

# Innovative solution for sediment beneficial use

Pilot Equipment to accelerate dehydration

**IXSANE**

Engineering company supporting Circular Economy initiatives

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# Consulting, Engineering & Innovation

Soil  
Contaminated sites/soils

Urban Waters  
Rain/waste Waters

Territories & Environment  
Rivers, sediment, renewable energy  
implementation

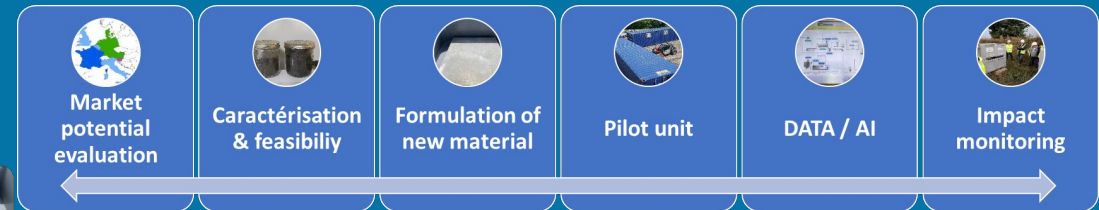
Environmental Transition  
Circular Economy, Data,  
Water Infrastructure optimisation



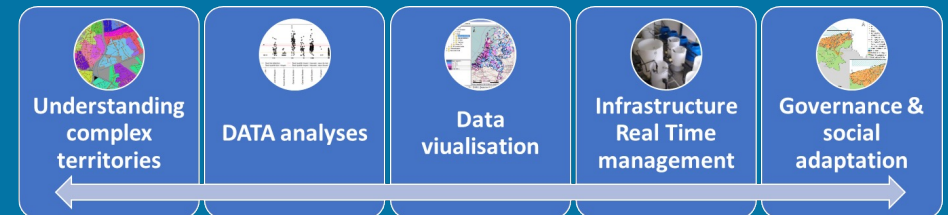
- Software for engineering
- Artificial Intelligence
- Process for Circular Economy



## Circular Economy



## Territories & infrastructure optimisation



# Objective

Addressing space & timing issues for sediment reuse with innovative continuous dehydration equipment

- Design and construction of a pilot equipment for real life conditions tests
- Onsite tests for demonstration and performances Evaluation
- Roll-out potential & Adding value evaluation to drive sediment reuse to the market

# Design and construction of a pilot equipment

for real life conditions tests

# PILOT EQUIPMENT - REQUIREMENTS

- **End-user operational constraints**

- Provide material from sediment for
  - bioengineering
  - cement
  - pozzolanic applications

=> Separation of fine fraction (silt and clay enriched in organic matters), sand and gravel fractions (mineral matters)

- Equipment to be carried onsite by road or boat

- **Design/process constraints**

- Sediment with high water content for granular separation
- Mobile equipment
  - Autonomous process
  - Equipment must be compact in each dimension: Packed in containers

*Bowling site regeneration works as a perspective*





# PILOT EQUIPMENT - HOW IT WORKS?

**GRANULAR CLASSIFICATION**  
*Gravel & waste extraction*  
>2,5mm material extraction



**GRANULAR CLASSIFICATION**  
*Sand extraction*  
> 63µm

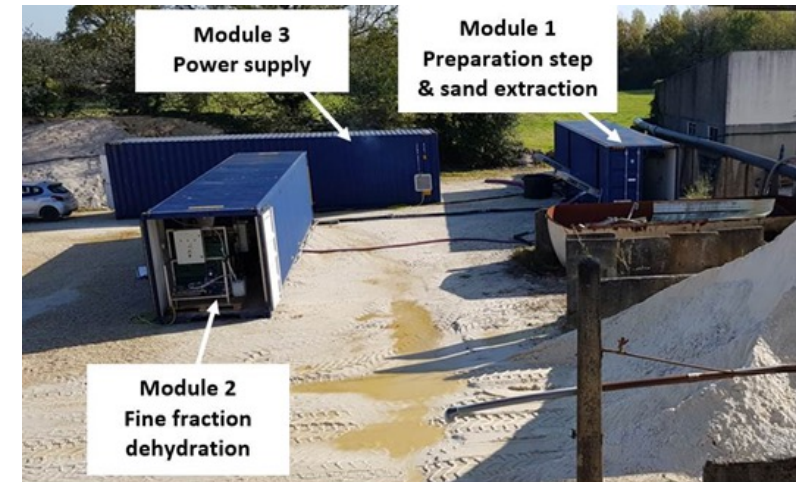


**FINE FRACTION DEHYDRATION**

– **Module 1**  
Granular classification of the material into several categories

– **Module 2**  
Treatment of the fine part of the material below the threshold predefined in module 1 (Dehydration)

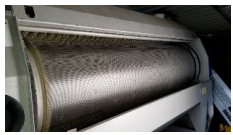
– **Module 3**  
Independent operation of the entire machine: energy generation, water storage, spare parts, pipes, toilets,....



# PILOT EQUIPMENT - DESCRIPTION

## Module 1

Granular classification



Rotary sieve



Sand extraction



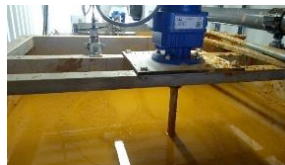
Hydrocyclone

## Module 2

Fine fraction Dehydration



Flocculant preparation zone



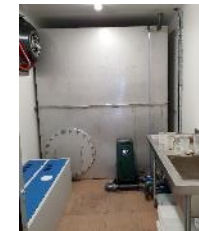
Flocculation



Fine fraction dehydration

## Module 3

Process autonomy



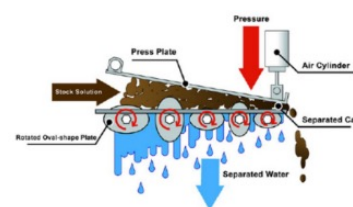
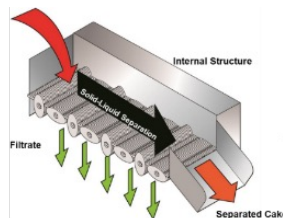
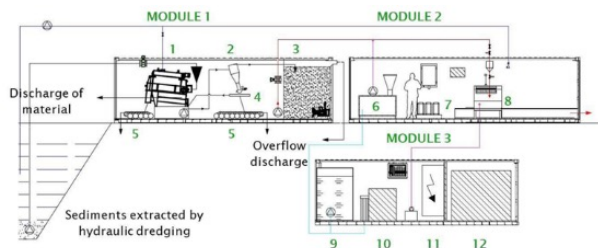
Water storage



Storage area



Power supply

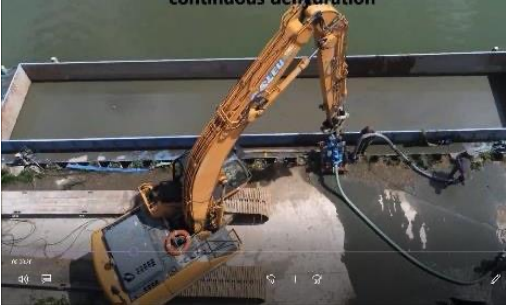


# Demonstrations & Performances Evaluation

Onsite tests



# ON-SITES DEMONSTRATIONS



**ENTRANCE**  
70% of water

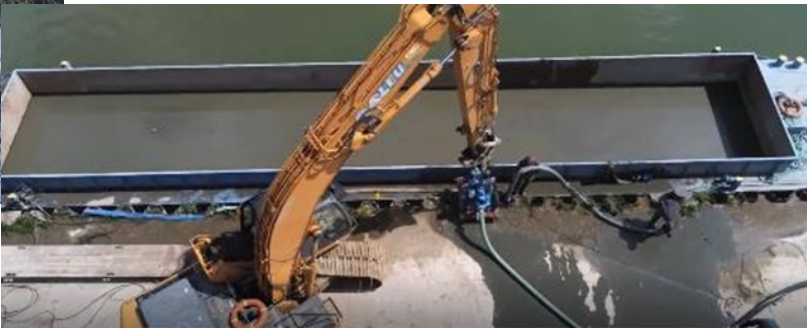


**MODULE 1**  
Granular classification  
( $D > 80 - 40 \mu\text{m}$ )



**MODULE 2**  
Dehydrated products  
( $\leq 80 - 40 \mu\text{m}$ )

# ON-SITE TESTS WITH SEDIMENTS



Sediments to be dehydrated



Sand



Dehydrated fine sediments



# ON-SITE TESTS WITH SEDIMENTS FROM QUARRIES

## Quarry 1



## Quarry 2



# Granular classification performances



**Process capacity to extract sand and larger material from the flow**



**Added value for sediment reuse by allowing optimal allocation of sediment matters for optimal application:**

- Gravel & Sand for concrete & cement applications,
- Fine fraction for Bioengineering and pozzolanic properties use.

	Sample ref	Sand 2.00-0.063mm	Silt 0,063-0,002mm	Clay <0,002mm	Textural Class
Sediment from the lagoon	IFT 1	6%	50%	44%	Silty Clay
Sediment from the lagoon	IFT 2	36%	32%	32%	organic Clay Loam
Extracted sand	IFT 3	<b>93%</b>	7%	0%	sand
fine dehydrated fraction	IFT 4	12%	<b>45%</b>	<b>43%</b>	Organic Silty Clay

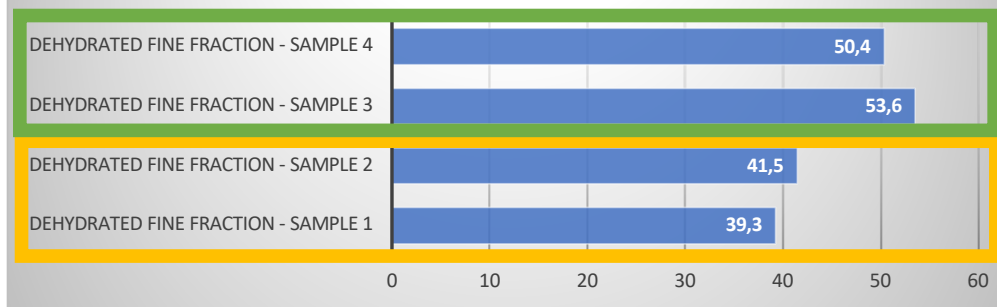
*Falkirk sampling campaign results done by UoS*



# Fine fraction dehydration performances

## Process in stabilised phase

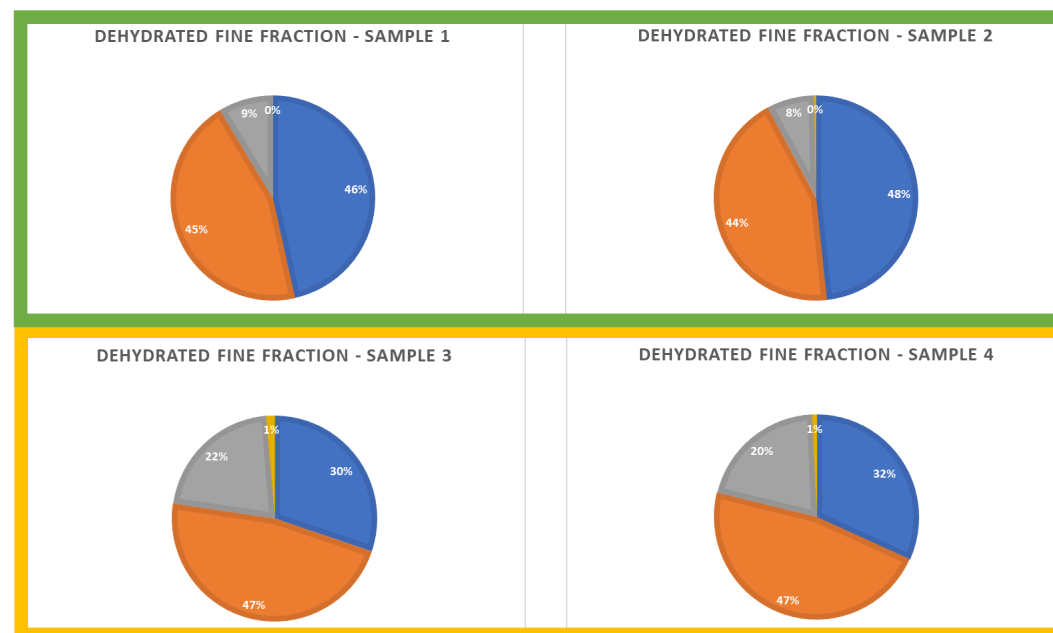
### Dry Matter content (% of total weight)



## Process in adaptation phase



**20 minutes to reach 4-6 months lagoon process dehydration levels (50% fine fraction/50% water)**



■ 2 - 20 µm   
 ■ 20 - 63 µm   
 ■ 63 - 200 µm   
 ■ 200 - 2000 µm



# Adding value to drive sediment reuse to the market

**Onsite tests demonstrated the capacity of such process to generate raw materials easy to handle for optimal allocation strategy for reuse optimisation**



**Optimised formulations for sediment reuse applications**

**Environmental monitoring: no impacts**



# Adding value to drive sediment reuse to the market

- **20min to 3 hours vs 3 to 6 months**
- **Savings on transportation costs**
  - Water extraction & granular classification save around 45€/km/day with the current pilot unit
- **Savings from landfill costs**
  - Sand/gravel reuse from contaminated sediment can save 100€-200€/t

# Remaining major challenges for a prototype



Increasing fine fraction flow capacity (limited to 250kg/h)



Developping real time process management techniques to optimize process adaptation capacity with input variations



Improving equipment compacity to decrease transport cost



# Roll-out applications seen by stakeholders

## Improving settling lagoon installation capacity



## Improving desalinisation process of marine sediment

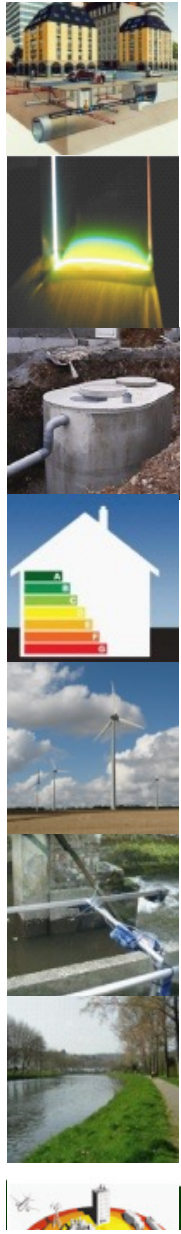


## Industrial sludge / contaminated sediment dewatering



## Sand industry: sand washing water treatment





Environmental & Urban  
Sustainable development  
Engineering  
Research and Technological Transfer




*Harmony in development*

*Ethics in innovation*

[www.ixsane.com](http://www.ixsane.com)

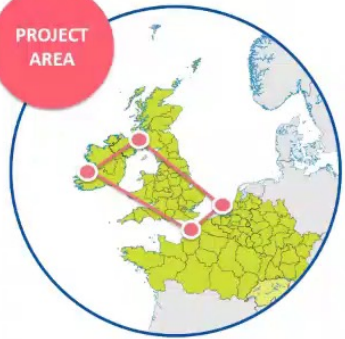




**Interreg**   
North-West Europe  
**SURICATES**  
European Regional Development Fund

**Increasing sediment reuse for erosion and flood protection**

**PROJECT AREA**



**ixsane**

**ARMINES**

**Université de Lille**

**University of Strathclyde**

**Port of Rotterdam**

**IMT Lille Douai**  
École Mines Télécom  
IMT Université de Lille

**CIT CORK INSTITUTE OF TECHNOLOGY**  
WYTHROW TECHNOLOGICAL CAMPUS

**Deltares**

**UCC**  
University College Cork, Ireland  
Coláiste na hOllscoile Corcaigh

**brgm**  
Géosciences pour une Terre durable

**Scottish Canals**

**team2**  
L'innovation pour l'économie circulaire

Video on YouTube

<https://youtu.be/NJ-iuAgOu1Q>

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