

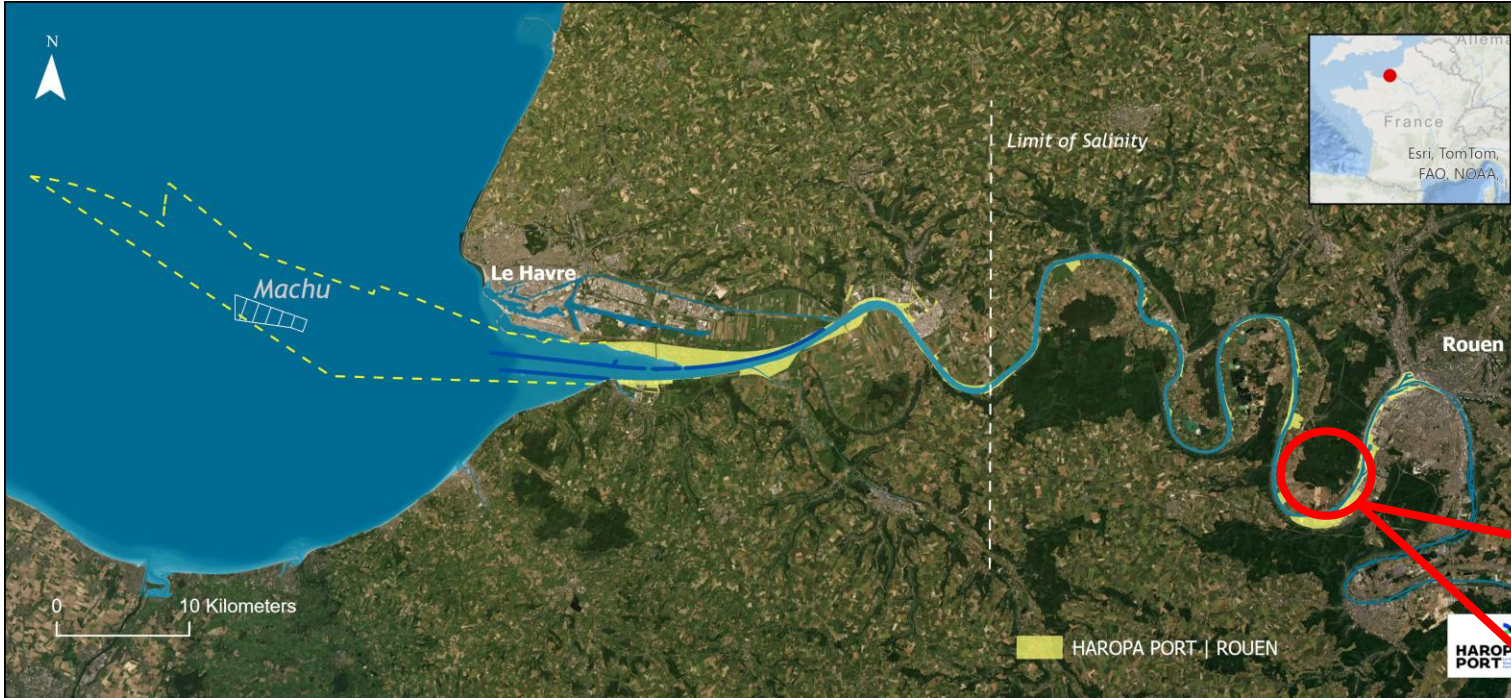


**HAROPA  
PORT** Le Havre  
Rouen  
Paris

SEDISEINE PROJECT  
Reuse of sediment for  
agricultural application

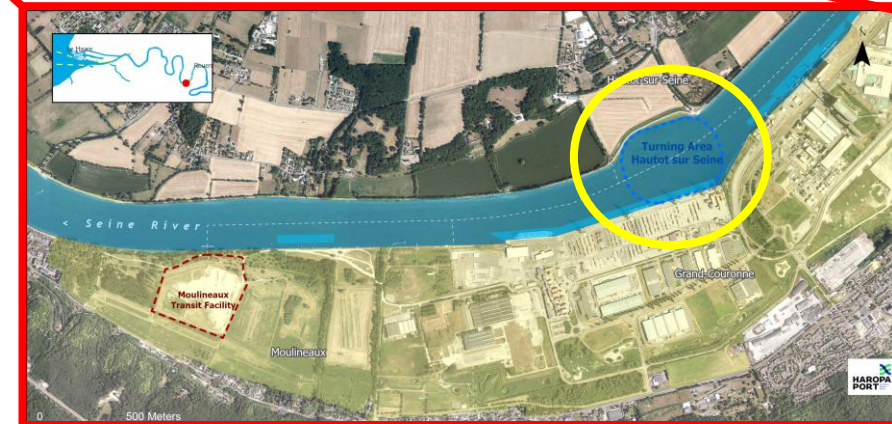


# SEDISEINE project



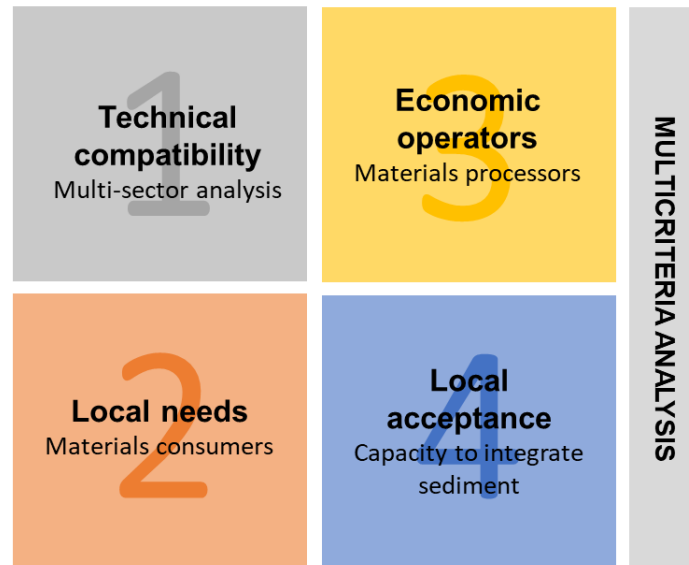
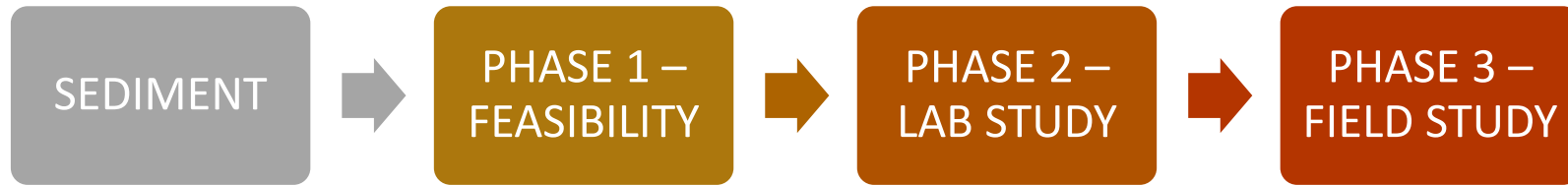
- ✓ 8 million cubic meters of sediment are dredged on a yearly basis (hopper volume)
- ✓ Only 7% discharged on land for disposal (mostly in upstream estuary sector because required by permit)

HAROPA PORT | Rouen has started a new research project to identify ways to **valorise** upstream port silt sediments : the **SEDISEINE** Project.



# Project's Methodology

Inspired from French national approach « SEDIMATERIAUX »



## CRITERIA SCORING RESULTS

SECTOR	RATING
CONCRETE	8/10
CEMENT	5,5/10
ROAD ENGINEERING	9,5
LANDSCAPING	7,5/10
<b>AGRONOMY</b>	<b>10/10</b>

Choice of two applications in these two sectors responding to the needs of HAROPA PORT & local territory needs

# Focus on agronomy field

Application : Agricultural soil restoration

## Objectives:

- ✓ Enrich agricultural soils composed of sandy silts with finer silts
- ✓ Improve the particle size distribution
- ✓ Project supervised by environmental and agricultural authorities

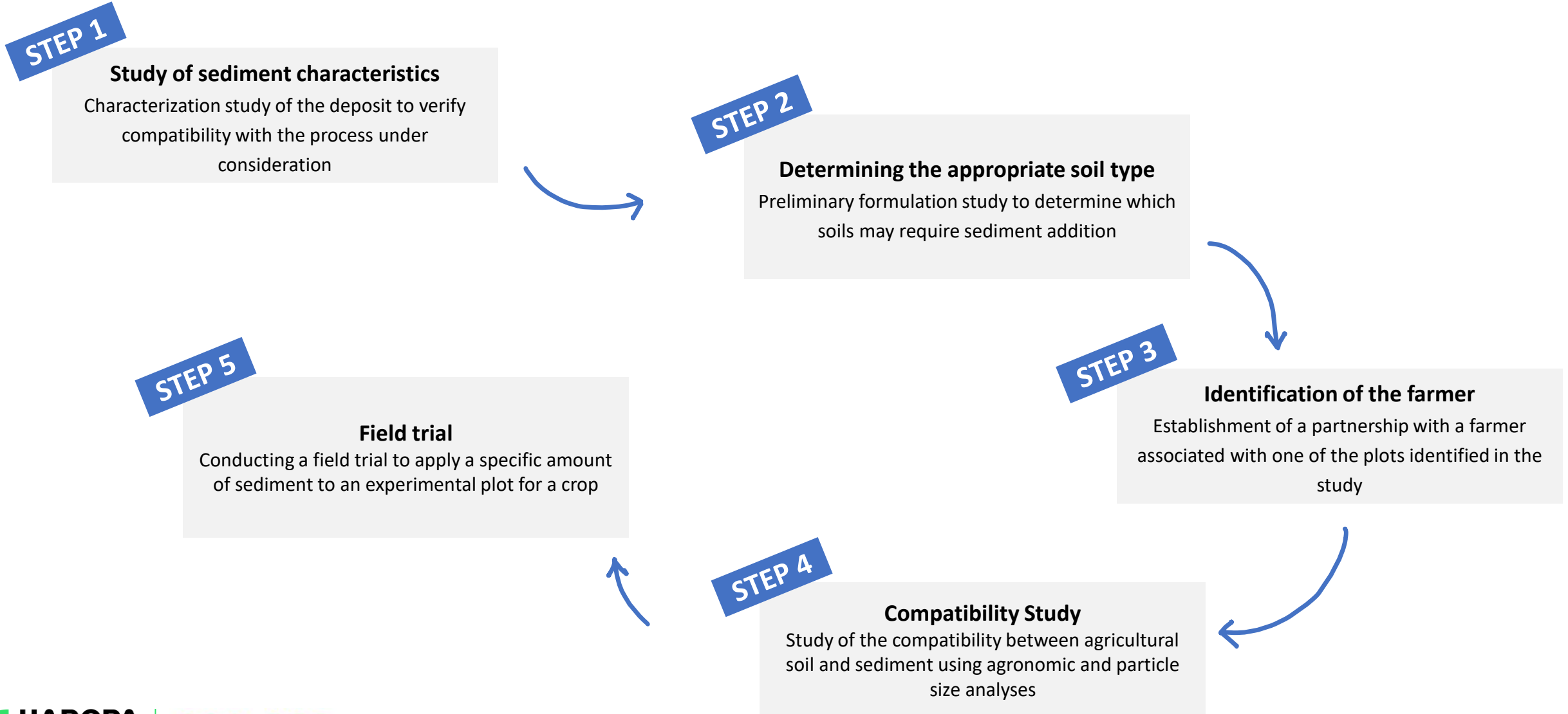


## Benefits:

- ✓ Better rooting of plantations.
- ✓ Improved soil moisture management.
- ✓ Reduction of soil leaching.
- ✓ Increased efficiency of input products (e.g., fertilizers).

# Focus on agronomy field

## Compatibility study

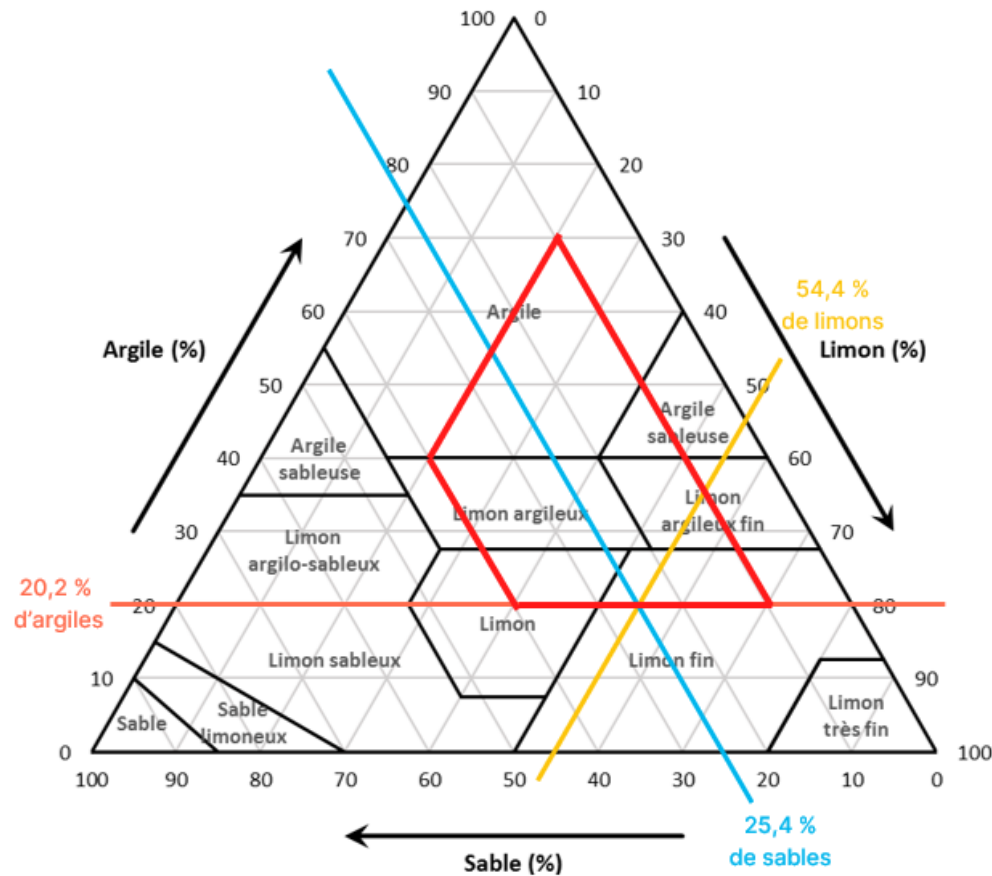


# Focus on agronomy field

## Study of sediment characteristics

Precise the physical and chemical characteristics and the texture of the sediment

STEP 1



STEP 2

STEP 3

STEP 4

STEP 5

Essai	Unité	Valeurs limites d'innocuité - socle commun	Sédiment	Sol agricole
<b>Etat d'acidité</b>				
CEC	meq%	-	8,4	3,1
Taux de saturation	%	-	438,4	140,1
pH H <sub>2</sub> O	unité pH	-	8,1	7,0
pH KCl	unité pH	-	7,7	6,8
<b>Etat organique</b>				
Matière organique	%	-	2,5	2,1
Azote totale	p.mille	-	1,4	1,1
C/N	-	-	10,4	11,1
<b>Etat minéral</b>				
P <sub>2</sub> O <sub>5</sub> Dyer	p.p.m.	-	97	408
P <sub>2</sub> O <sub>5</sub> Olsen	p.p.m.	-	213	83
K <sub>2</sub> O	p.p.m.	-	129	146
MgO	p.p.m.	-	317	55
CaO	p.p.m.	-	9790	1050
<b>Etat en éléments-traces métalliques (ETM)</b>				
Hg (Mercure)	mg/kg MS	5	0,193	<0,03
Cd (Cadmium)	mg/kg MS	5	0,68	<0,25
Cr (Chrome)	mg/kg MS	800	19,1	14,8
Cu (Cuivre)	mg/kg MS	1000	18,8	3,6
Ni (Nickel)	mg/kg MS	200	8,3	3,7
Pb (Plomb)	mg/kg MS	60	24,3	10,8
Zn (Zinc)	mg/kg MS	3 000	112,5	24,5
Se (Sélénium)	mg/kg MS	-	<0,63	<0,63
As (Arsenic)	mg/kg MS	60	3,6	2,4
Sr (Strontium)	mg/kg MS	-	288	4,4
Ba (Baryum)	mg/kg MS	-	51	14,8
Co (Cobalt)	mg/kg MS	-	5,6	2,1
Mo (Molybdène)	mg/kg MS	-	<0,63	<0,63
Fe (Fer)	mg/kg MS	-	11268	4 853
<b>Composés Traces Organiques (CTO)</b>				
Fluoranthène	mg/kg MS	4	0,300	
Benzo(b)fluoranthène	mg/kg MS	2,5	0,370	
Benzo(a)pyrène	mg/kg MS	1,5	0,300	
HAP (somme de 16 HAP)	mg/kg MS	8	2,483	
PCB (somme des 7 congénères)	mg/kg MS	0,8	0,010	

# Focus on agronomy field

Determine the appropriate soil type

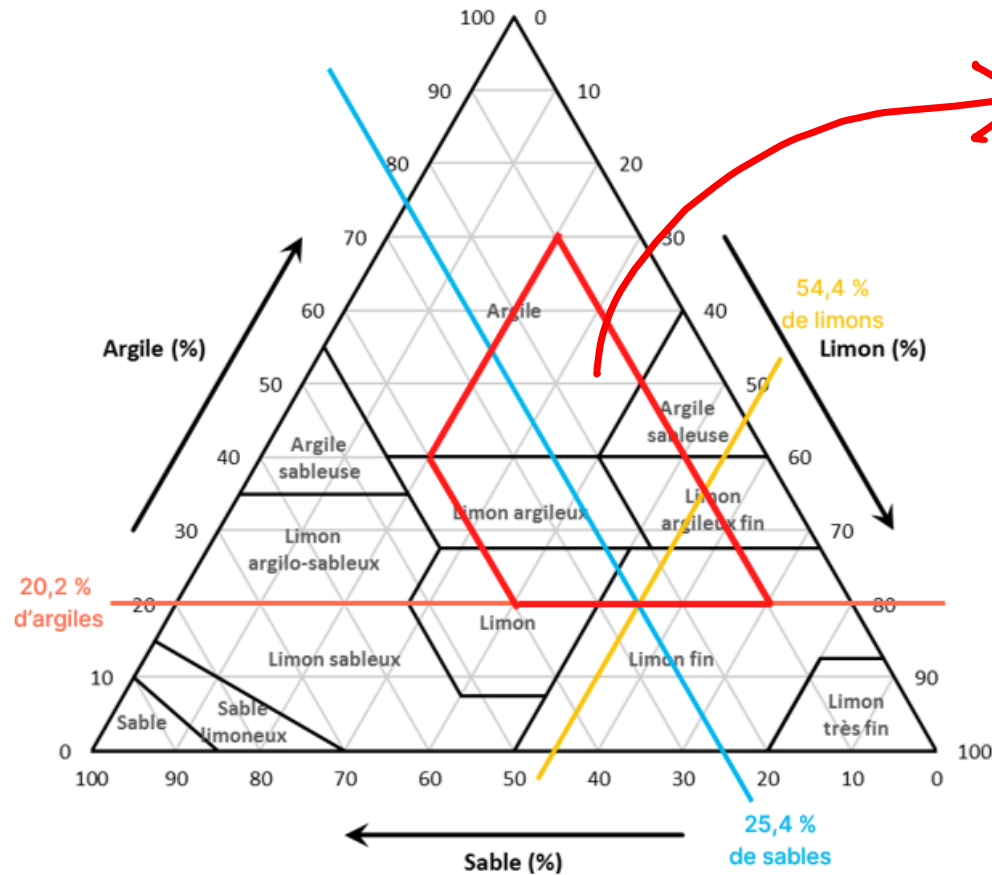
STEP 1

STEP 2

STEP 3

STEP 4

STEP 5



- ✓ The sediment is close to the ideal texture range
- ✓ Seeking a “sandy” texture to create a harmonious blend of materials

# Focus on agronomy field

Determine the appropriate soil type

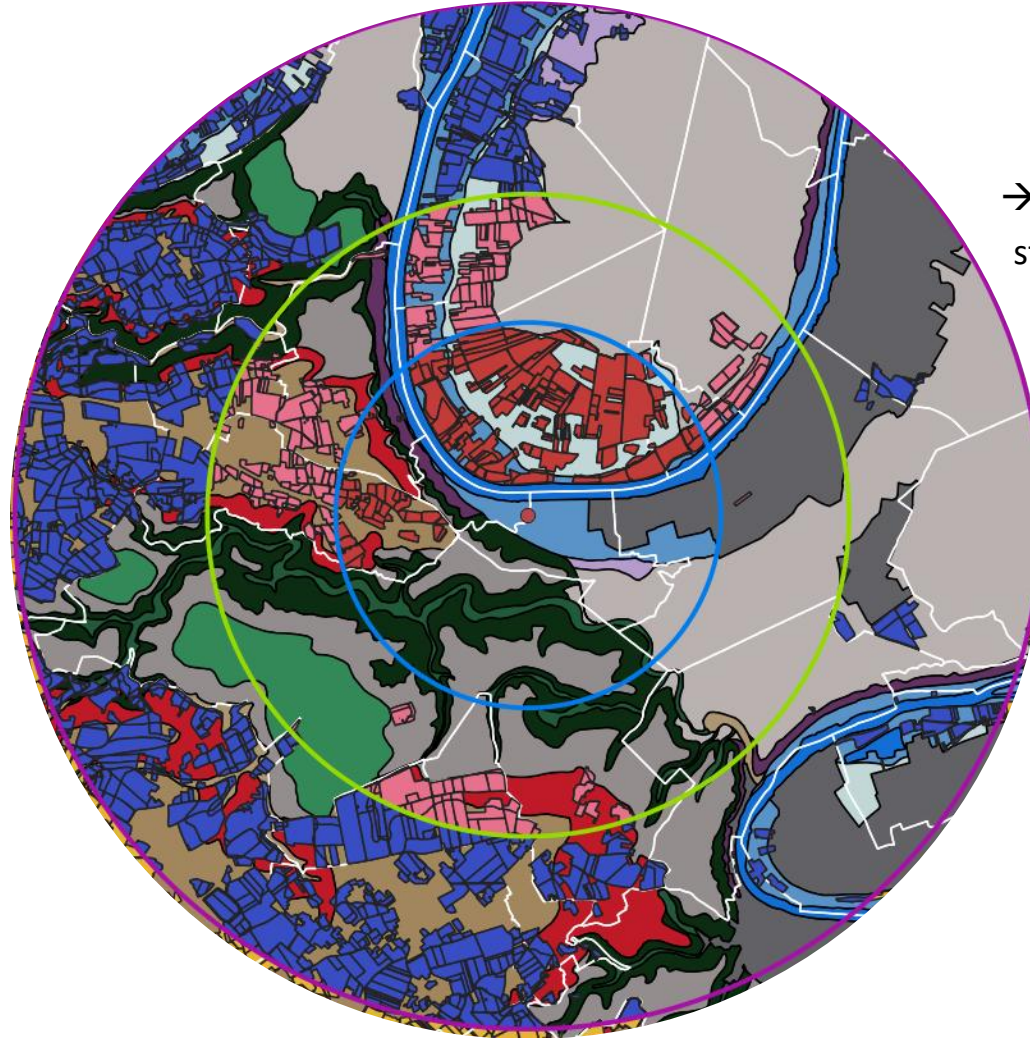
STEP 1

STEP 2

STEP 3

STEP 4

STEP 5



→ Conduct of a detailed mapping study to identify local soil sandy textures fitting our sediment

# Focus on agronomy field

## Compatibility Study

STEP 1

STEP 2

STEP 3

STEP 4

STEP 5

✓ Compatibility check (in theory)

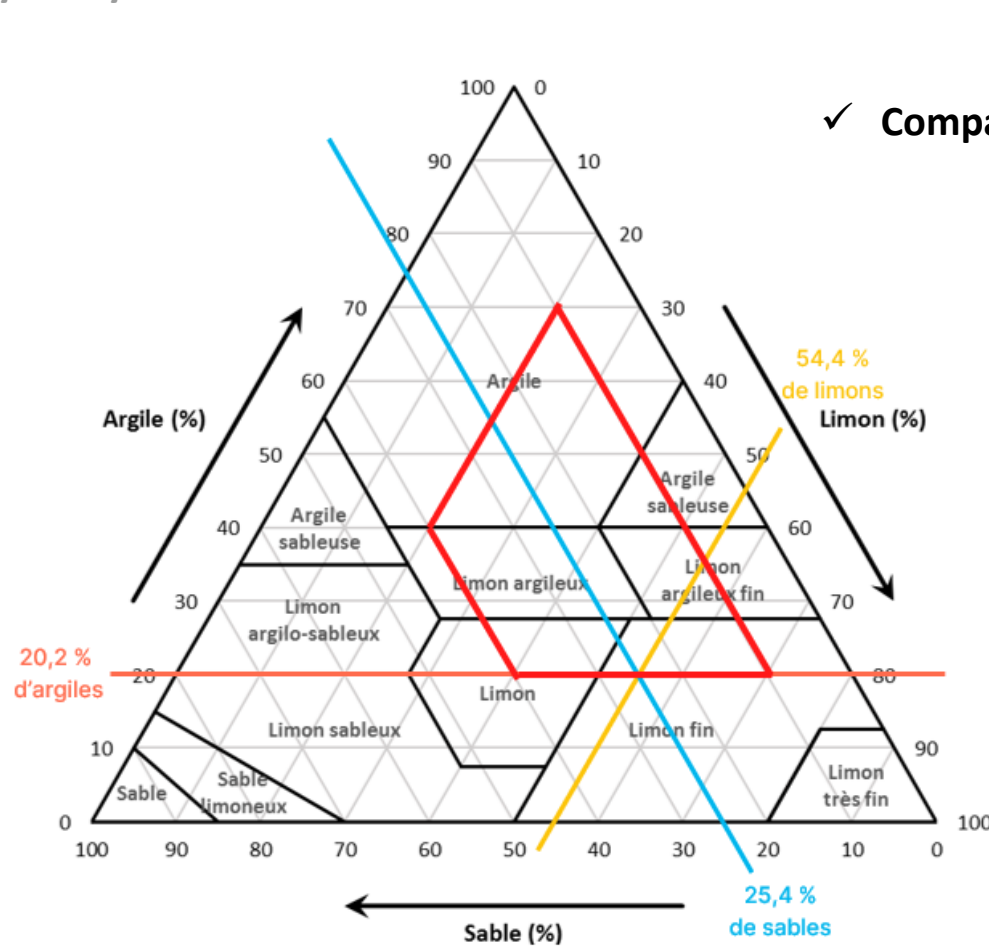


Diagramme de texture – sédiment 2024

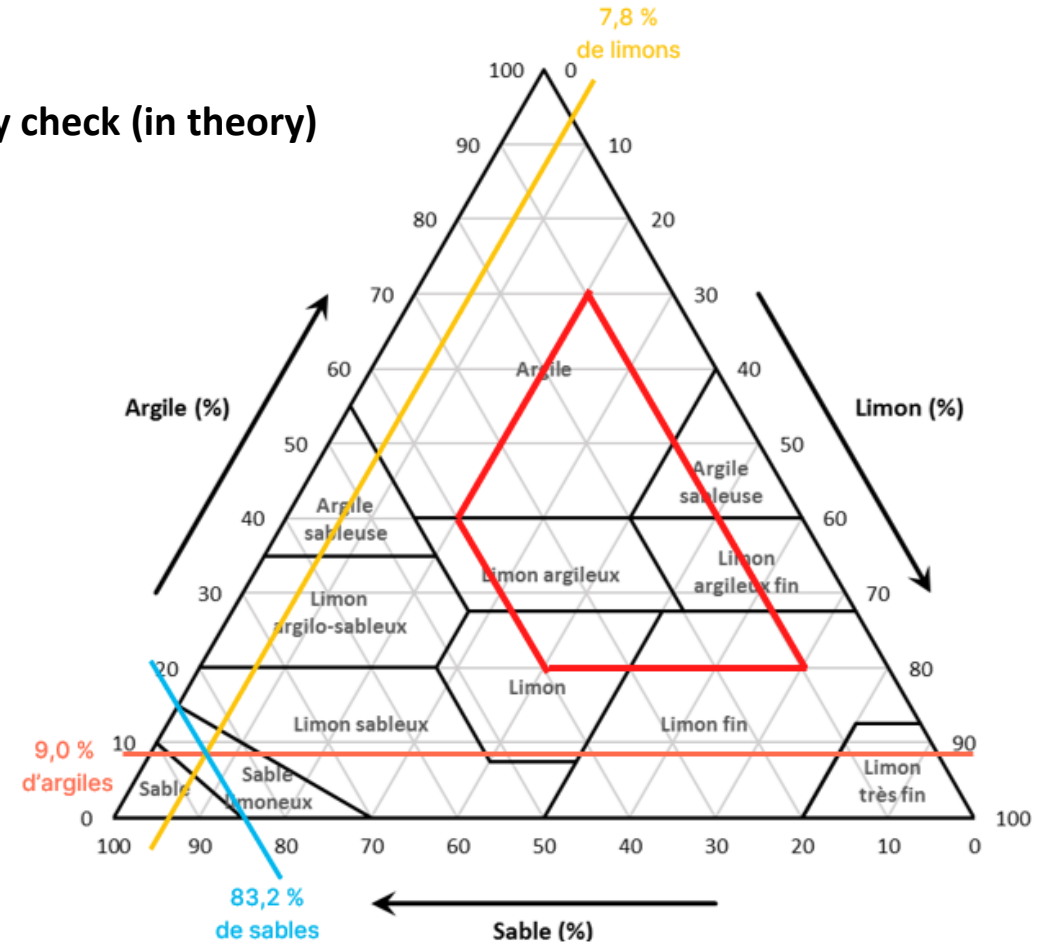


Diagramme de texture – sol agricole 2024

# Focus on agronomy field

Field trial : sediment incorporation

STEP 1



STEP 2



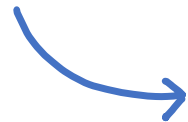
STEP 3



STEP 4

The sediments are then incorporated into the soil through the normal action of plowing

STEP 5



- ✓ 2,600 m<sup>2</sup> of footprint
- ✓ 120 m<sup>3</sup> of deposited sediments
- ✓ Barley cultivation

Arrangement of test plots

0 cm	0 cm
15 cm	10 cm
10 cm	15 cm
0 cm	0 cm

# Focus on agronomy field

Field trial : the tests

STEP 1

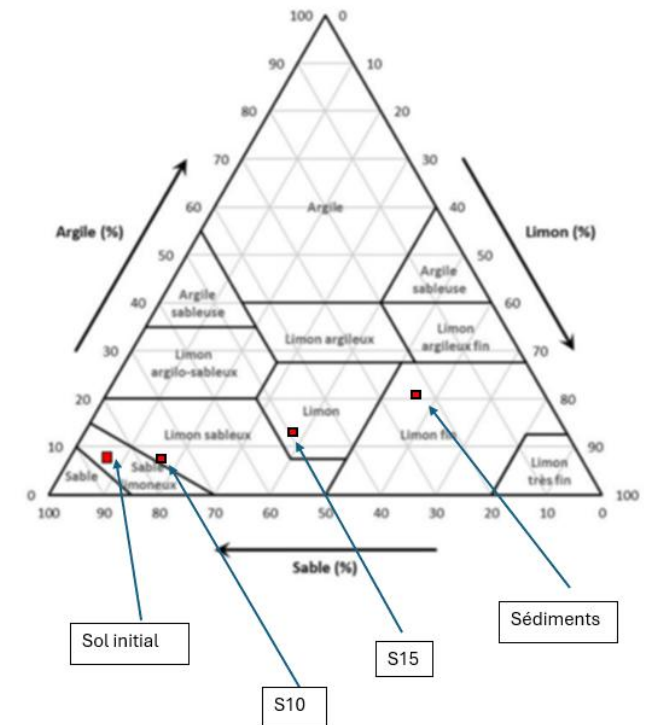
Paramètre	Effet
<b>Structure</b>	Modify the texture of the existing floor to bring it closer to the center of the texture triangle
<b>Conductivity</b>	Improved conductivity, promoting better root-soil exchange
<b>Cation exchange capacity (CEC)</b>	Enhancing soil fertility by enabling the soil to act as a larger reservoir of cations, which will be used for plant-soil exchange via the roots
<b>Trace metals</b>	Compliance with environmental quality criteria prior to sediment placement
<b>Effective water reserve</b>	Increase in EWR compared to the control (without sediment)
<b>Water content</b>	Higher water content in plots with sediment Positive effect on water retention in the receiving soil
<b>Yield</b>	Yields increased by nearly 35% on farmland containing sediment.
<b>Grain quality</b>	Grains with lower protein content (higher ear density, meaning they are more widely spaced); however, higher specific gravity (the mass of grain that can fit into a given volume) = transport of a greater mass of grain within the same volume = higher revenue.

STEP 2

STEP 3

STEP 4

STEP 5



# Focus on agronomy field

Field trial : the results

STEP 1

STEP 2

STEP 3

STEP 4

STEP 5

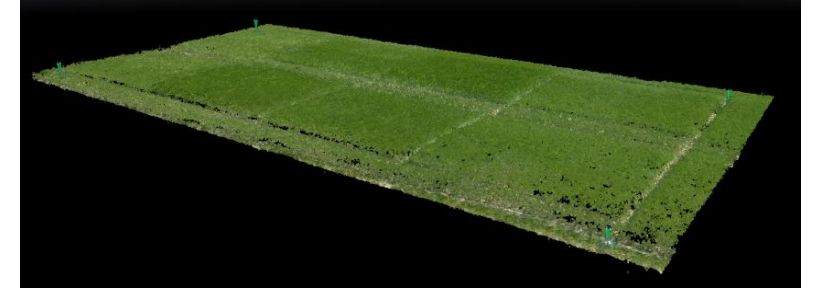


Drone view from May 12, 2025

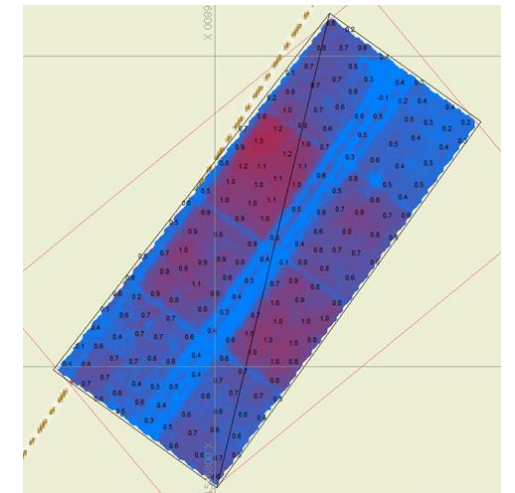
## Main results :

- ✓ **Increased water reserve in the soil**
- ✓ **More stable aggregates**
- ✓ **Favored ion exchanges**
- ✓ **More substantial vegetative development**
- ✓ **Higher Yield** (quintal/ha) by :
  - ✓ + 37 % with 10 cm of sediments
  - ✓ + 63 % with 15 cm of sediments

**Optimum : 12 cm**



Photogrammetric analysis



# Focus on agronomy field

Field trials : photos essay

STEP 1



STEP 2



STEP 3

STEP 4

STEP 5



Difference in plant height visible to the naked eye – photos taken 5 days before harvest

# Focus on agronomy field

Fiel trials : extension of the trial

STEP 1

## Extension of the initial test on the expanded initial plot

Objectives :

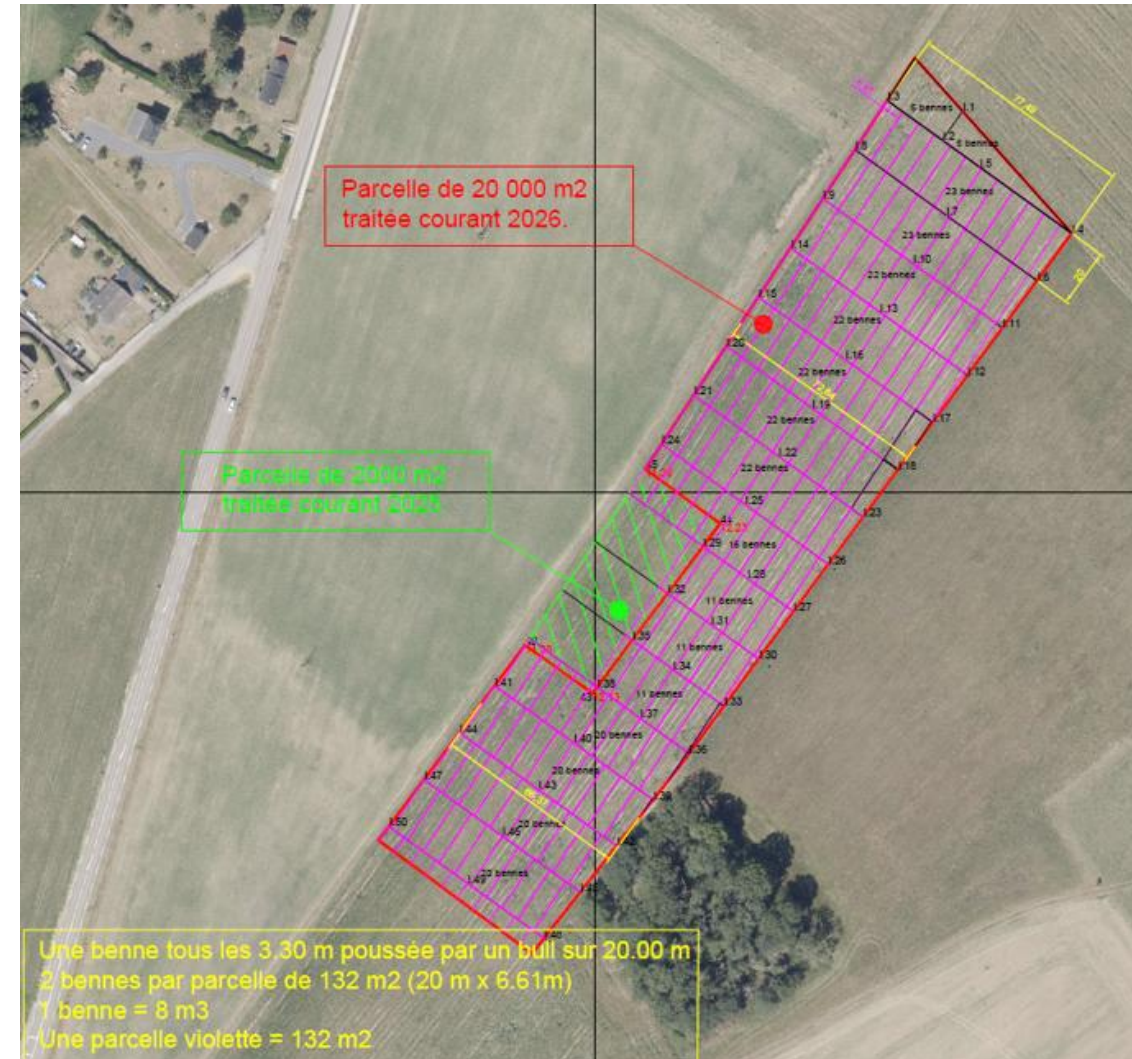
- ✓ Test on plot of 2,1 ha
- ✓ 2,600 m<sup>3</sup> sediments = 3,000 t (12 cm of thickness)
- ✓ Biodiversity monitoring :
  - ✓ Test of **bioaccumulation** of metals in plant tissues (1 year)
  - ✓ Measurement of soil **biological activity** (5 years)
- ✓ Continuity of **agronomic monitoring** with agricultural authorities (5 years)
- ✓ Project supervised by environmental and agricultural authorities
- ✓ *Define an operational deployment strategy...*

STEP 2

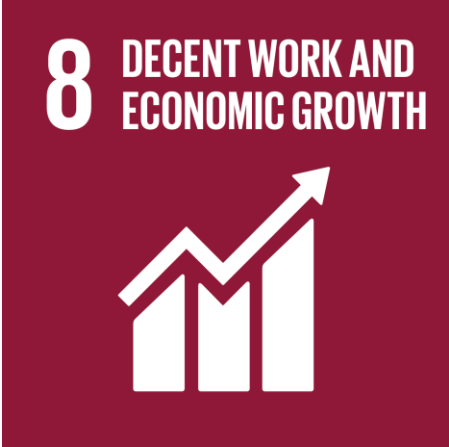
STEP 3

STEP 4

STEP 5



# SEDISEINE: We connect land, sea and people



# To resume

*“From the sea to the field, HAROPA PORT & Neo-Eco boost agriculture thanks to innovative way to use dredging materials”*



*HAROPA PORT turns dredged sediment into certified eco-products: a first in France*



**A deliberate governance shift:** HAROPA PORT's Directoire broke with conventional ballast-pit disposal, accepting financial and regulatory uncertainty for an open-ended R&D commitment to the circular economy.

*Two scientifically validated applications*



## Road sub-base layers

Treated sediments integrated into road construction sub-base layers, scientifically validated and moving toward full-scale pilots.



## Agricultural soil restructuring

From the sea to the field: treated sediments used to restructure and amend agricultural soils, in partnership with Neo-Eco.

## Three structured phases, with Neo-Eco

### Phase 1

R&D and sediment characterisation



### Phase 2

Full-scale pilot sites



### Phase 3

Pursuing “end-of-waste” status

**Beyond compliance:** open-ended environmental monitoring, quality assurance planning, and proactive engagement with state regulators.