7th International SedNet conference

on 6-9 April 2011, Venice-Italy

Projet Européen SETARMS/

SETARMS European Project

(2009-2013)

Valorisation des Sédiments Marins aux travers de Techniques de Traitements Durables et Environnementales/

Sustainable,**E**nvironmental **T**reatment **A**nd **R**euse of **M**arine **S**ediments

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Introduction

SETARMS partners will work jointly for the economic development of Channel Sea ports by finding modern economic and environmental solutions, based on robust scientific work.

The English Channel is acknowledged as:

- **one of the busiest shipping lanes in the world**
- **and fishing is also a key industry.**

To accommodate the ever increasing size of modern ships in European ports and waterways, and to prevent natural silting up of harbour access, significant dredging activity is constantly required to enlarge, deepen and maintain harbour access and achieve appropriate water depths along waterside facilities.

These dredging activities are:

- **essential for the local economy**
- **generate dredging materials that are traditionally disposed at sea or stored on land.**

Introduction

Today, the dredging operations, have to confront difficulties such as:

- **Regulations** (more and more detailed and strict)
- **Financial** (cost of the dredging operations and treatment if needed)
- **Environmental** (Thresholds of contamination, New Protected Marine Areas…)
- **Scientific and Technical** *(treatment and means of re-use)*
- **Social** (strong opposites of the fishers and the Environmental Association against the dredging operations,…)

So, the functioning of the ports could be endangered

Introduction

Le projet SETARMS / the SETARMS project:

-The Setarms project was selected under the European Cross-border Cooperation Programme INTERREG IV A France (Channel) – England

-Match-funded by the European Regional Developement Funding

An Ambitious project, realist and innovative, with outcomes available and transferable for all the Channel ports.

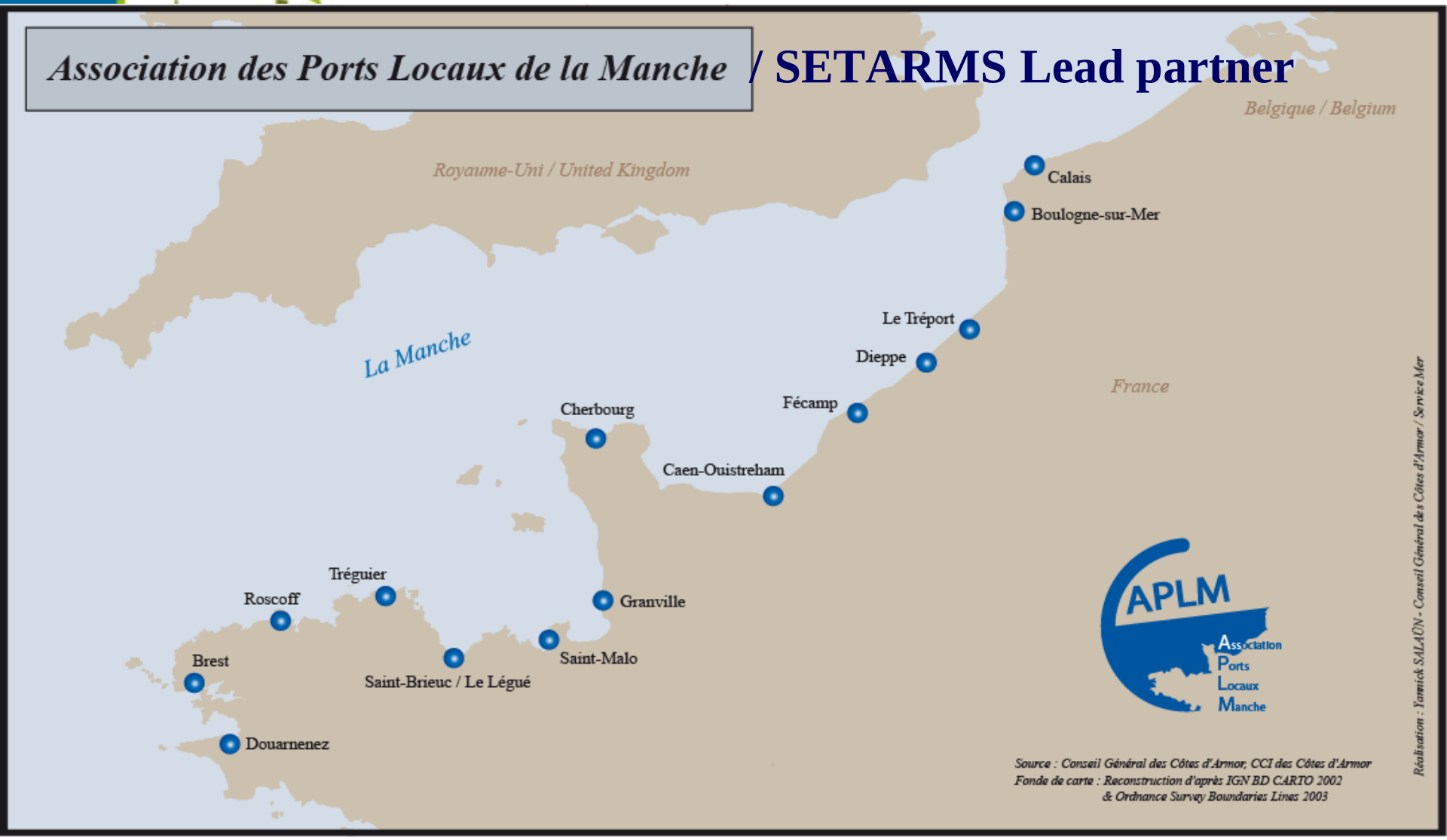
A Project which brings together most of the stakeholders concerning by the dredging operations in the Channel:

- *Scientists, School of Engineers*
- *Local authorities*
- *Port authorities*
- *Industrials*

SETARMS budget: **5.2 M €**
Term : 2009-2013

The Partnership

Association des Ports Locaux de la Manche / SETARMS Lead partner



14 ports of commerce

8 Local Authorities (owners) + 11 Chambers of Commerce

The Partnership

setarms

APLM Association Ports Locaux Manche

Ecole d'Ingénieurs Centre de Recherche Mines de Douai LILLE EURORÉGION

LE HAVRE port Connecting Europe

University of Brighton

ARMINES

ESITC caen l'école d'ingénierie et travaux de la construction

Laboratoire d'Analyses de Surveillance et d'Expertise de la Marine CHERBOURG

Université de Caen Basse-Normandie

Conseil Général Côtes d'Armor

EUROVIA VINCI

PNA LES PORTS NORMANDS ASSOCIÉS AUTORITÉ PORTUAIRE CAEN-OUISTREHAM CHERBOURG

UNIVERSITY OF EXETER

Main objectives

- Have a better knowledge of the dredged sediments in the Channel

- Develop and promote the sustainable practices of the sediments management we can't disposed at sea

- Develop and provide crossborder management tools

- Create a center of excellence and long-term relationships between all the partners.

4 Work packages

- ***WP1: Overview of the dredging in the Channel***

  WP leader: APLM

- **WP2: Sediment Characterisation**

  WP leader: University of Brighton

- **WP3: Sediments re-used:** (electro kinetic treatment, civil engineering)

  WP leader: ESITC

- **WP4: Communication, monitoring and dissemination of the results**

  WP leader: APLM

WP1: Overview of the dredging in the Channel

Action 1: Overview

1.1: Report of the Dredging methods and sediment re-used opportunities

Objective: Knowledge of the French and English practices

1.2 Study of the Sediment typology, characterisation of the disposal at sea site (dumping site)

Objective: Define a common practice regarding the sediment disposed at sea (quality of the sediment disposing at sea, distance between sites, monitoring studies) and the knowledge of the potential volume to treat

1.3: Compare French and English regulations and study of the differences of interpretation between all organisations in charge of regulations

Objective: Suggested synchronization / harmonization and improvement of the consistency of the regulations

WP1: Overview of the dredging in the Channel

Action 2: Assessment of co-operation potential

- 2.1: Identification of current and future needs

  Objective: implementation of a joint dredging programme

- 2.2: Assessment of the potential to share material and means

  Objective: check the economic feasibility and the legal possibility to buy material in common or to buy material through an invitation to tender/bid request.

WP1: Overview of the dredging in the Channel

Action 3: Study the environmental consequences and constraints of dredging as well as their social impact

3.1: **Current and future environmental constraints and consequences** (Water Framework Directive, Natura 2000 sites, Protected marine areas, biodiversity, bio-accumulation)

3.2: **Social impacts of dredging**.

Objective: implementation of lobbying actions and concerted communication actions before, throughout and after the dredging operations.

WP1 expected outcomes

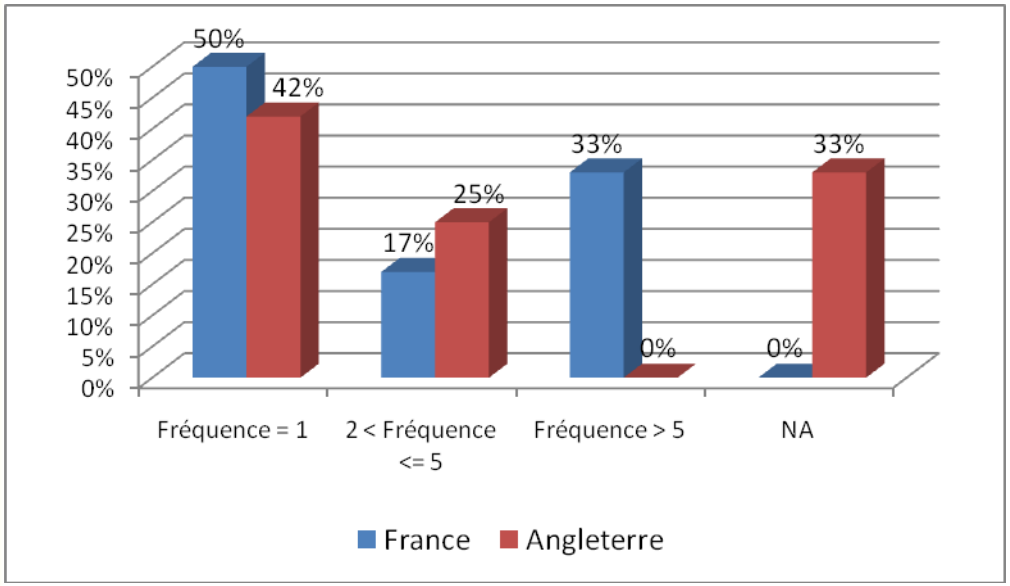
With a better knowledge of the dredging methods, the features of disposal at sea sites and the regulation, social and environmental aspects, we wish to be able to :

- Define some good and common practices regarding the management of disposal at sea

- Suggest joint and sustainable solutions regarding the dredging operations

3- Results of the Study 1: Dredging methods and sediment re-use opportunities

Study of the frequency of the maintenance dredging in the local Channel Ports:

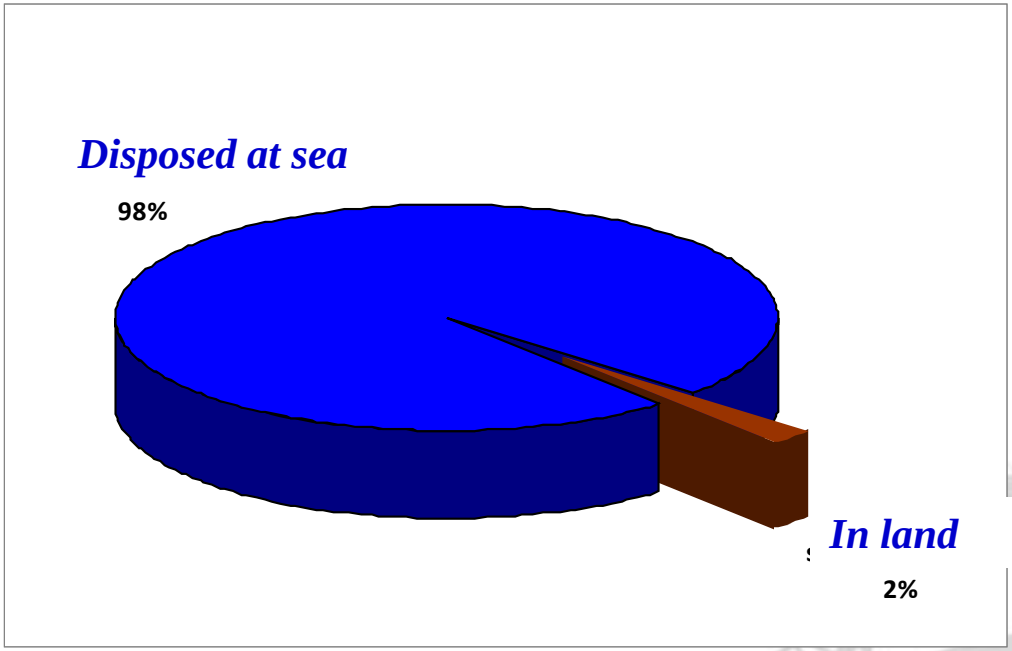


Most ports dredge at least one time per year

⇒one of information to take account to develop the mutualization operations between the Channel ports

3- Results of the Study 1: Dredging methods and sediment re-use opportunities

Destination of the Dredged sediments in the Channel French local ports



=> Representative of the national distribution

3- Results of the Study 1: Dredging methods and sediment re-use opportunities

The french needs of the career materials: 400 MT/year

Either:

-More 1 MT/day

- 7 tonnes/inhabitant/ year

-20 kg/inhabitants/days

Matériaux de carrière */ Carreer material*

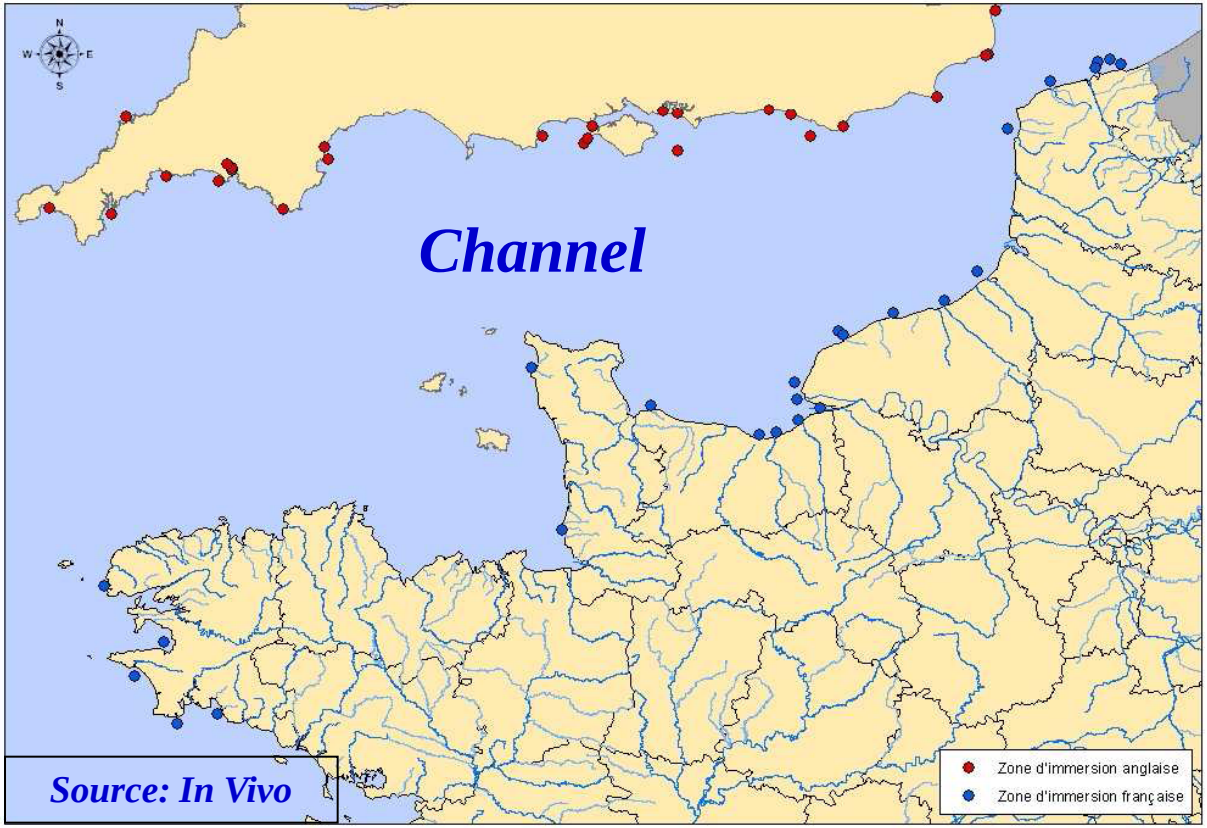
Produits de mines */ mine products*

- Produits énergétiques
- Minerais métalliques
- Autres substances (sel, potasse, soufre)

EUROVIA VINCI

3- Results of Study 2: Technical overview of sediments types and immersion site

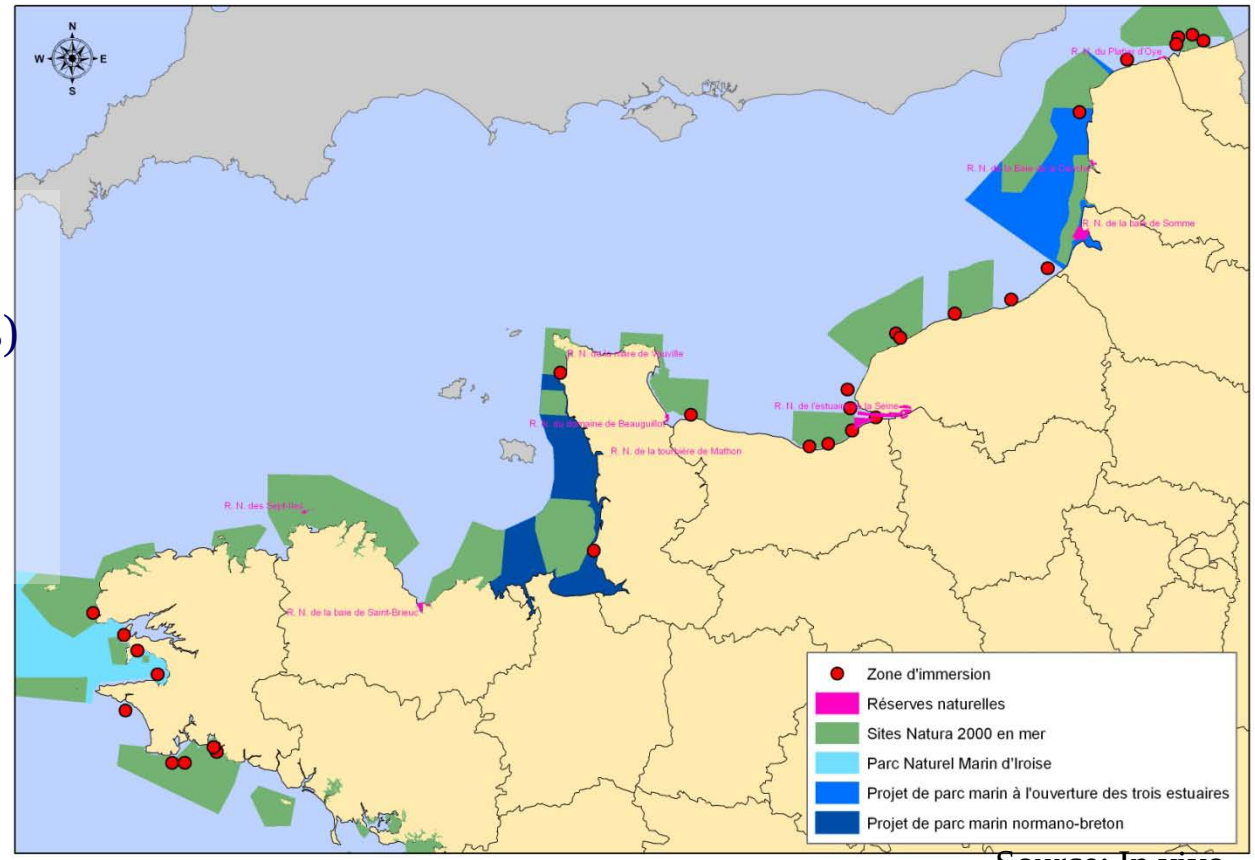
Map of the disposal at sea sites in the Channel



3- Results of the Study 2: Technical overview of sediments types and immersion site

Ex: Map of the dumping sites and environmental constraints in France

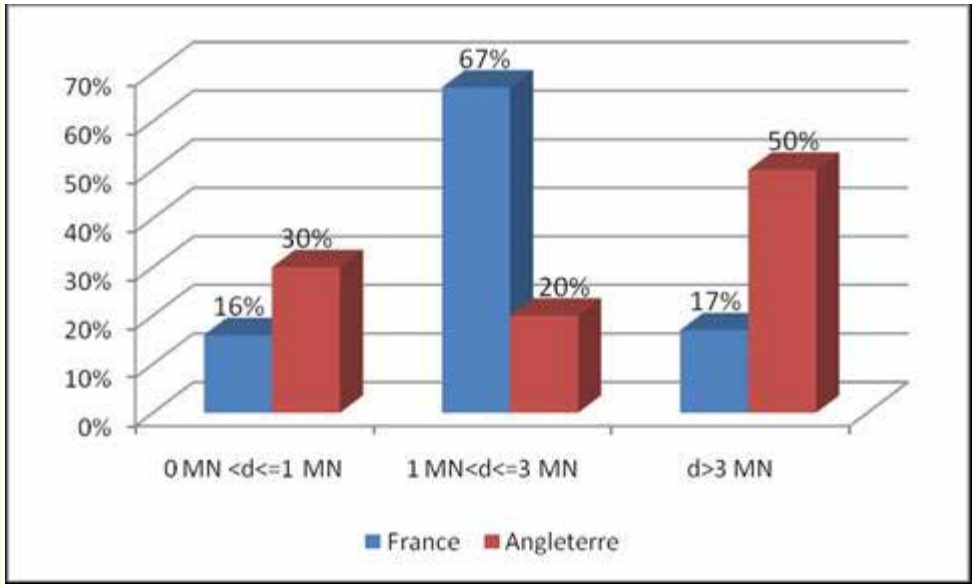
- Context
  - Natura 2000 (17 sites)
  - 3 Marine Parks
  - 3 Natural reserves



Source: In vivo

3- Results of the Study 2: Technical overview of sediments types and immersion site

Distance between the coast and the disposal at sea sites (nautic miles-NM)



6 French sites and 10 English sites analysed

The highest distance : 5 NM

But some of new sites will be certainly more far.

Ex. A request of permit is in progress with a suggested disposal of sea site at 15 NM from the port after 10 years of studies

So, Energetic print will increase in the same time

3- Results of the Study 3: Compare French and English regulations and study of the differences of interpretation between all regulatory organisations

Comparison of the French and English thresholds

Eléments traces	unité	Seuils français		Seuils anglais	
		Niveau N1	Niveau N2	Action level 1	Action level 2
Arsenic (As)	mg/kg	25	50	20	100
Cadmium (Cd)	mg/kg	1,2	2,4	0,4	5
Chrome (Cr)	mg/kg	90	180	40	400
Cuivre (Cu)	mg/kg	45	90	40	400
Mercure (Hg)	mg/kg	0,4	0,8	0,3	3
Nickel (Ni)	mg/kg	37	74	20	200
Plomb (Pb)	mg/kg	100	200	50	500
Zinc (Zn)	mg/kg	276	552	130	800
PCB totaux	mg/kg	0,5	1	/	/
Somme des 7 PCB définis par le CIEM	mg/kg	/	/	0,01	/
Somme des 25 PCB	mg/kg	/	/	0,02	0,2
PCB 28	mg/kg	0,025	0,05	/	/
PCB 52	mg/kg	0,025	0,05	/	/
PCB 101	mg/kg	0,05	0,1	/	/
PCB 118	mg/kg	0,025	0,05	/	/
PCB 138	mg/kg	0,05	0,1	/	/
PCB 153	mg/kg	0,05	0,1	/	/
PCB 180	mg/kg	0,025	0,05	/	/
TBT	mg/kg	0,1	0,4	0,1	1
DDT		0,001	/	/	/
Dieldrin		0,005	/	/	/

- N2 more restrictive in France (10 times)
- N1 less strict in France
- PCB controlled variously

Seuils	Allemagne		Belgique		Danemark		Espagne		Finlande		France		Irlande		Royaume-Uni		Norvège	
Mg/kg de M.S.	N1	N2	N1	N2	N1	N2	N1	N2	N1	N2	N1	N2	N1	N2	N1	N2	N1	N2
Mercure	1	5	0,3	1,5	0,25	1	0,6	3	0,1	1	0,4	0,8	0,2	0,7	0,3	3	0,6	5
Cadmium	2,5	12,5	2,5	7	0,4	2,5	1	5	0,5	2,5	1,2	2,4	0,7	4,2	0,4	5	1	10
Chrome	150	750	60	220	50	270	200	1000	65	270	90	180	120	370	40	400	300	5000
Cuivre	40	200	20	100	20	90	100	400	50	90	45	90	40	110	40	400	150	1500
Plomb	100	500	70	350	40	200	120	600	40	200	100	200	60	218	50	500	120	1500
Arsenic	30	150	20	100	20	60	80	200	15	60	25	50	9	70	20	100	80	1000
Zinc	350	1750	160	500	130	500	500	3000	170	500	276	552	160	410	130	800	700	10000
Nickel	50	250	70	280	30	60	100	400	45	60	37	74	21	60	20	200	130	1500

(Source: IN VIVO/ CETMEF)

To relativize due to different uses of these thresholds in each country

3- Results of the Study 3: Compare French and English regulations and study of the differences of interpretation between all regulatory organisations

Ex.: Evolution of the French regulations

More and more regulations since the last decade and new regulations are still in progress

(due to European Directive implementations at national level)

One of benefits

→ ***Environmental aspects better taken into account***

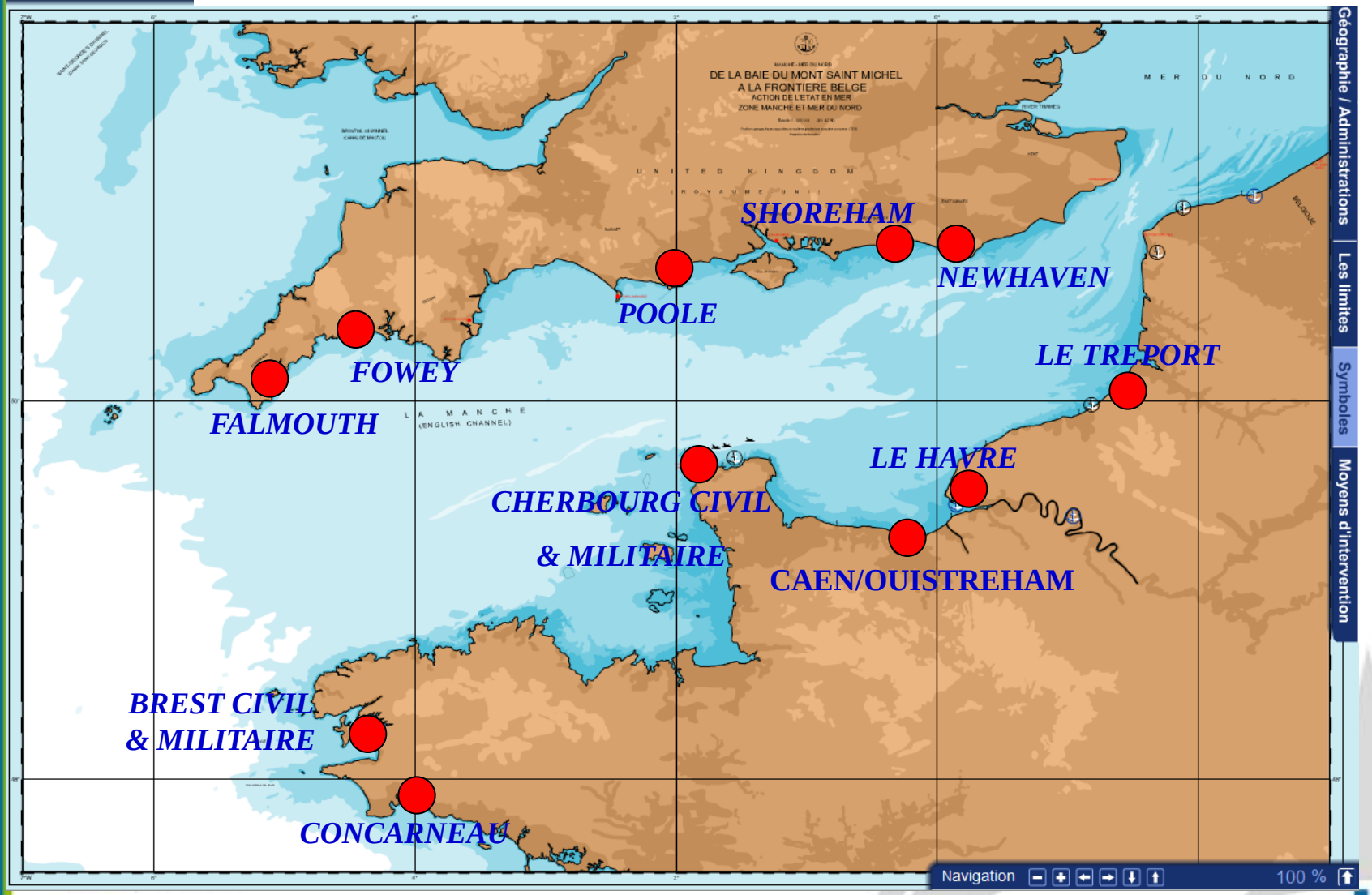
Nevertheless :

→ ***Still lack of consistency between all the regulations***

Réglementation internationale	Réglementation européenne	Droit français
Immersion		
Convention OSPAR, 1992		
Convention de Londres, 1975		
	DCE 2000/60/CE	Loi sur l'eau n°92-3
	DCSMM 2008/56/CE	Non repris en droit français
		Loi n°76-599 du 7 juillet 1976 relative à la prévention et à la répression de la pollution marine par les opérations d'immersion effectuées par les navires et aéronefs, et à la lutte contre la pollution marine accidentelle
		Ordonnance n°2005-805 portant simplification, harmonisation et adaptation des polices de l'eau et des milieux aquatiques, de la pêche et de l'immersion des déchets
Dépôt à terre		
	DCD 2008/98/CE	Non repris en droit français
	Catalogue européen des déchets, 2002	Décret n°2002-540 relatif à la classification des déchets
		Circulaire du 4 juillet 2008 relative à la procédure concernant la gestion des sédiments lors de travaux ou d'opérations impliquant des dragages ou curages maritimes et fluviaux
	Directive 1999/31/CE concernant la mise en décharge des déchets	- arrêté du 31/12/2004 relatif aux installations de stockage de déchets industriels inertes provenant d'installations classées - Arrêté du 19 janvier 2006 modifiant l'arrêté du 9 septembre 1997 modifié relatif aux installations de stockage de déchets ménagers et assimilés - Arrêté du 30/12/02 relatif au stockage de déchets dangereux
		Loi n°76-663 du 19 juillet 1976 relative aux installations classées pour la protection de l'environnement

4- WP 2 and 3: Characterisation and re-use of the sediments

13 Sampled ports



WP2: Sediment characterisation

Coordinator: University of Brighton

Several analysis will be lead to obtain:

- ❑ **Geochemistry and mineralogy measures**
- ❑ **Bioavailability**
- ❑ **Geotechnics measures**
- ❑ **Answers to Electrokinetic tests**

WP2: Sediment characterisation

Geochemical analysis

METAUX/METALS (mg/kg MS)
Al
As
Fe
Mg
Mn
Ti
Cd
Cr
Cu
Hg
Ni
Pb
Zn
Bioavailibility
CACO3 (%)
SO_4^{2-}
Cl^-
$NO3^-$
N (g/kg)
P (g/kg)
COT/ TOC (% de M.S)
HCT/ TPH (mg/kg MS)

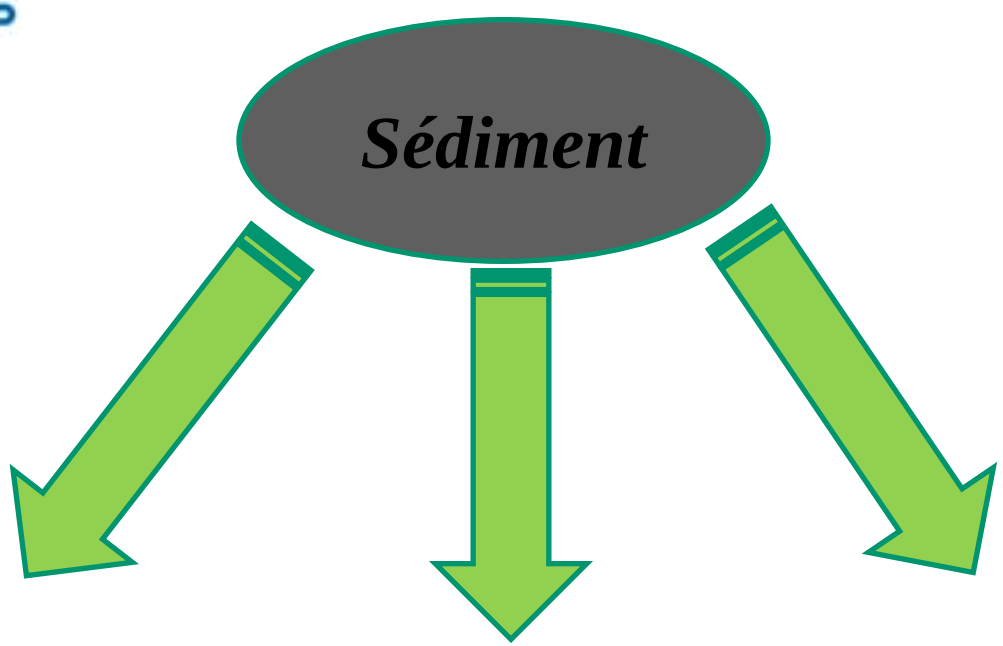
HAP/PAHs (mg/kg MS)
Acénaphtène
Anthracène
Benzo(a)anthracène
Benzo(a)pyrène
Benzo(b)fluoranthène
Benzo(ghi)pérylène
Benzo(k)fluoranthène
Chrysène
Dibenzo(ah)anthracène
Fluoranthène
Fluorène
Indéno(1,2,3,cd)pyrène
Méthyl(2)fluoranthène
Méthyl(2)naphtalène
Naphtalène
Phénanthrène
Pyrène

PCB/ PCBs (mg/kg MS)
PCB 28
PCB 31
PCB 52
PCB 101
PCB 118
PCB 138
PCB 153
PCB 180
Radioactivité/ Radioactivity Bq/Kg de M.S
40K (natural)
235 U
65 Zn
60Co
137Cs
241Am

Pesticides concentrations (mg/kg MS)
Aldrin
Heptachlor exo
Heptachlor endo
•-HCH
•-HCH (lindane)
Hexachlorobenzène
Fenthion
Diazinon
Ethion
Malathion
Parathion-éthyl
Parathion-méthyl
Azynphos-éthyl
Triazophos
Organo étains/ organostained
Mineralogy
Laser granulometry

WP2: Sediment characterisation

Bioavailibility Methods



Kinetic Extraction

metals fastly removable
Metals slowly removable

Simple Extraction

Sequentiel Extraction

WP2: Sediment characterisation

<u>Geotechnical Characterisation</u> of pre and post treated dredged marine sediment
And assessment of re-use applications.

- A complete appraisal of the strength and deformation characteristics will be obtained from a series of laboratory tests.
- Characterisation will aid in the development of
  - Process options
  - Storage options
  - Deposit management

University of Brighton

ESITC caen
l'école d'ingénierie et travaux de la construction

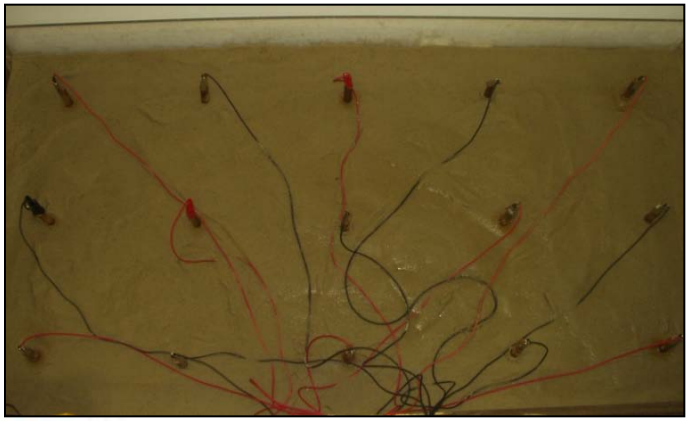
Mines de Douai
LILLE EUROREGION

WP3: Sediment re-used

Electrokinetic remediation

Linkage to work package 3 –Reuse - characterisation

Electrokinetic remediation and stabilization is an emerging technology that has received attention as a practical *in-situ* and ex-situ remediation technique for clay-rich soils.
In its most basic form: apply electrical current between electrodes that have been implanted in the ground on each side of a contaminated soil mass.
Less advanced is its use on dredged marine sediments, although its use as a mechanism to accelerate dewatering of slurries is well established.



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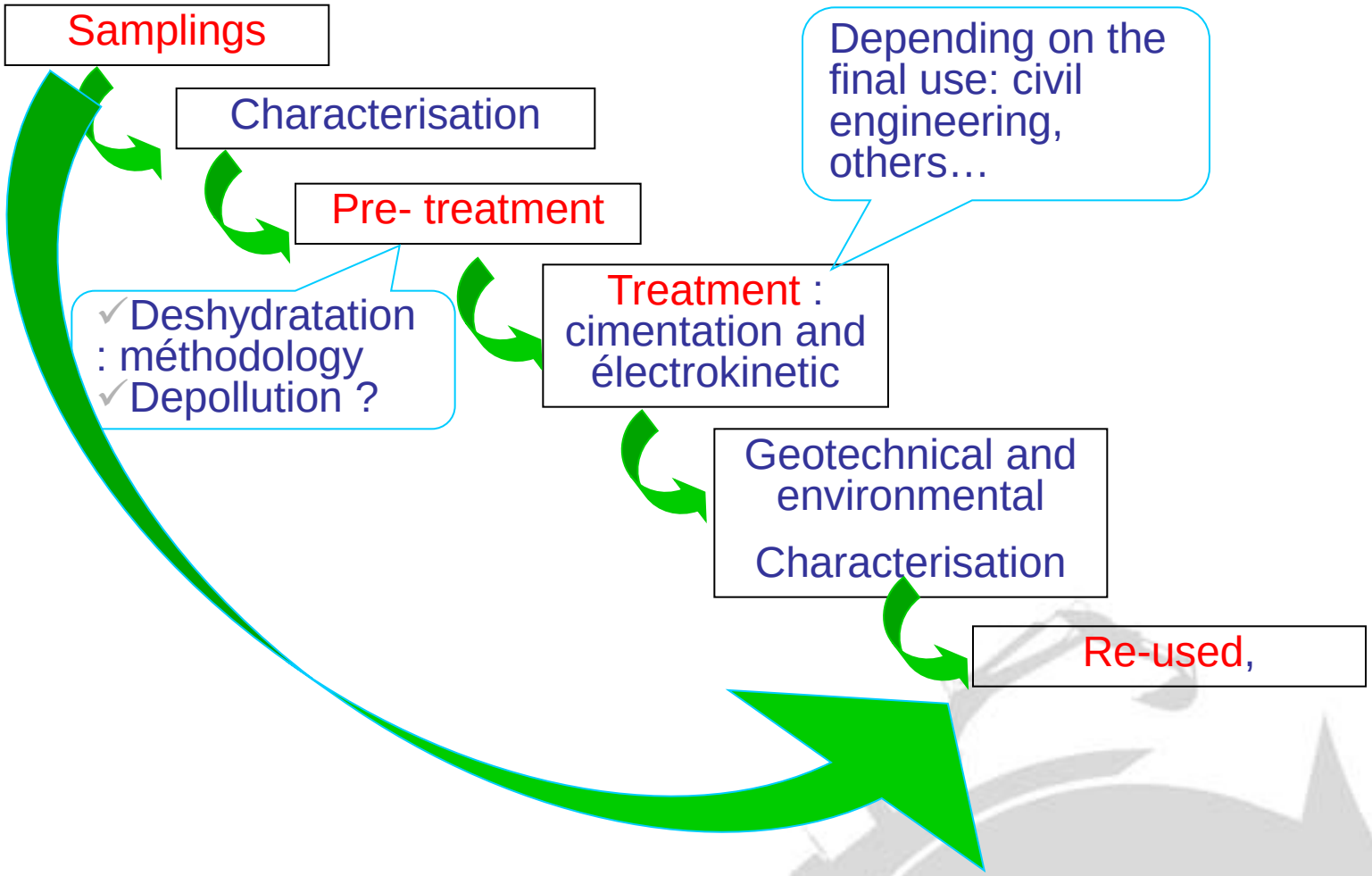
Expected results regarding the WP2 and 3



Expected results regarding the WP2 and 3

Typology

ECHANTILLONS	CARACTER. SEDIMENTS NON TRAITES				PRETRAITEMENT	TRAITEMENT	CARACT. SEDIMENTS TRAITES			COUT
	Geochimique	biodisponibilit	geotechnique	modélisation	déshydratation	(cimentation/e	Geochimique	biodisponibilité	geotechnique	
A										
B										
C										
D										
E										
F										
....										

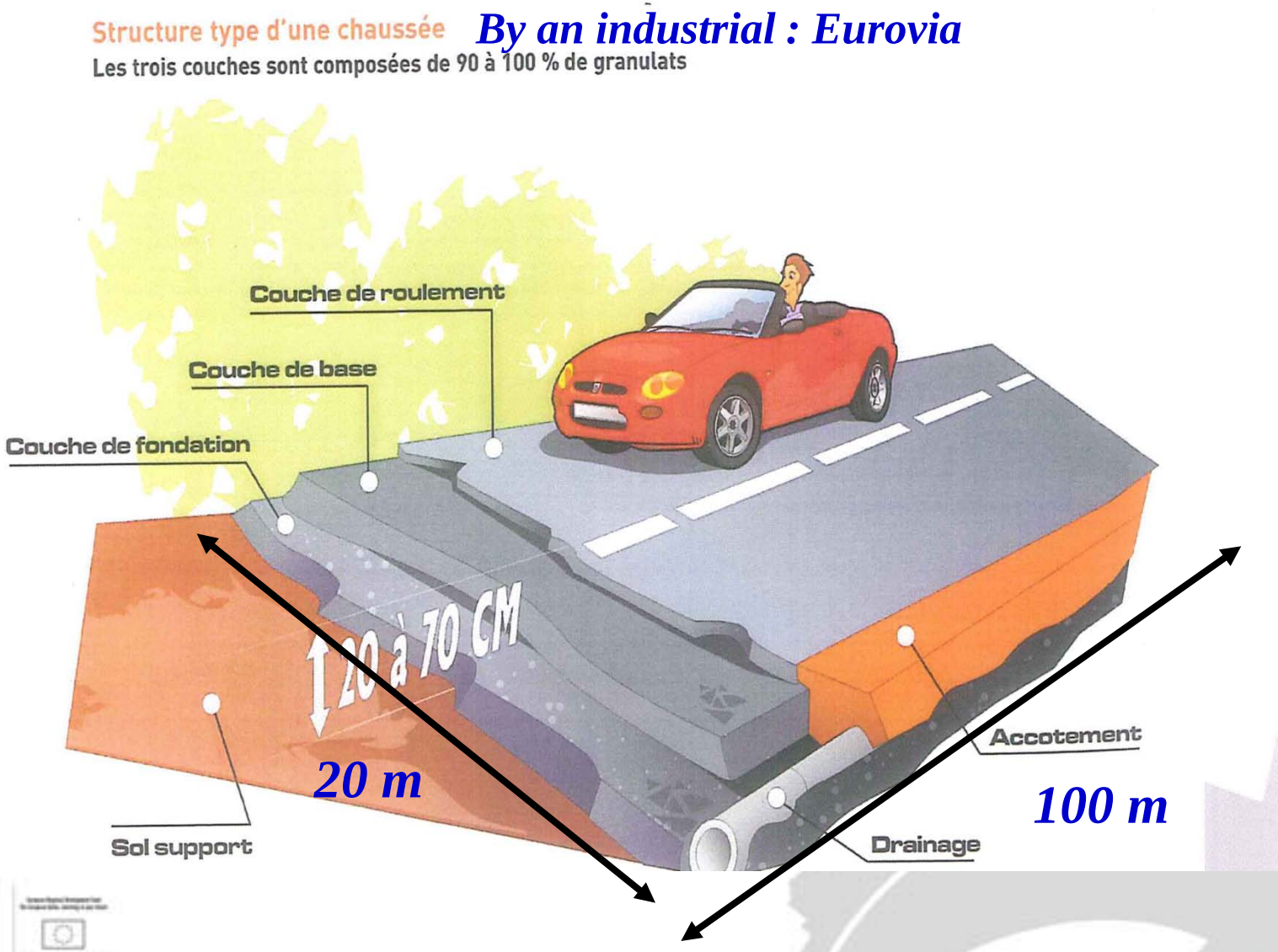
6 samples selected

Creation of trial roads (5m x 20 m) in situ and test

WP3: Sediment re-used

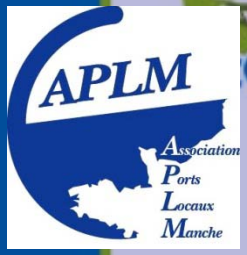
Experimental tests on 6 samplings in 2012-2013

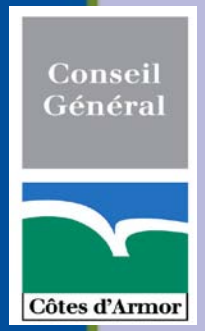
By an industrial : Eurovia



WP4: Communication, monitoring and dissemination

- ***Audience:*** *Ports authorities, state services, European institutions, Association, economic stakeholder*
- ***Organisation of 2 scientific seminars*** *: next one in september 2011*
- ***Organisation of 2 public seminars:*** *next one in June 2013*
- ***Links with another national and European projects:***
  SEDIMATERIAUX, SEDIGEST, SuPorts, …
- ***A website : www.setarms.org***





Thank you for your attention

Contact :

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