



# Innovative solution for sediment beneficial use

Pilot Equipment to accelerate dehydration

**IXSANE**

Engineering company supporting Circular Economy initiatives

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# 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

# Partners collaboration

Partner	Activities
IXSANE	Design and Construction of the pilot equipment Onsite test Communication documents material (video)
Scottish Canals	End-user operational constraints inputs for the design Support for onsite tests
UoS	Analyse of treated sediment Support for onsite tests
ARMINES - IMT Lille Douai	Analyse of treated sediment
Port of Rotterdam	End-user operational constraints inputs for the design
MTU/BRGM/UCC/ Deltares/ UoS	Advices and general concept validation for the equipment design
TEAM <sup>2</sup>	Communication document material (video) dissemination and integration to project web-site
ULille	Promotion to local authorities of SURICATES including the dehydration pilot equipment



# 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

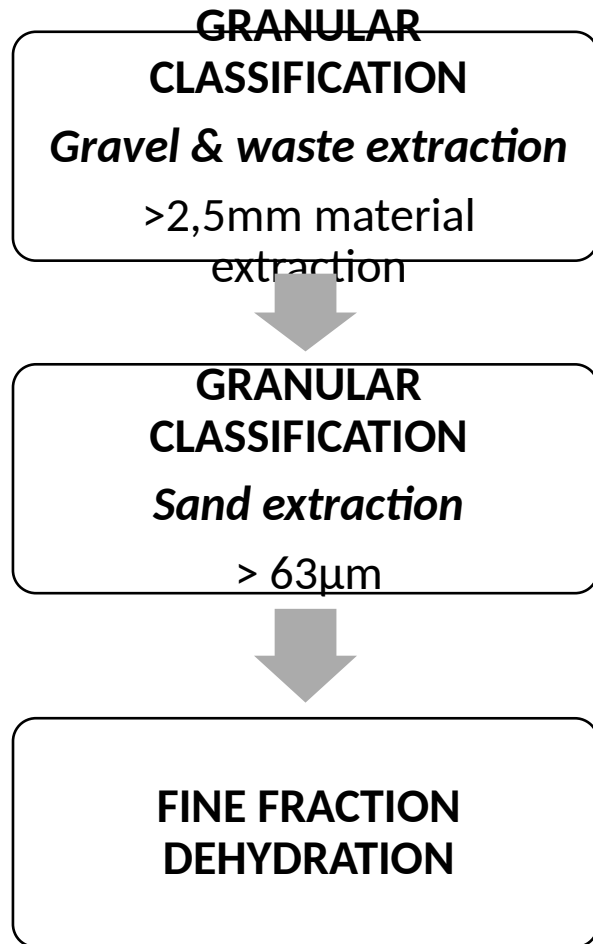
- **Design/process constraints**

- 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*



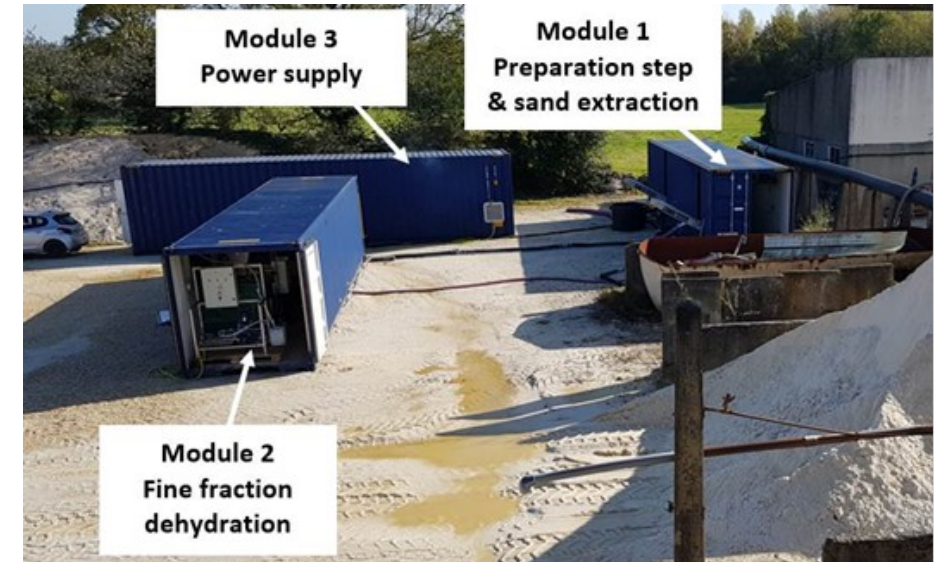
# PILOT EQUIPMENT – *How it works?*



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

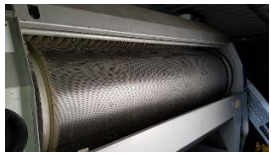
- **Module 2**  
Treatment of the fine part of the material below the threshold predefined in module 1 (Dehydration)

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



# PILOT EQUIPMENT – *Description*

## Module 1 Granular classification



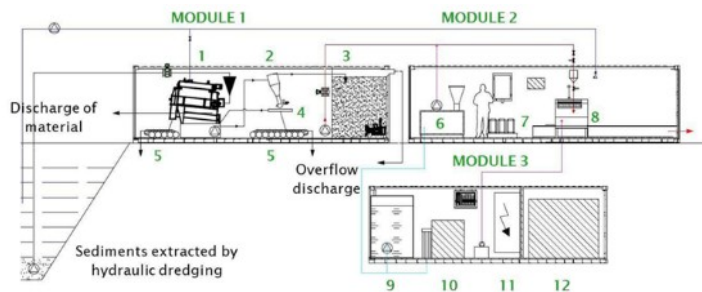
Rotary sieve



Sand extraction



Hydrocyclone



## Module 2 Fine fraction Dehydration

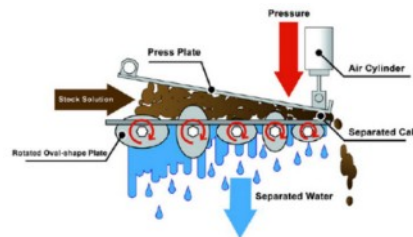
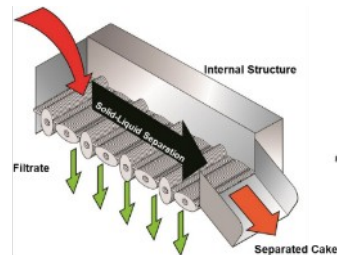


Flocculant preparation zone



Fine fraction dehydration

Flocculation



## Module 3 Process autonomy



Water storage



Storage area



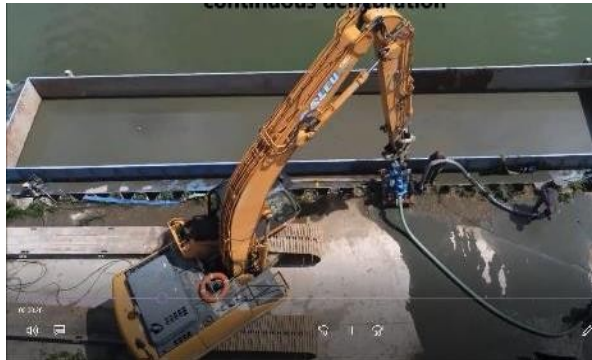
Power supply



# 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



Falkirk demonstration (Scotland)



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%	45%	43%	Organic Silty Clay

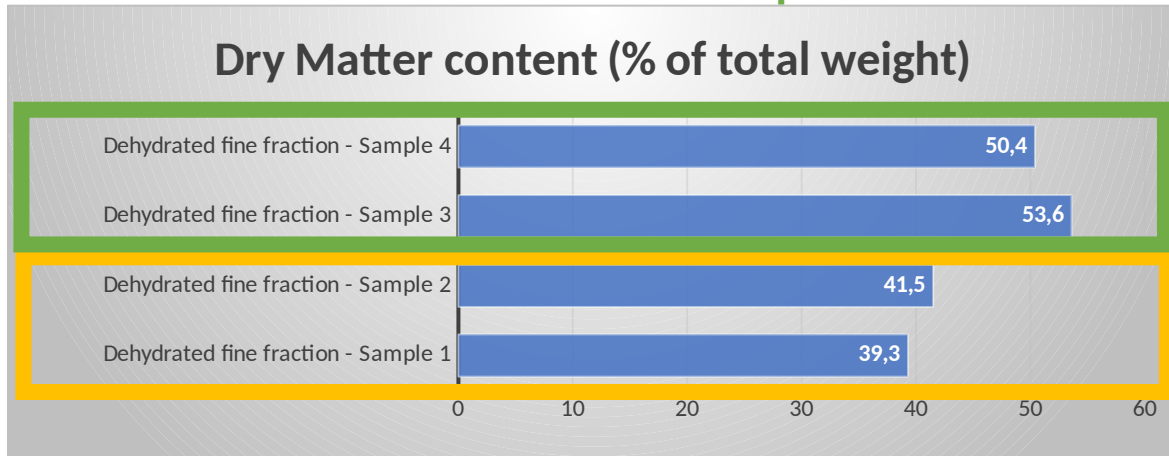
*Falkirk sampling campaign results done by UoS*



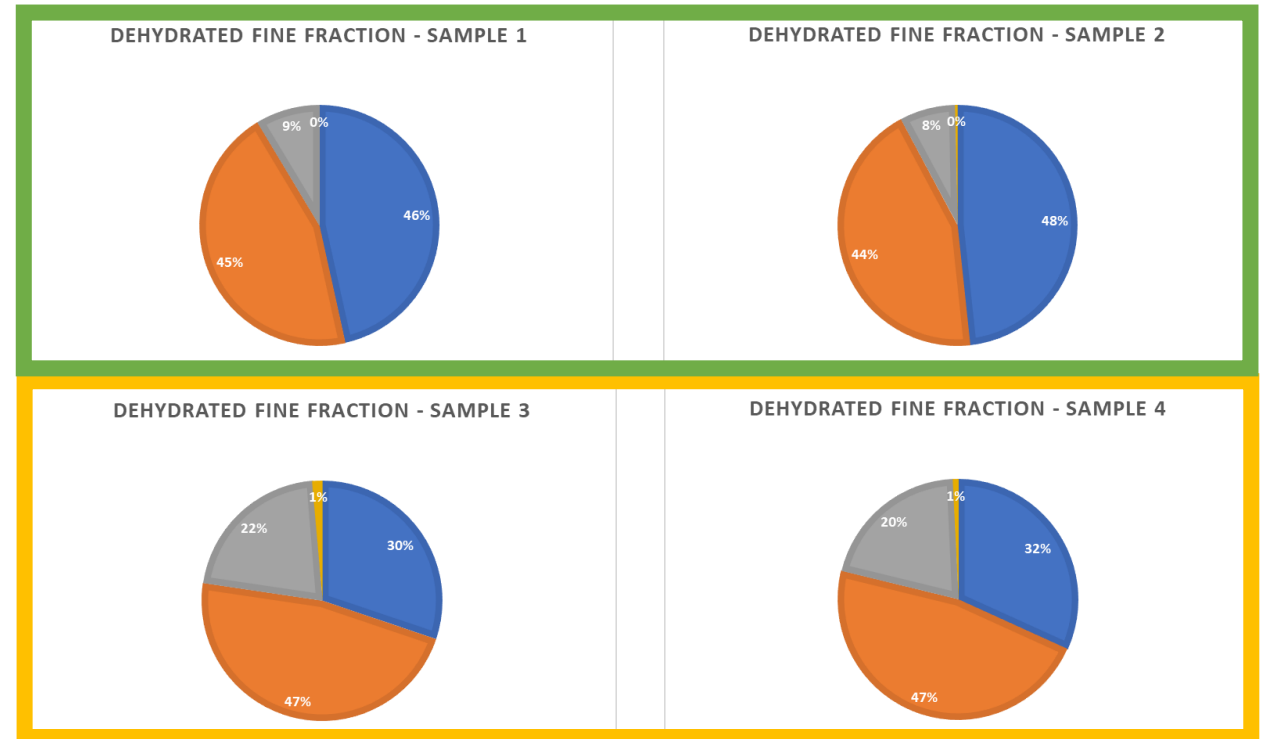
# Fine fraction dehydration performances

Process in stabilised phase

Dry Matter content (% of total weight)



Process in adaptation phase



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



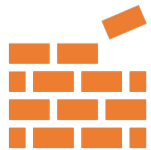
**20 minutes to reach 4-6 months lagoon process dehydration levels (50% fine fraction/50% water)**



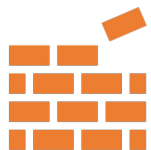
# Remaining major challenges for a prototype



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



# Adding value evaluation & Roll-out potential

to drive sediment reuse to the market

# 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 reuse in for Circular Economy**
  - Gravel and material above 2.5mm
  - Sand
  - Fine and dehydrated fraction (50% of dry matters/50% of residual waters)
- **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

# 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**



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



Video on YouTube  
<https://youtu.be/NJ-iuAgOu1Q>

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