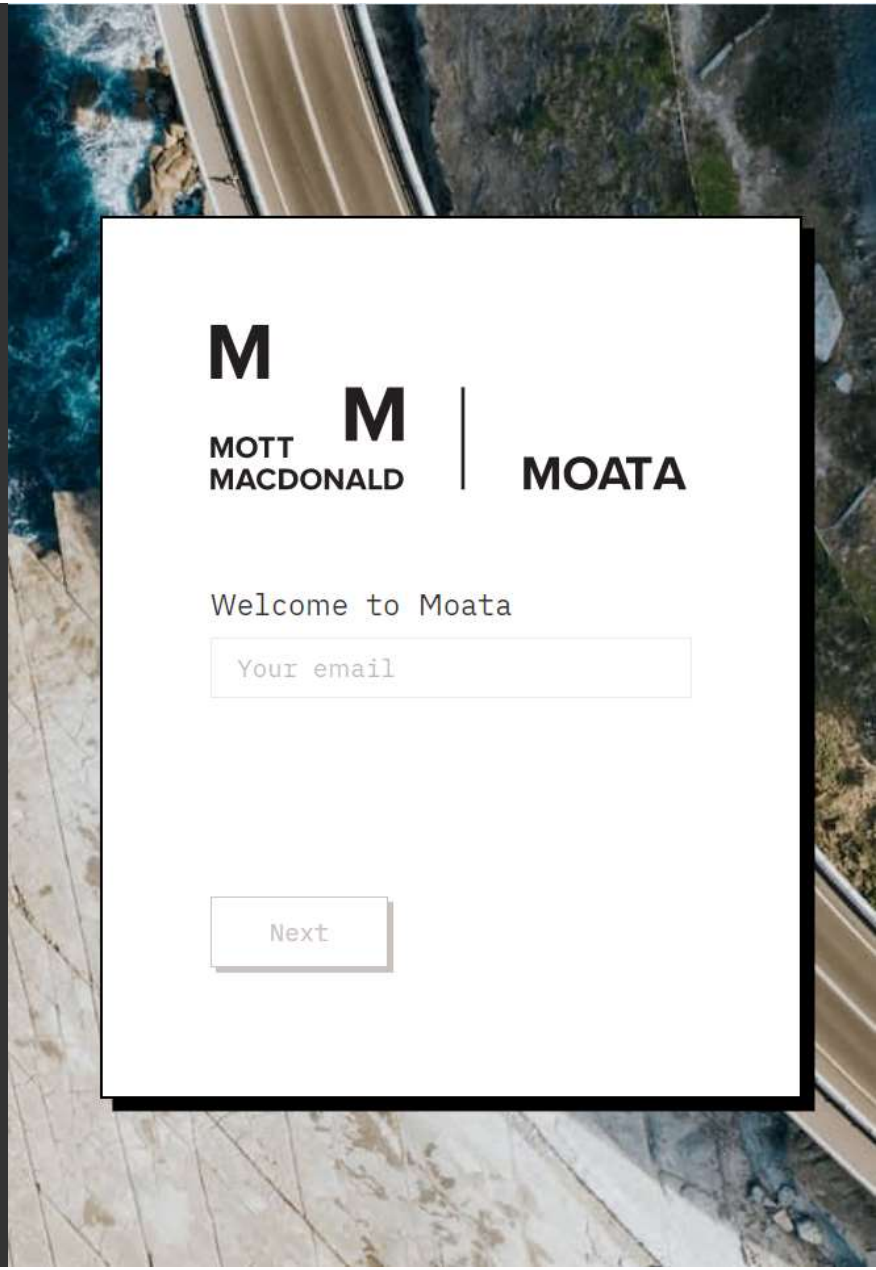
Singapore International Water week 2022

Our digital twin platform

Combination of Domain + Digital

Powered by data with our digital expertise, it delivers predictive power in geospatial context.

Host solutions to solve today's most pressing infrastructure problems across sectors and the asset lifecycle.



Moata Smart Water

Suite of **cloud-based** analytics and visualisation products providing **real-time** insight into water asset performance to enable **predictive maintenance** and better decision making.

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solving the world's water challenges

100 years

KS0

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Optimising Operational Planning in England

Marginal Cost of Water (MCOW)

providing insights for better decisions

Background to MCOW project

Severn Trent Water

Population served: 8 million people

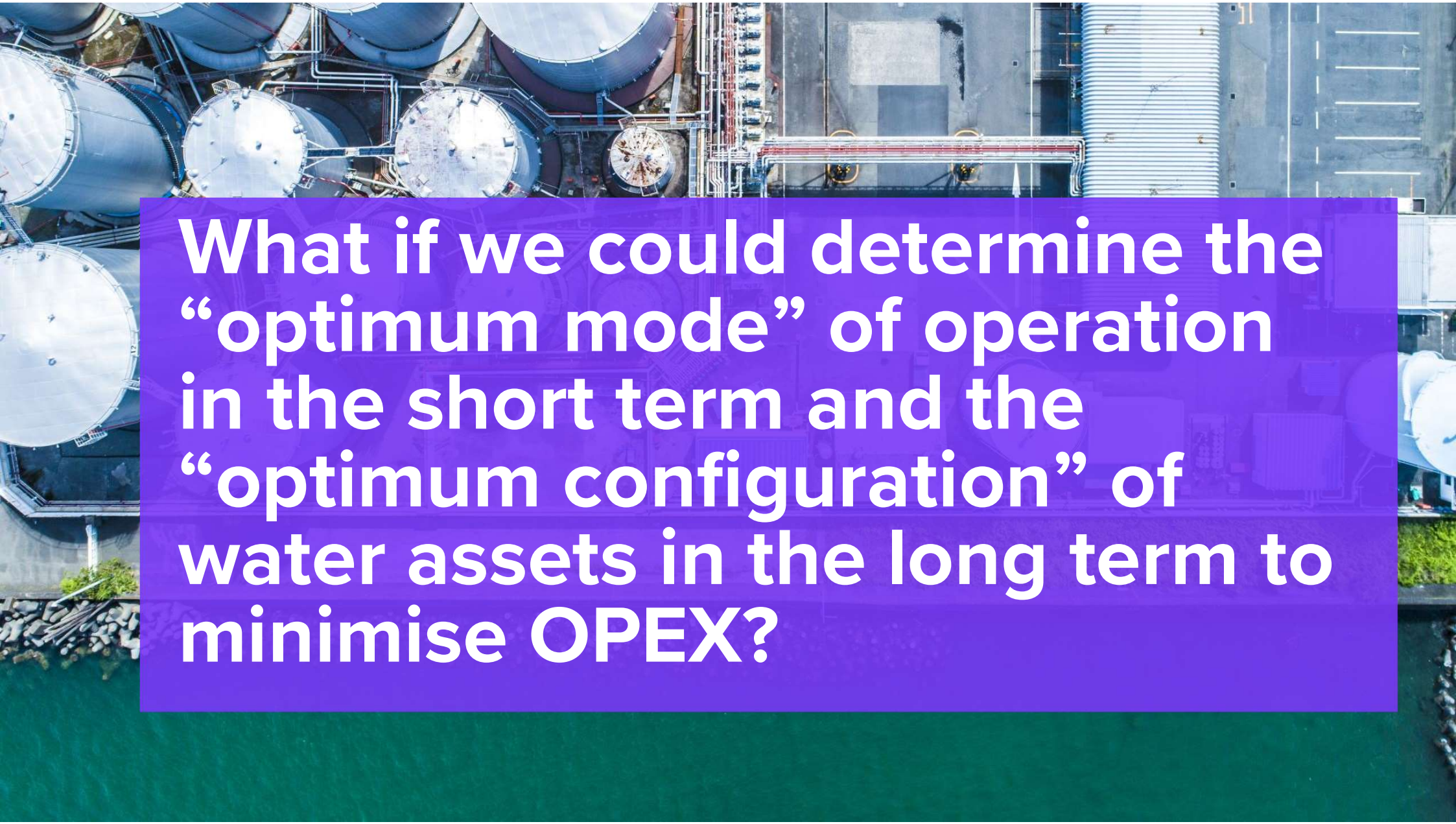
Area of utility: Central England and parts of Wales – catchment of River Severn and River Trent

Key utility drivers: Operational Efficiency

Resilience

Water Quality (Drinking and Discharge)

Growth



What if we could determine the “optimum mode” of operation in the short term and the “optimum configuration” of water assets in the long term to minimise OPEX?

Process flow for MCOW project

Prove concept for a key section of Severn Trent's Strategic grid

Explore consolidation options to minimise marginal cost of supply

Extend method to whole of strategic grid, improving visuals/analysis

Incorporate marginal costs of abstraction, treatment and transmission into "Aquator" and optimise for **cost** accounting for **yields, licences, capacities, constraints.**

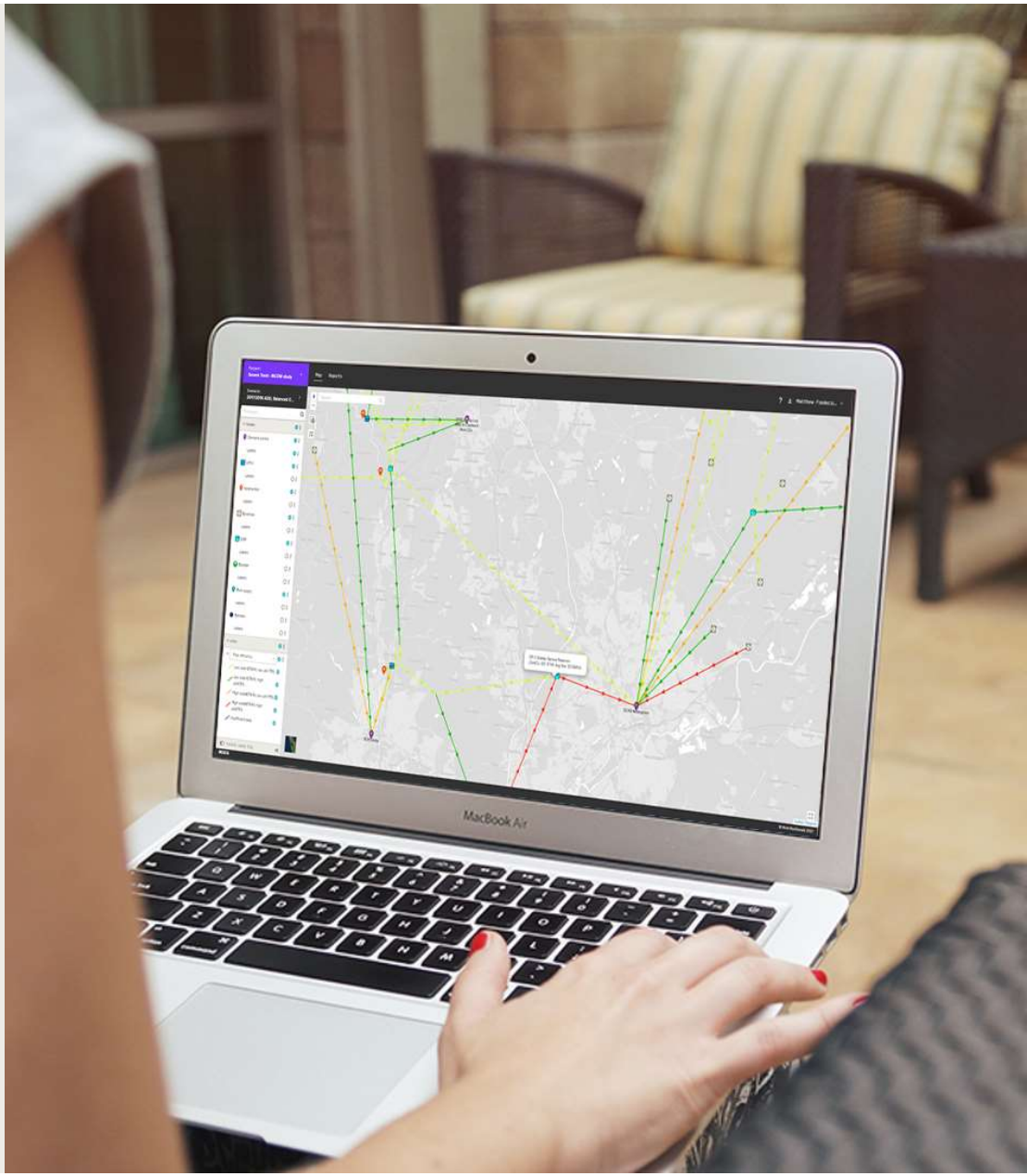
Moata Marginal Cost of Water

- Find operational efficiencies in the network without investing capital
- Derive marginal costs of individual components
- Translate specialist knowledge of how supply/demand propagates through the network into automated code
- Replace outdated reporting framework
- Quickly model and visualise multiple future scenarios

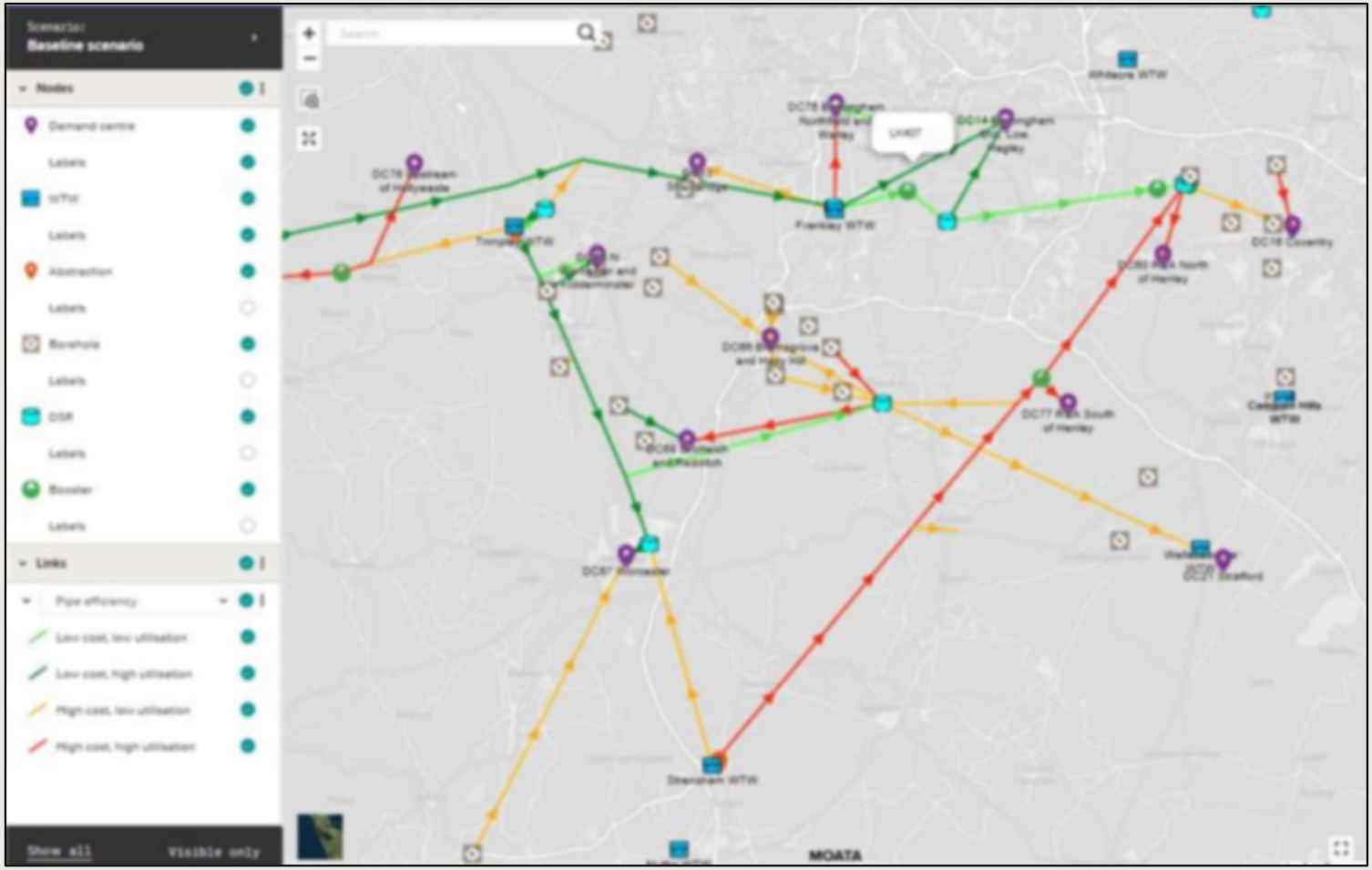
643
components in the digital model

3 min
to compute, upload and visualise scenario results

>99.9%
time saving on previous process



- **Benefits**
  - Optimises source utilisation and WTW outputs to minimise marginal cost of supply within constraints
  - Identifies high-cost-high utilisation hot-spots and low-cost-low-utilisation opportunities
  - Visualisation and drill-down functions enable rapid access to insights from modelling

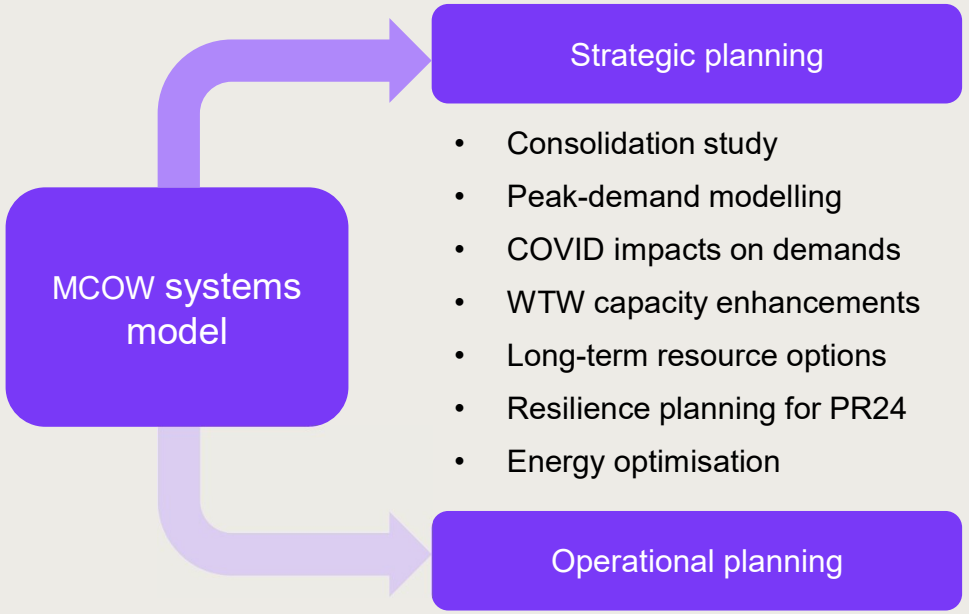


Red: Higher MCOW
Green: Lower MCOW

KS0

Where next?

Potentially a tool for planning today as well as tomorrow



- Consolidation study
- Peak-demand modelling
- COVID impacts on demands
- WTW capacity enhancements
- Long-term resource options
- Resilience planning for PR24
- Energy optimisation

- WTW production planning
- Maintenance planning
- Outage planning
- Energy optimisation

Strategic planners
(MRO for transfer planning and design)

Water resource planners

Asset planners

Network controllers

WTW managers

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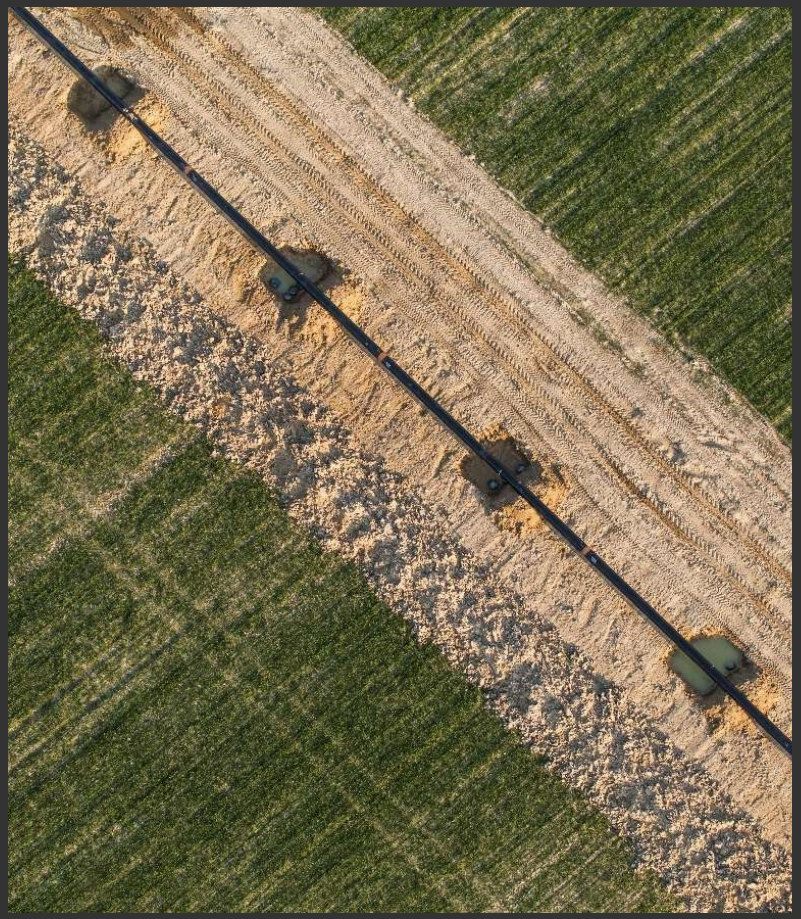
Optimising Pipeline Design in England

Moata Route Optimiser

From strategic to detailed pipeline design development focusing on whole life cost from the outset.

What Route Optimiser offers in Water



Programme savings

Up to **10%**

80+ constraints
(linear and polygon)

70+
pipes in the catalogue

Over 100
design rules

Outturn savings vs best modern alternative

4 - 10%

Operational carbon reduction

Up to **10%**

Speed | Stability | Consistency

UK projects

Over 100 strategic routes assessed to date – over 4000km

Various new pipeline assets

Essex and Suffolk + Berwick

Affinity Water WRMP 24 + T2AT

Thames Water WRMP 24

Water Resources South East

WRMP24, AW SROs (A2AT & SLR)

SPA pipeline project

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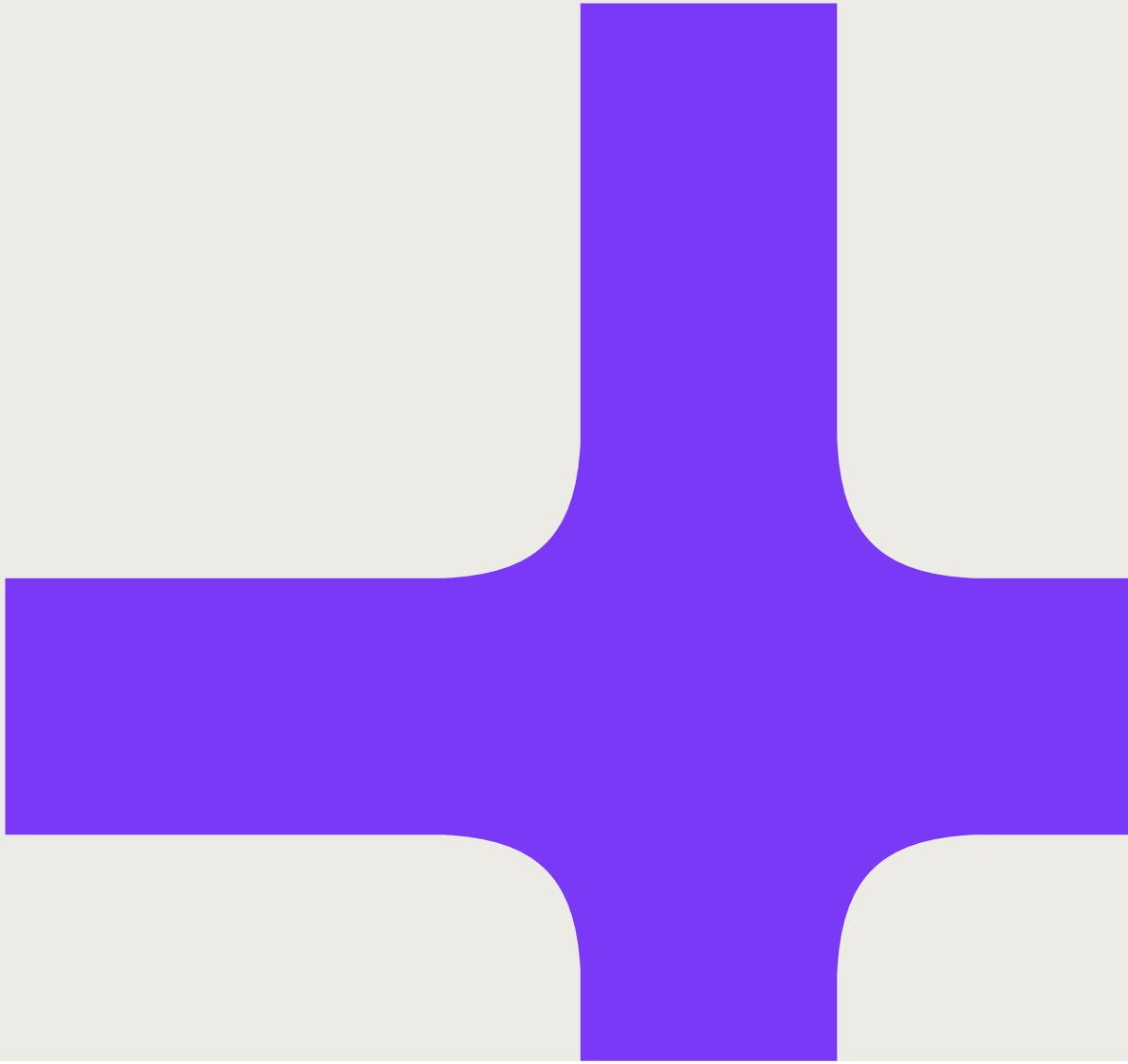
MRO
Product features

The spatial constraints (context)

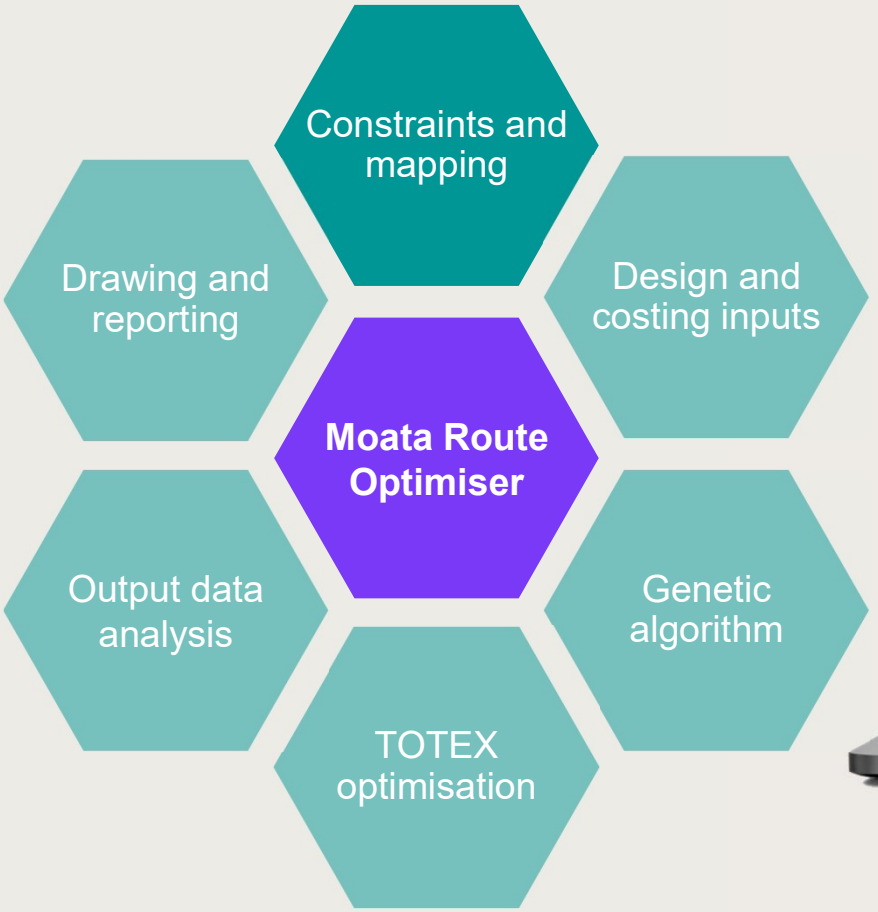
The hydraulic and geometric design variables

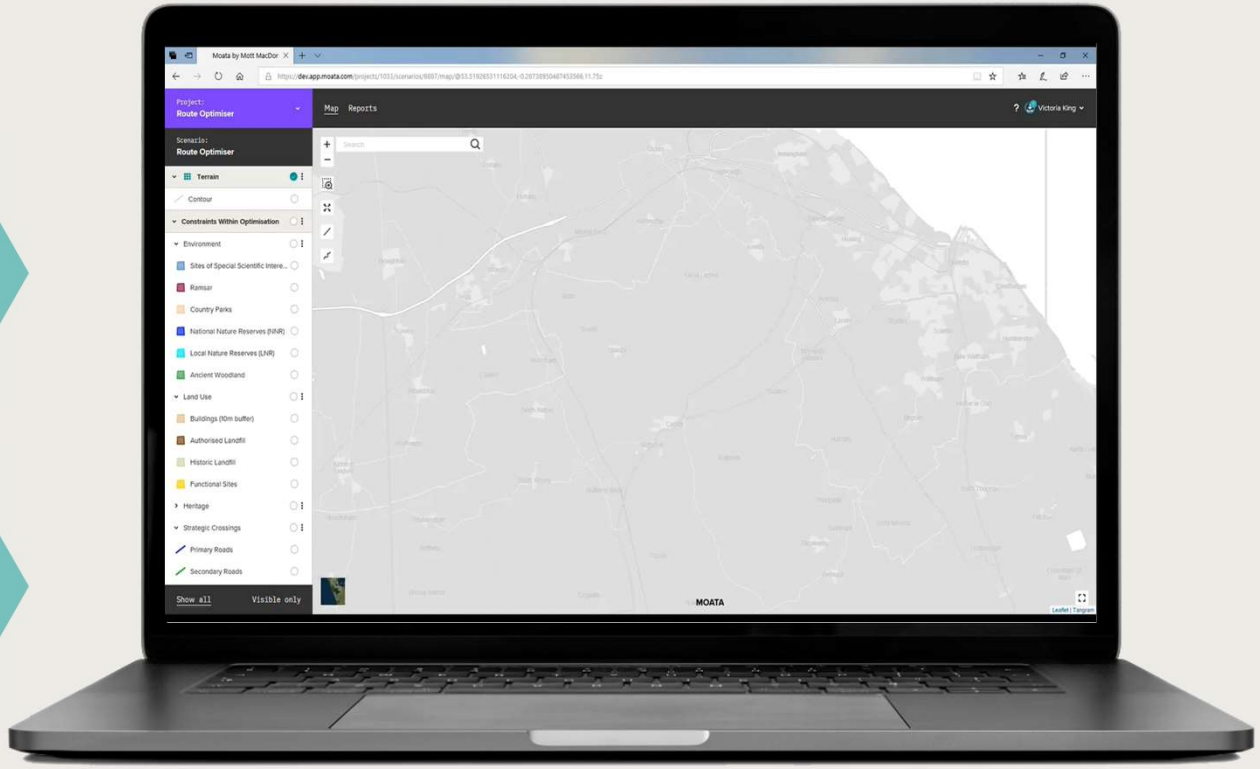
The cost drivers and GA behaviour

Detailed design outputs



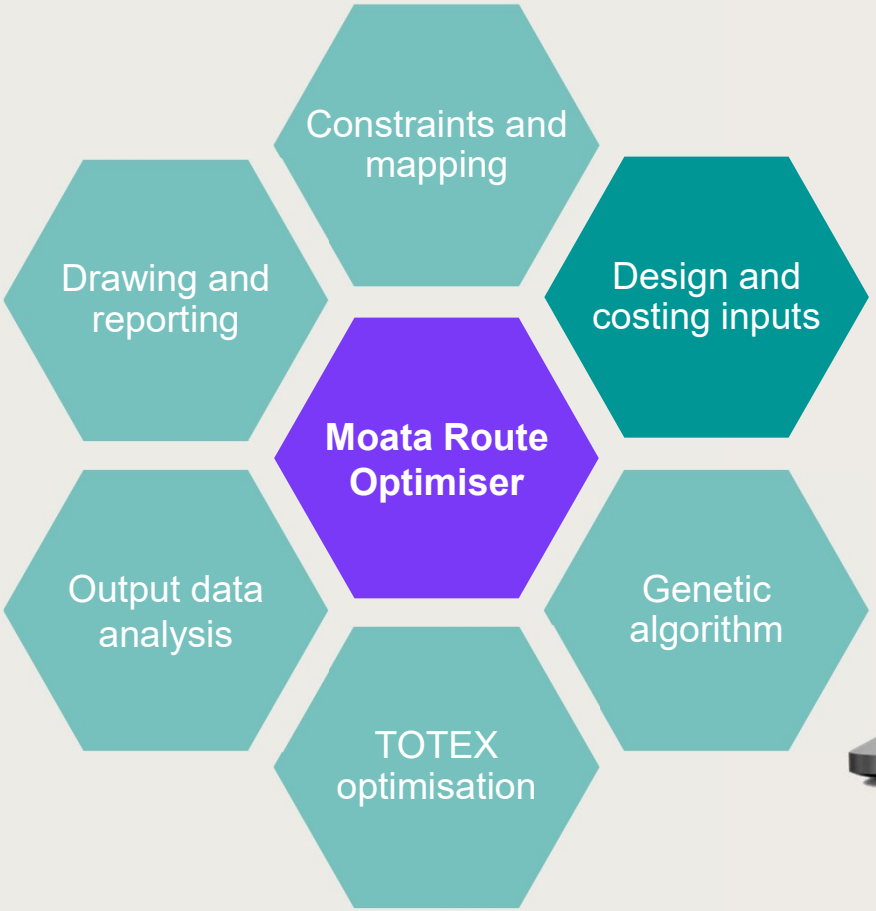
The spatial context

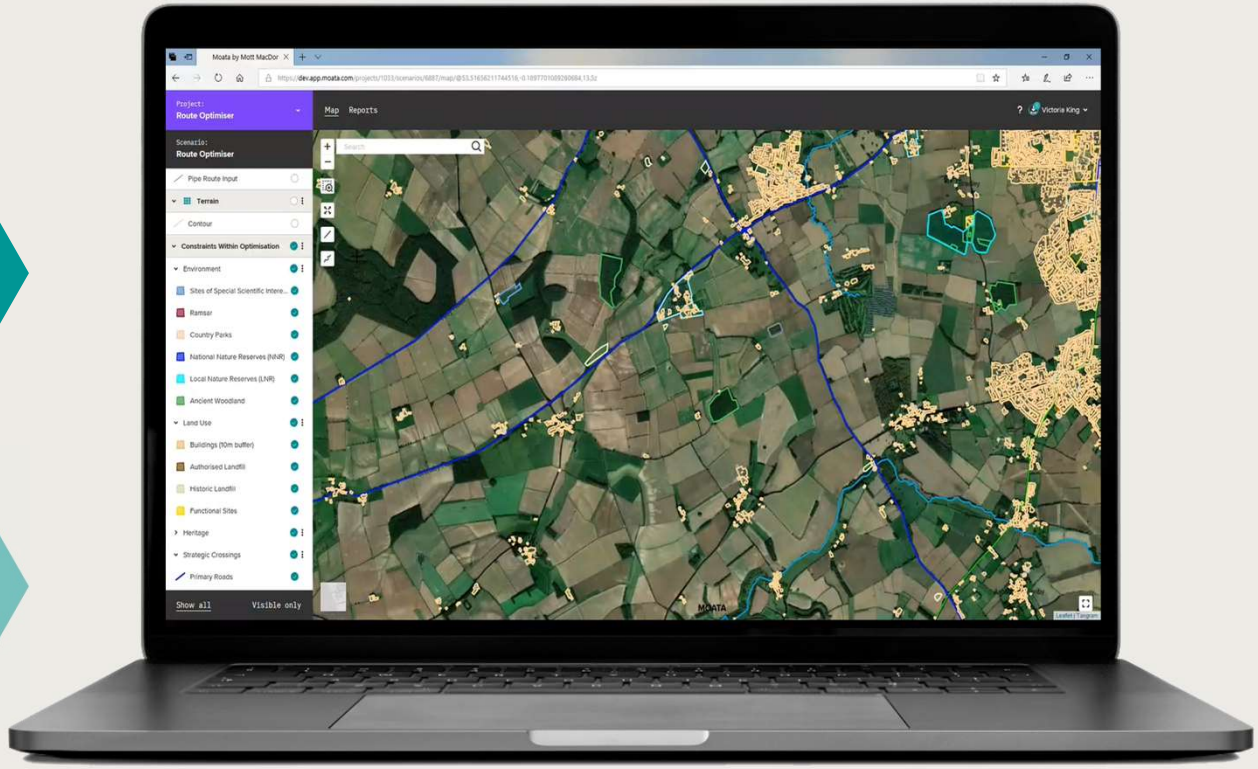




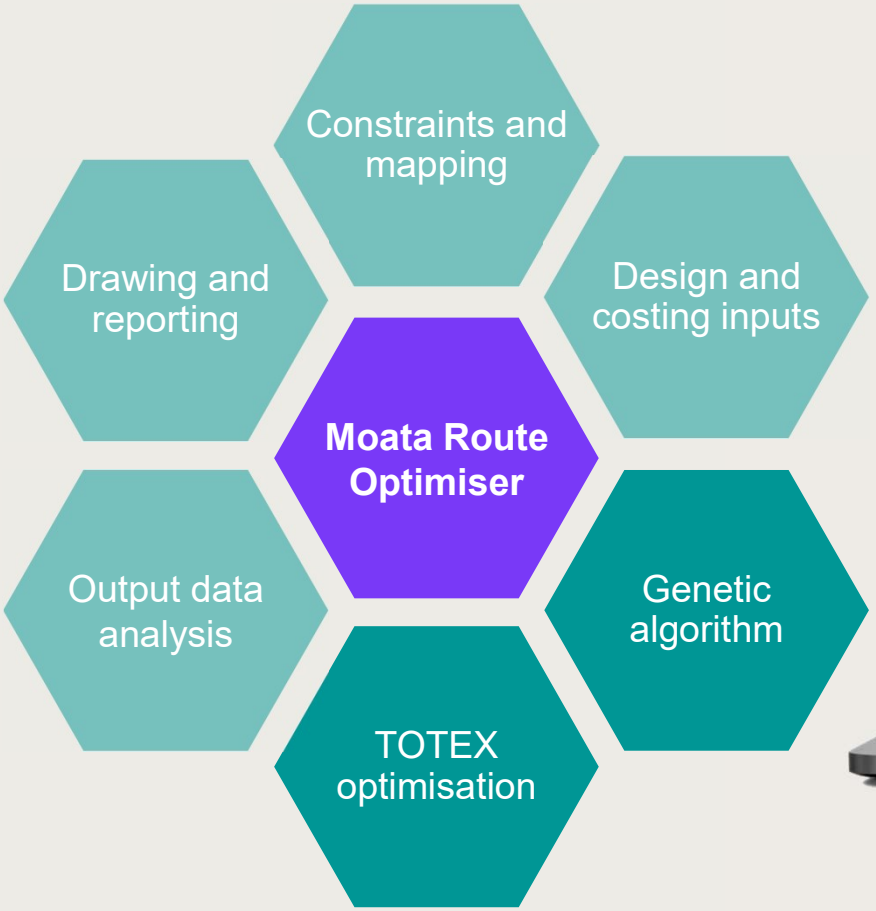
Geospatial user interface, topographical data and multiple constraints mapped

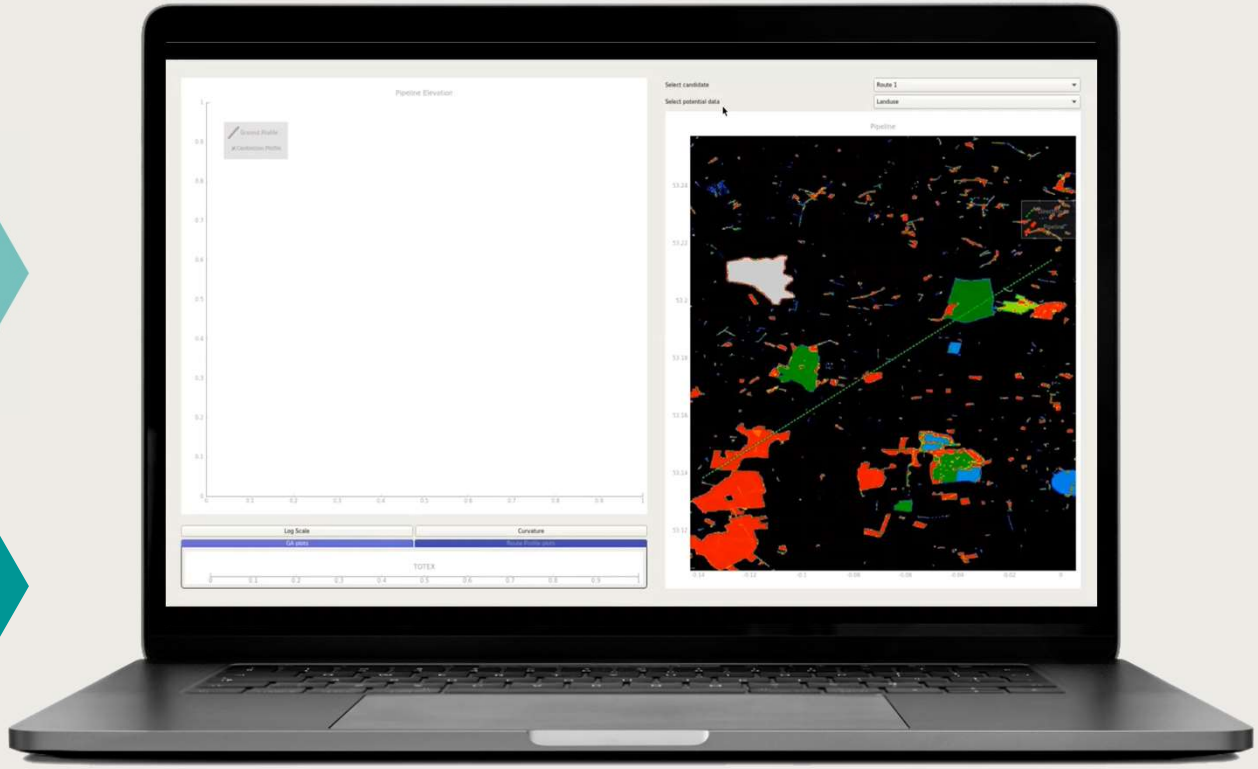
The hydraulics and geometric design variables





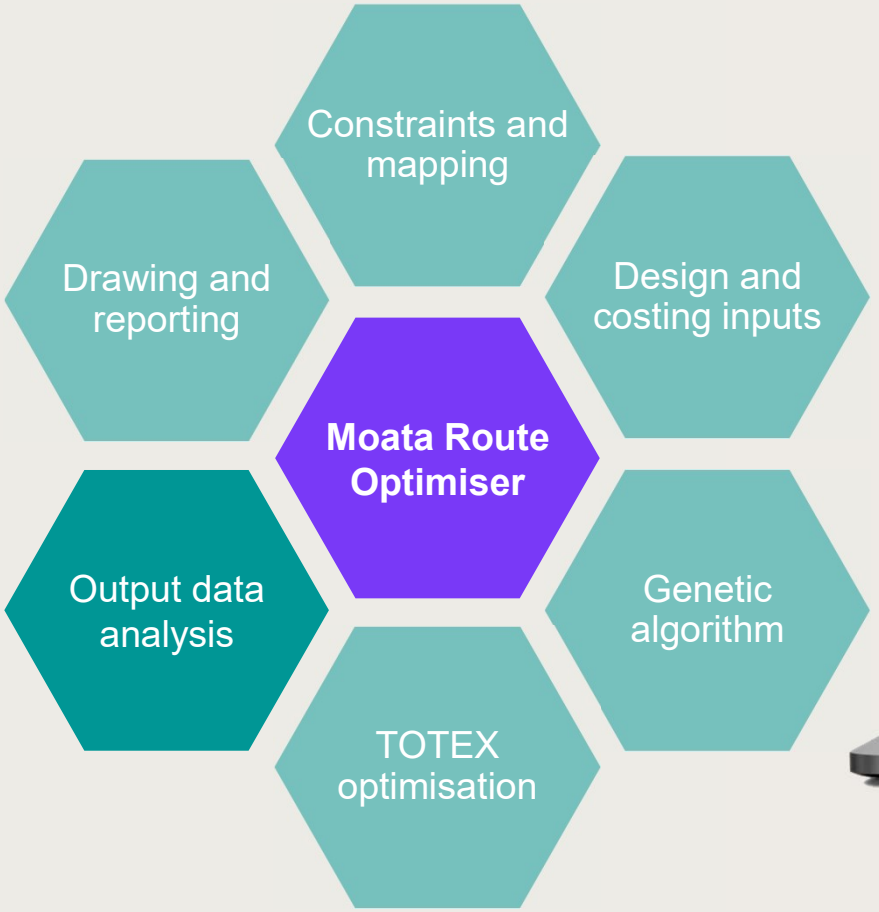
The digital piece: Using a genetic algorithm GA



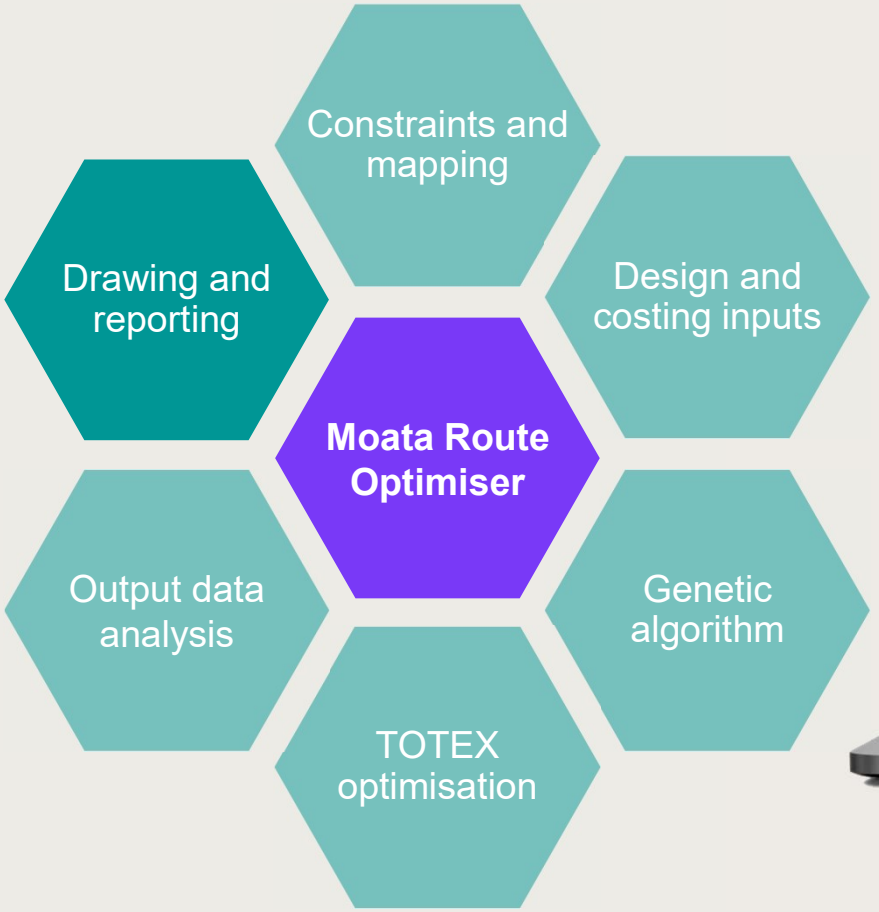


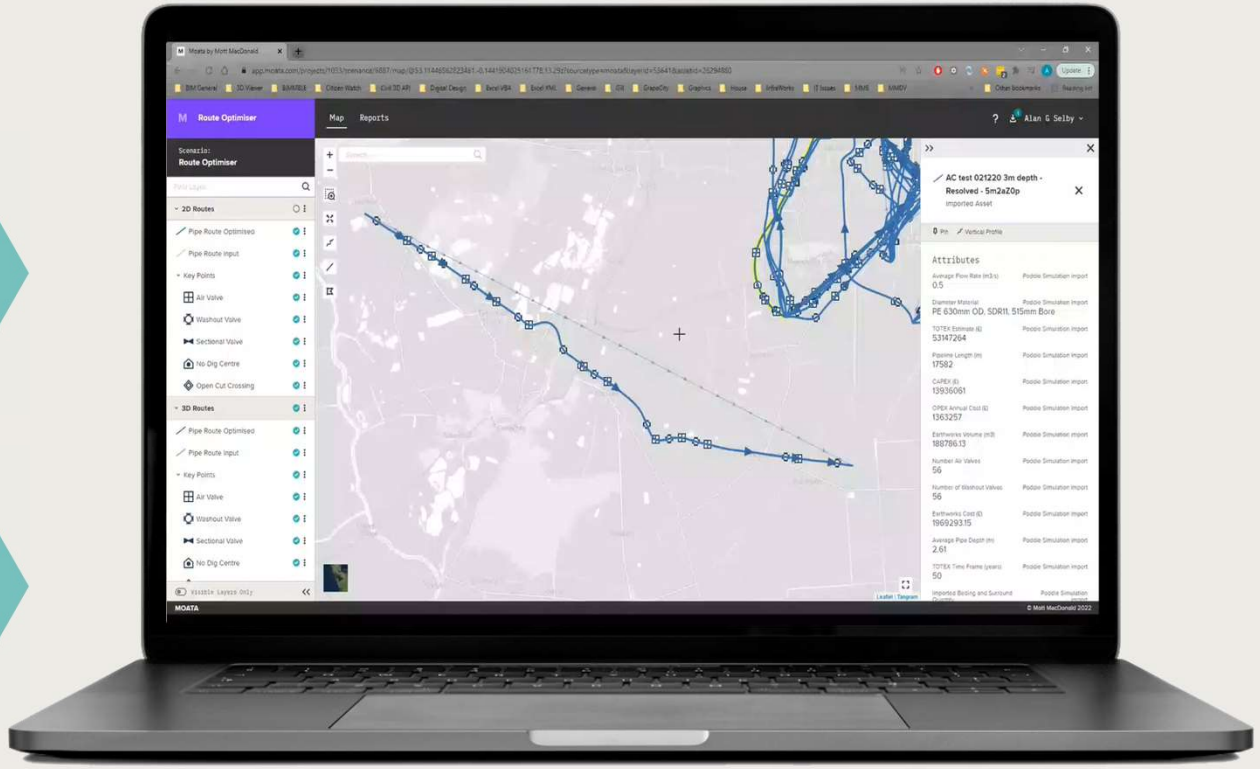
Pipeline route optimised by powerful Genetic Algorithm driven by costing data and design rules

Outputs and analysis



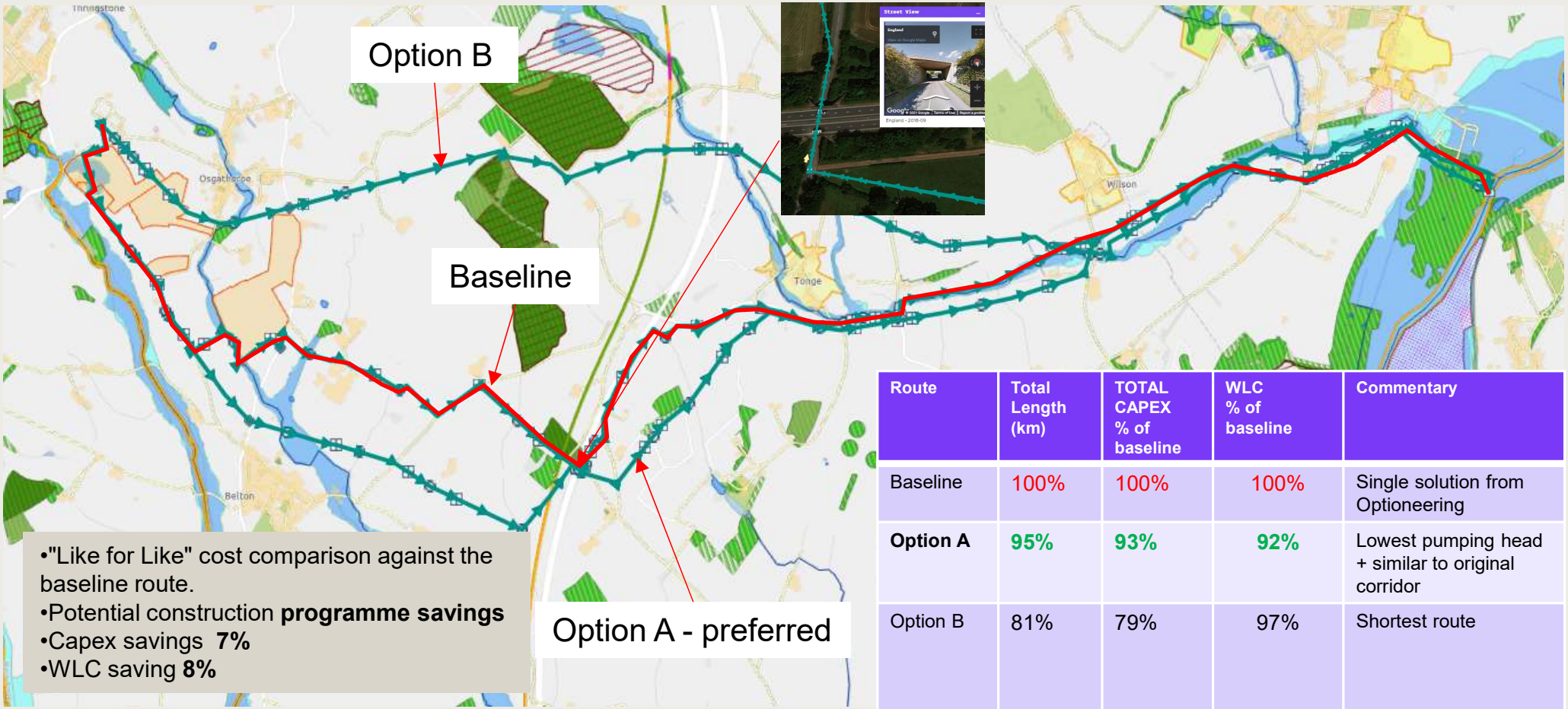
Detailed design deliverables






STW Case study

Snarrows Project

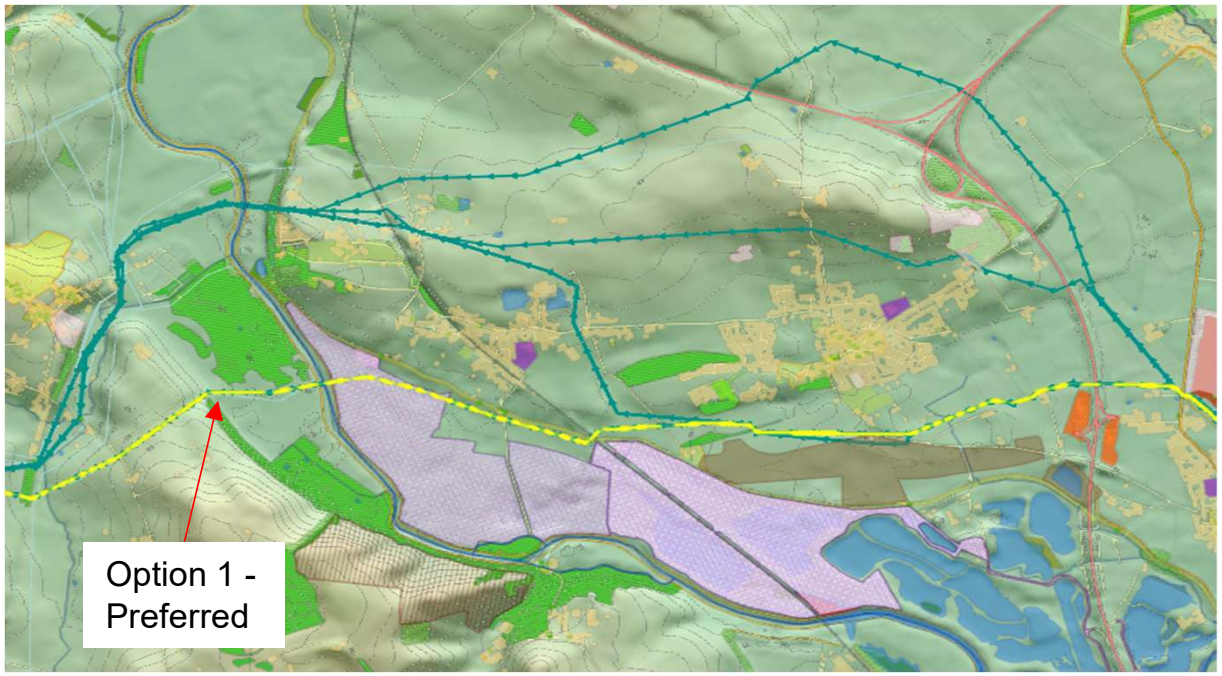


- "Like for Like" cost comparison against the baseline route.
- Potential construction **programme savings**
- Capex savings **7%**
- WLC saving **8%**

Route	Total Length (km)	TOTAL CAPEX % of baseline	WLC % of baseline	Commentary
Baseline	100%	100%	100%	Single solution from Optioneering
Option A	**95%**	**93%**	**92%**	Lowest pumping head + similar to original corridor
Option B	81%	79%	97%	Shortest route

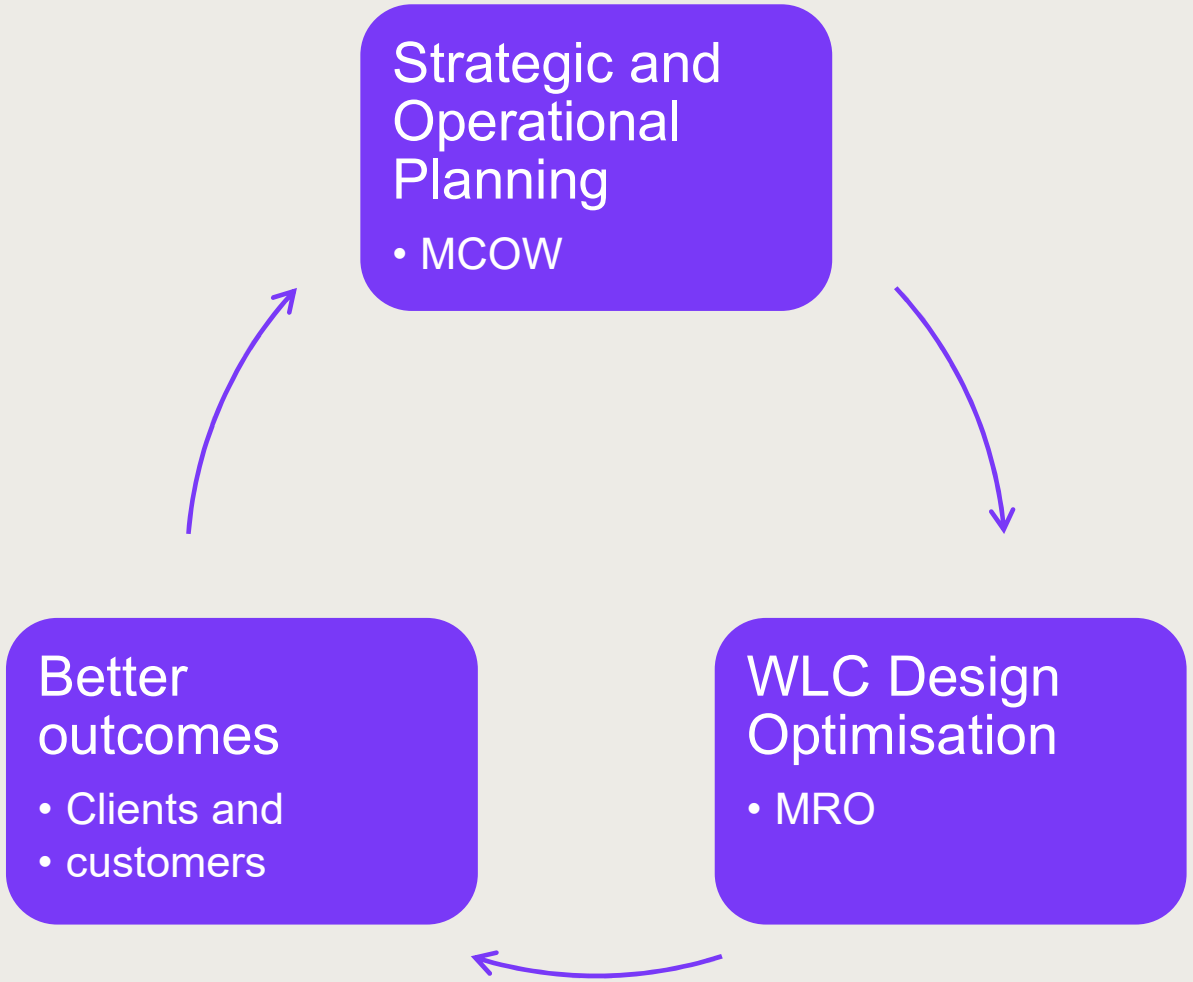
Church Wilne Project

- Fast-tracked robust route optimisation - two weeks, half the average time of traditional approaches.
- As the client had greater insights sooner, they could make evidence-based decisions faster, ultimately saving delivery programme time.
- Severn Trent Water asked Mott MacDonald to identify pipeline route options to transfer 50Ml/day of treated water from Church Wilne treatment works to Melbourne treatment works, and to also assess reverse flow capability.
- The client wanted a quick assessment of multiple options, covering the hydraulics, costs and environmental impact of each one.



Option	Length (km)	Crossing	CAPEX (%)	OPEX (%)	TOTEX (%)
Option 1: North Route (preferred)	12.5	6	-6.7%	-10.8%	-8.4%
Option 1A: North Route with diversion	14.0	6	+1.7%	-7.7%	-3.8%
Option 1B: North Route with diversion	13.7	8	+5.0%	-9.2%	-2.8%
Option 1C: North Route with Diversion	14.5	9	+13.0%	-9.2%	+0.4%
Option 2: South Route – rejected	14.0	5	100%	100%	30.85

How does pipeline route optimisation fit into the bigger picture?




It all begins with data and
ends with outcomes

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Thank you