

Life 4 Fish project: towards fish-protective hydropower production in the Lower Meuse in Belgium

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HECE – Hydraulics in Environmental and Civil Engineering

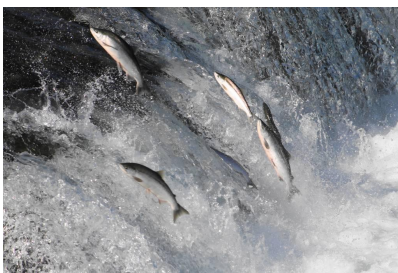
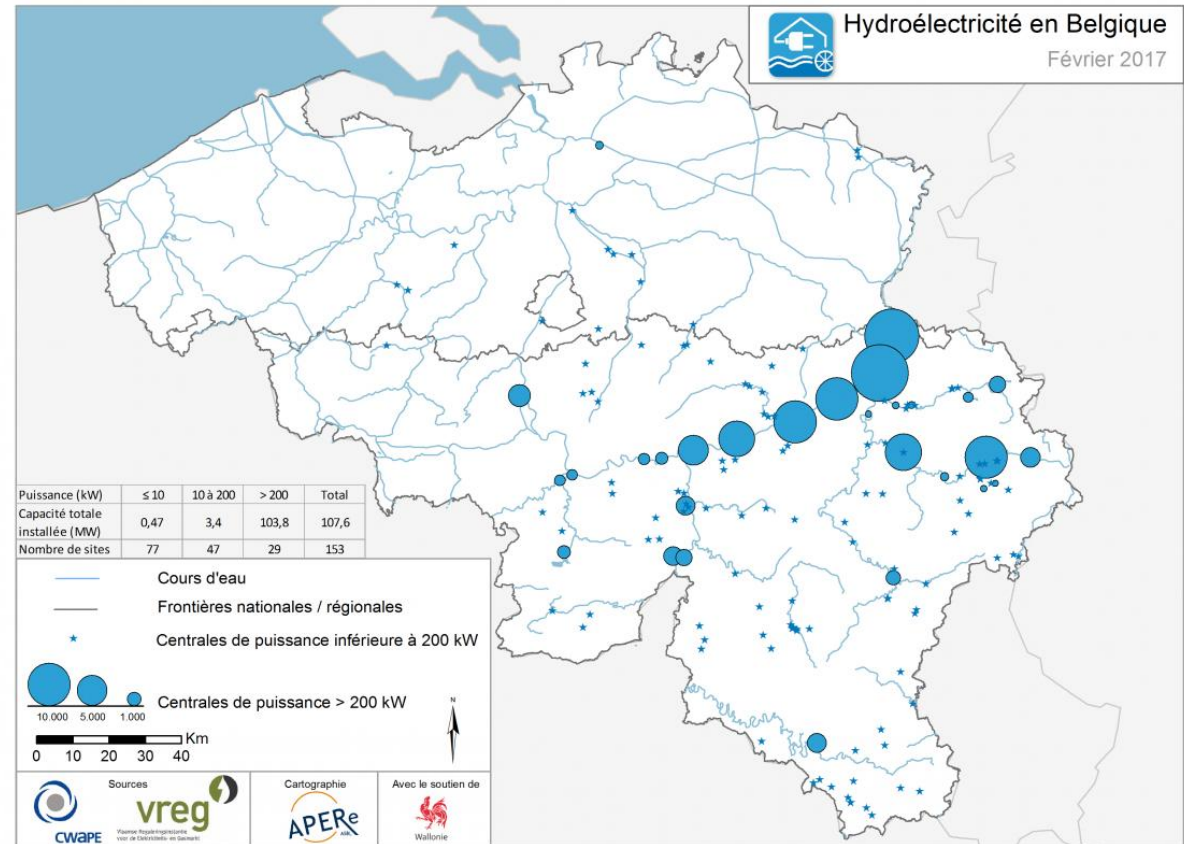
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Context

Equipment of most of european rivers for navigation, flood control and electricity production

Belgian low Meuse =

- 6 HPP
- 68 MW
- 1954-1988
- Operated by EDF-Luminus



Impositions at EU level on **ecological continuity**



Life4fish project

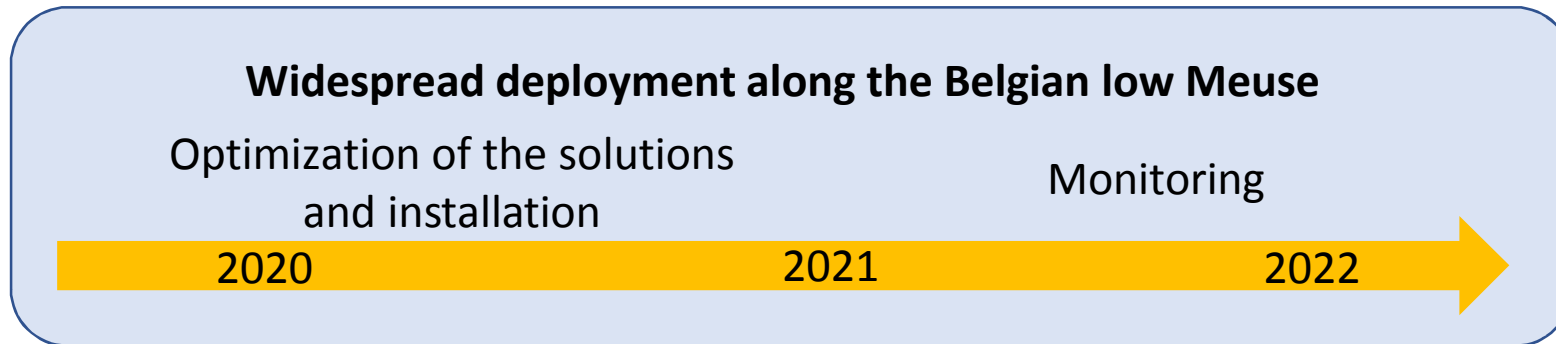
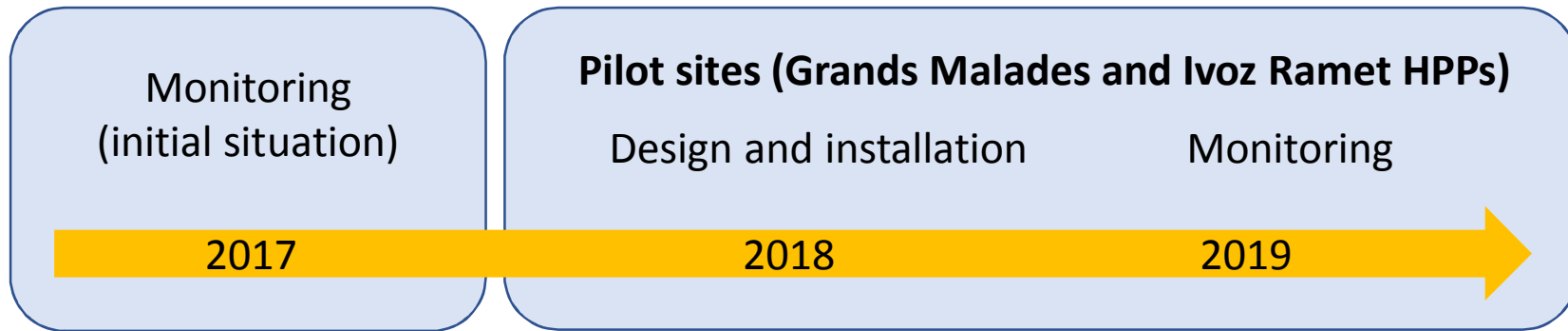
Safer downstream passage for downstream migrating eels and salmon at the 6 EDFL HPPs on the Belgian low Meuse river, while securing profitability of green hydro business

Private and public actors, from research and industry, to

- Collect (ecological) data
- Study, design and implement sustainable solutions to improve ecological continuity on the 6 sites
 - predictive model
 - repulsive barriers
 - safe downstream passages
- Install “Eco-sustainable” turbines



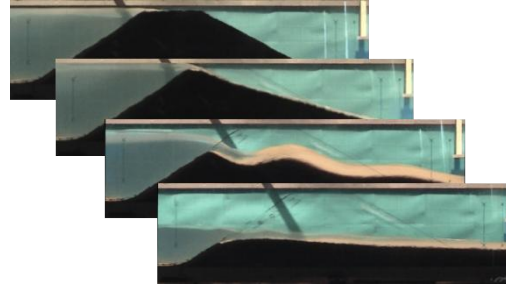
Life4fish project



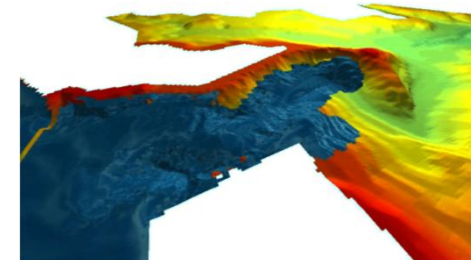
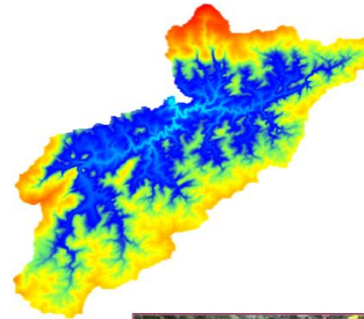
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Continuous developments in hydraulic modelling by means of interaction between

- Physical modelling



- Numerical modelling



- Field analysis



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Action A3: Modelling of passages through the hydraulic works in order to design the solutions

Hydraulic modelling to

Project time line

1) Describe flow conditions close to pilot sites (existing situation)

→ correlation with observed fishes behaviour

→ design of by-pass solutions (Actions C1 and C2)

2) Improve knowledge basis of salmon smolts behaviour regarding hydrodynamic conditions

→ improve by-pass solutions design (Action C4)

3) Describe flow conditions close to pilot sites (modified situation)

→ correlation with observed fishes behaviour

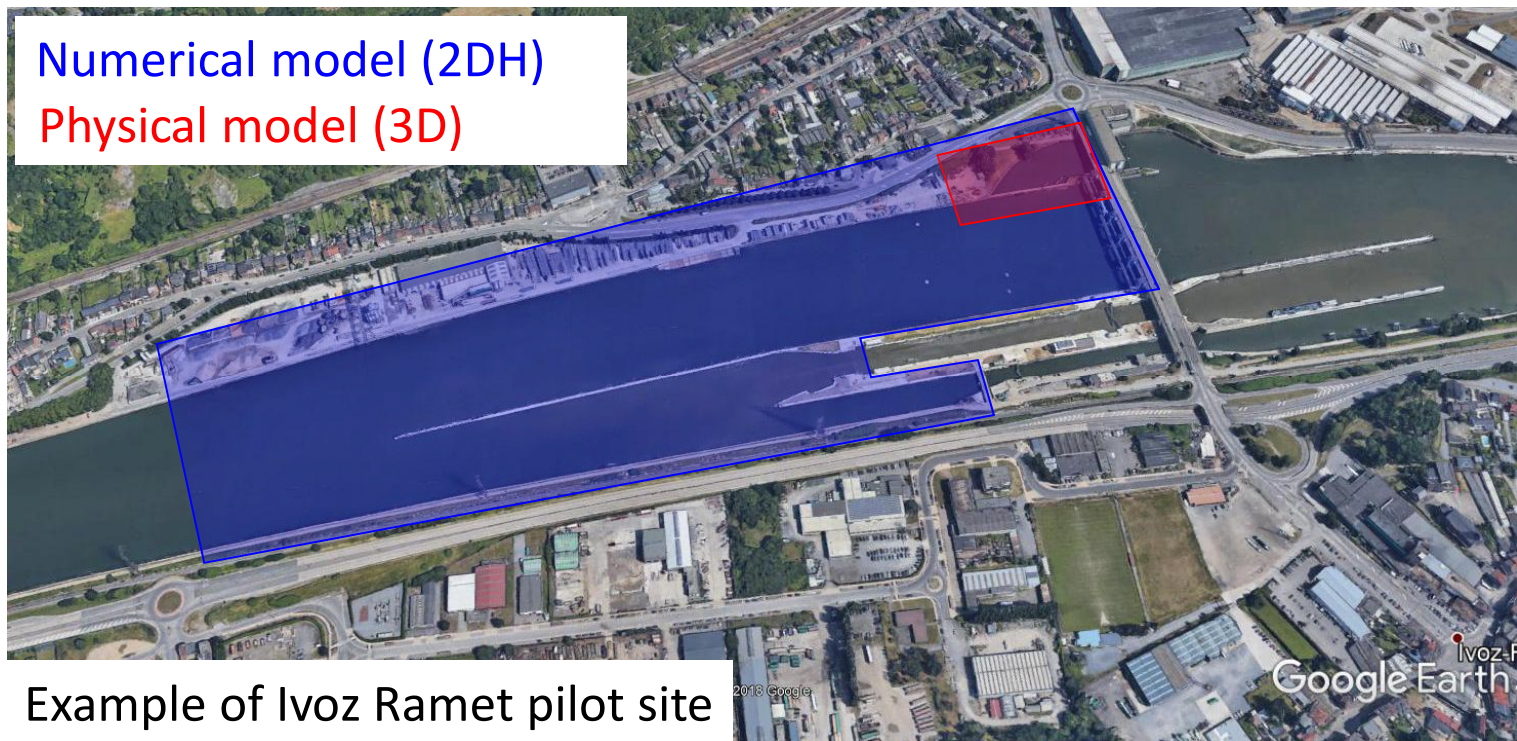
→ improve by-pass solutions design (Action C4)



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Action A3: Modelling of passages through the hydraulic works in order to design the solutions

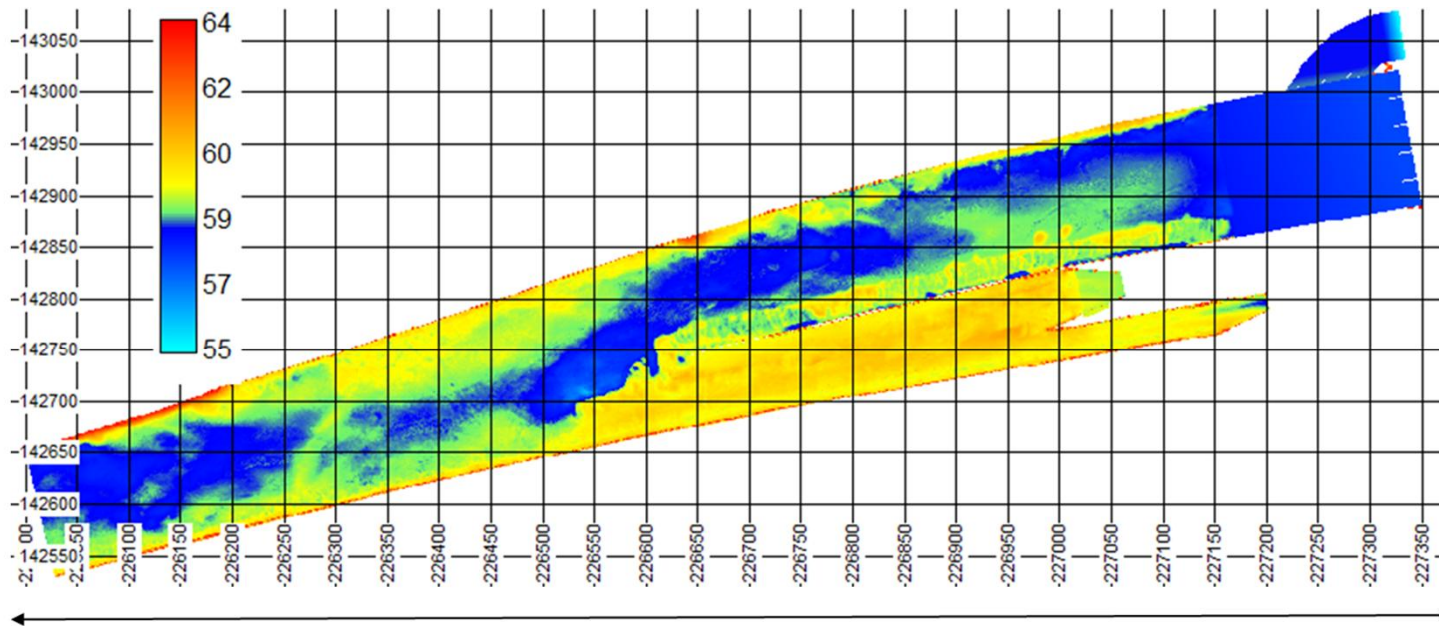
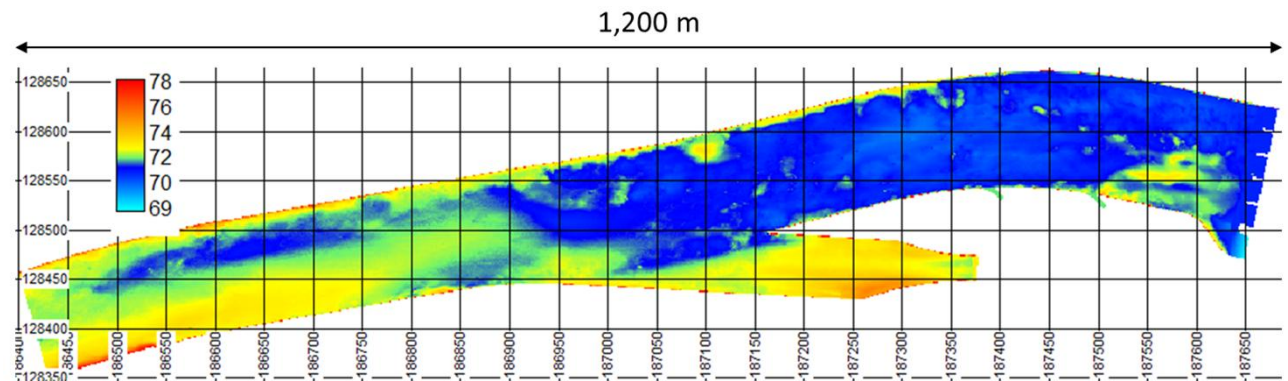
Combination of numerical and scale physical models (composite modelling)



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Numerical models
of the pilot sites

Grands Malades



WOLF2D model

- SWE
- k- ϵ turbulence model
- Finite volume
- Grid 50x50cm²

Ivoz-Ramet



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Scale physical models of the pilot sites

Grands Malades
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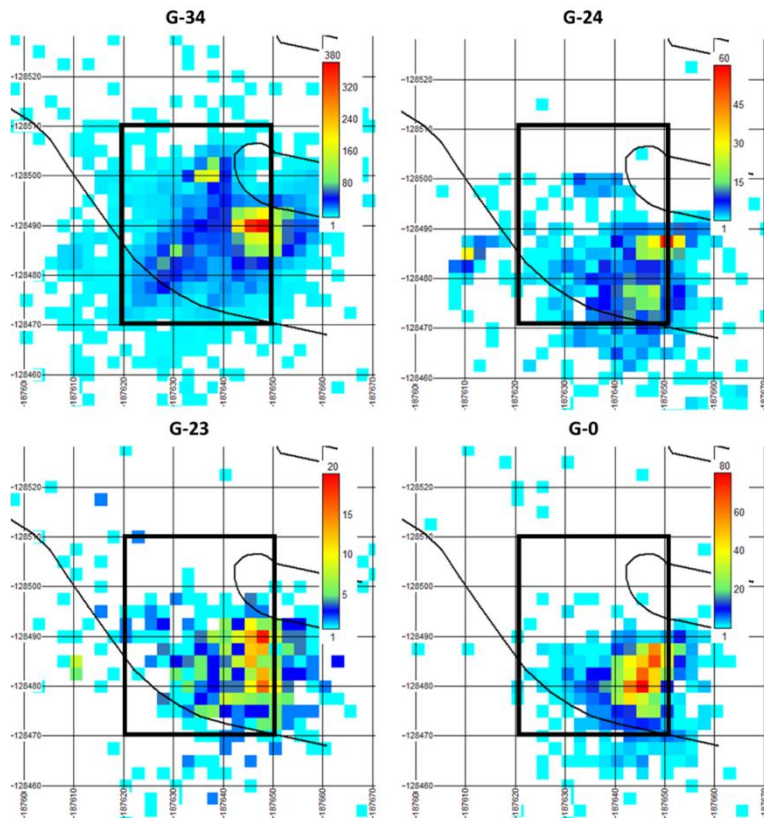


- First bay of the mobile dam
- Intake channel of the HPP
- Froude similitude
- Upstream limit defined from numerical modelling results
- BC: Q upstream, Z downstream + Q partition

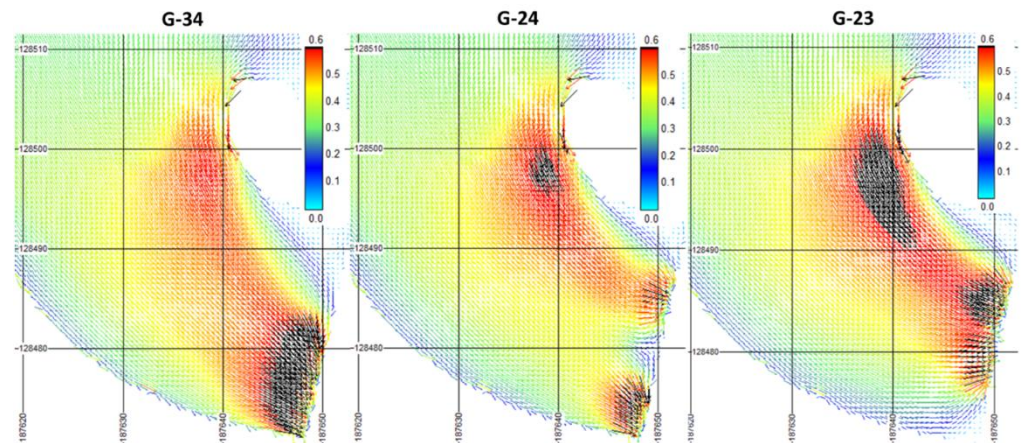
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Ongoing works at ULiege

Numerical modeling of hydraulic conditions close to pilot sites during observed smolt and eels downstream migration



Fish location density maps depending on HPP operation (GM)

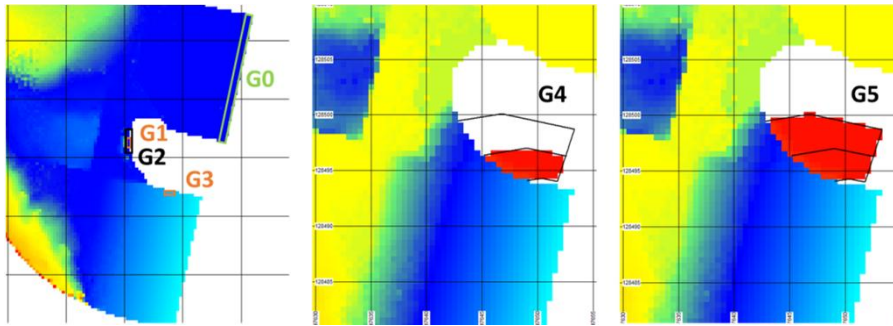


Flow velocity distribution depending on HPP operation (GM)

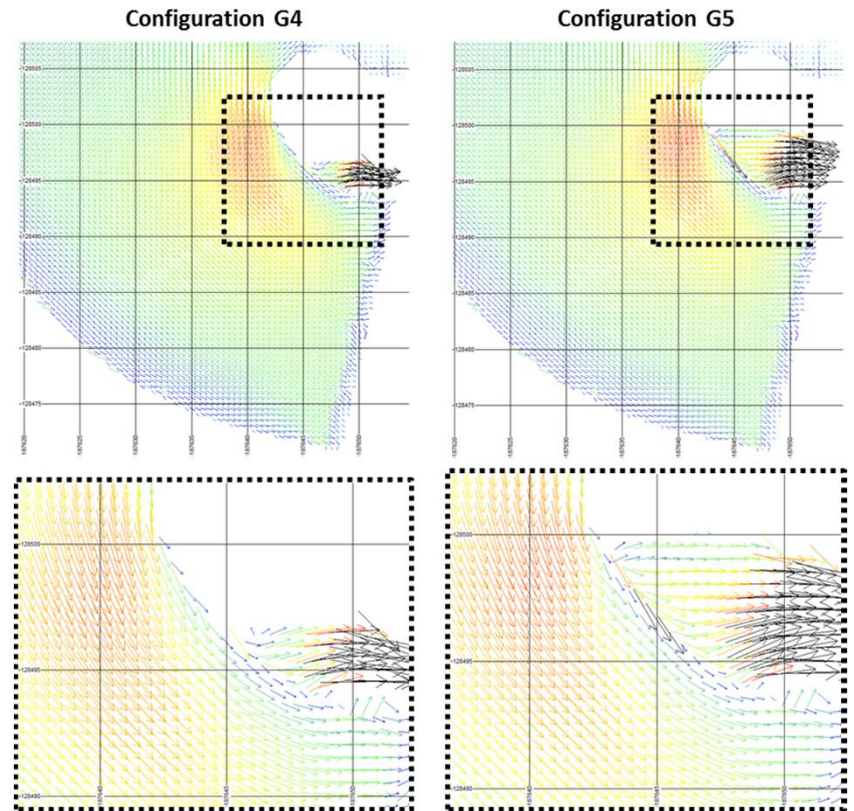


Ongoing works at ULiege

Numerical modeling of hydraulic impact of different solutions for downstream passage location



Configurations for downstream passage inlet location (GM)



Velocity fields for configuration G4 and G5 at GM

Ongoing works at ULiege

Physical modeling of downstream passage at best locations and geometry optimization

Downstream passage at GM: initial design (left) and optimised design (right)

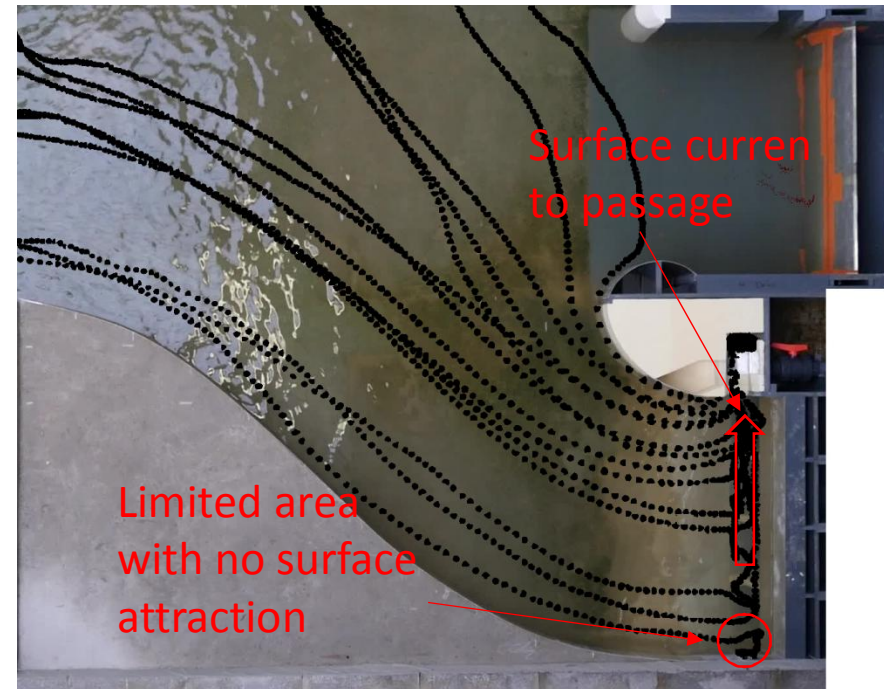
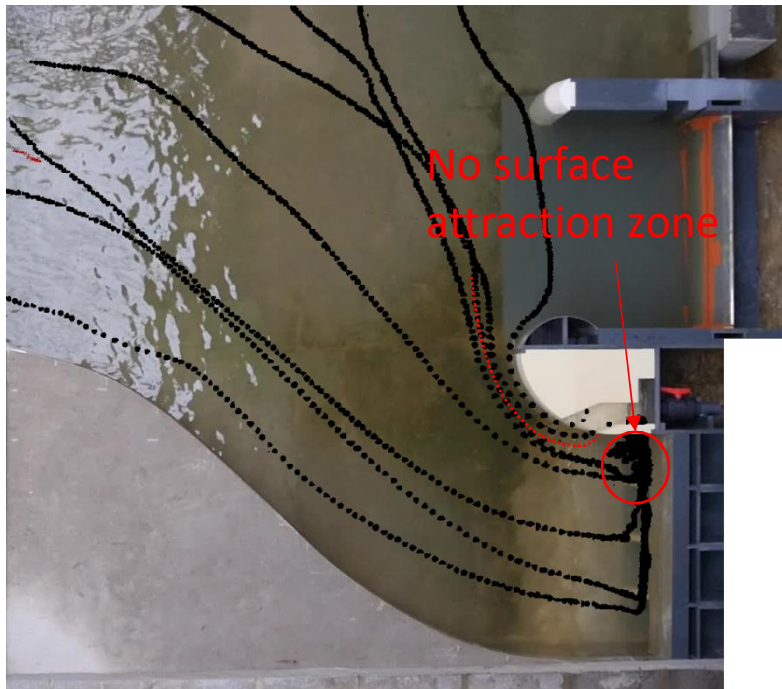


Downstream passage at IR: initial design (left) and optimised design (right)



Ongoing works at ULiege

Physical modeling of downstream passage at best locations and geometry optimization



Floats tracking at GM site. Initial design of downstream passage (left) and optimised geometry (right)

Conclusion

Life4Fish: ambitious program to improve downstream passage for migrating eels and salmons at the 6 EDFL HPPs on the Belgian low Meuse river, while securing profitability of green hydro business

- Collaboration between industrials and researchers, biologists and engineers
- Field monitoring (pre and post-installation), numerical and scale physical modeling + on site implementation (civil works)
- Mix of different solutions (predictive model, repulsive barriers, downstream passages) depending on each site specificities

→ Looking forward to getting the results!

