Introduction to Tube Dewatering Technology

Royal TenCate

TenCate Geosynthetics

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Manager Environmental Remediation

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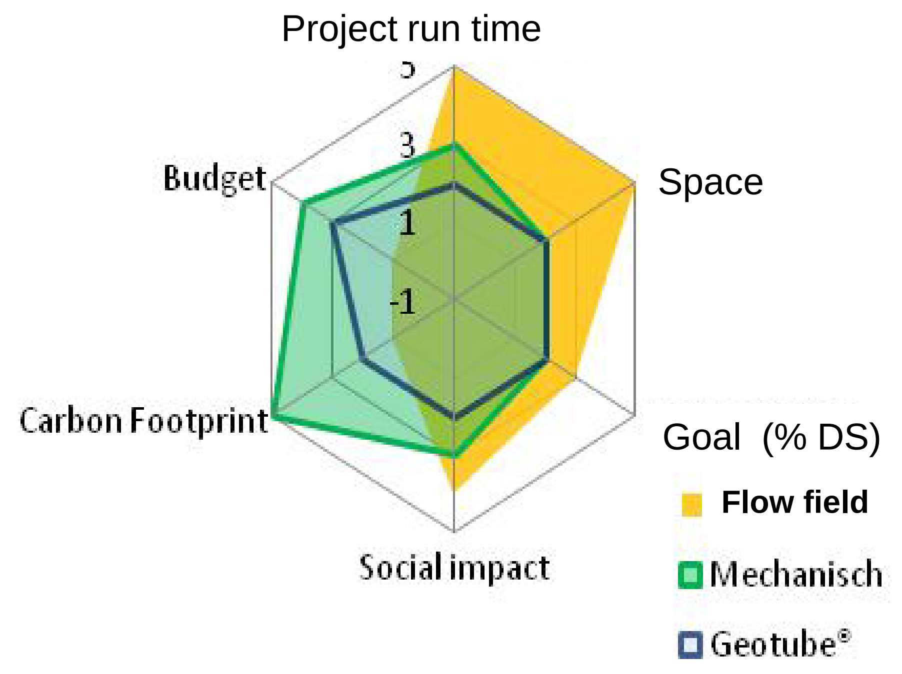
materials that make a difference

Geotube® technology for dewatering



Municipal and Industrial WWT

Mining WWT

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Mining Lagoon Management

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Mining Lagoon Management

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ENVIRONMENTAL REMEDIATION PROJECTS

- Uncontaminated use in berms : Kampen (NL)
- Contaminated use in berms: Zutphen (NL)
- Uncontaminated dike reinforcement: Dubbele Wiericke (NL)
- Uncontaminated use for subterranean surface elevation: Herne (GE)
- Landscaping co-using contaminated sediments: Tianjin Eco-City (CN)
- Container platform construction with contaminated sediments: Embraport (BR)

Project: Port la Forêt

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- Landscaping with contaminated sludge
- Dewatered and consolidated tubes transformed in football pitch

Project: Port la Forêt

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Project: Tianjin Eco-City, China

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Project Site Boundary

Google photo of Tianjin Eco-city Project with wastewater containment lake located at the center of the development site

The wastewater containment lake

- 2.56 km^2 wastewater containment lake
- Discharges from nearby domestic, agricultural and industrial sources since 1976
- Lake sludge sediments contain heavy metals eg. Hg, As, Cu, Cd and also DDT.

Project: Tianjin Eco-City, China

- In-situ sludge volume 2.600.000m³ at 10% ds
- Dewatered volume 460.000 m³ at 60% ds
- Dewatering area 12.000m²
- Circumferences 27,4 to 30,5m
- Total tube length 16.25 km

TenCate Geotube ® : example

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- Reconstitution of berms: uncontaminated sludge



Tube dewatering for : examples

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- Creation of a nature reserve within a sand filled TenCate Geotube® dike structure
- Bioremediation of contaminated sediments in safe confinement area

Reuse of contaminated sediments, Zutphen NL

Reconstruction of berms using TenCate Geotube® units hydraulically filled with (contaminated) sediments



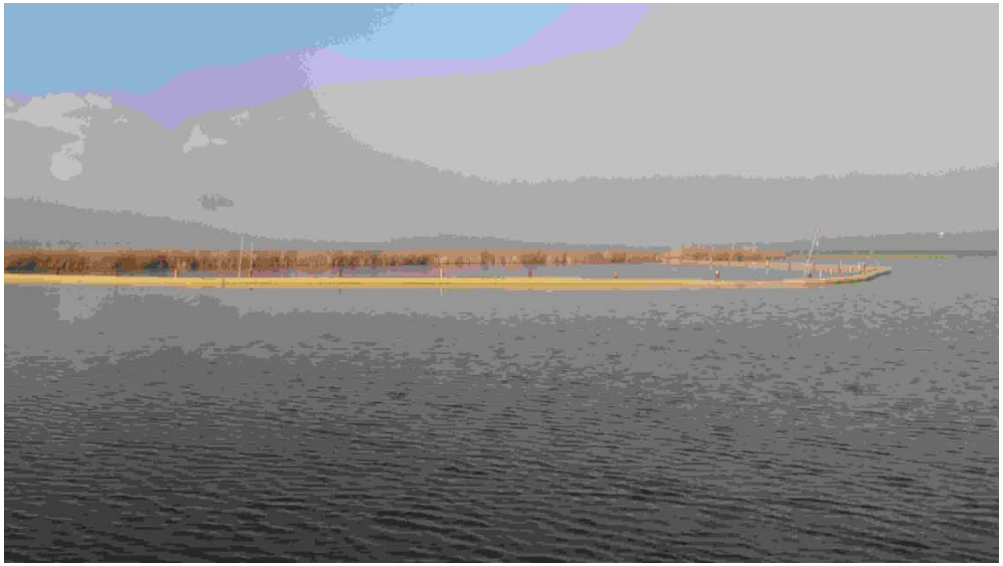



TenCate Geotube ® : example

- Creation of an anchored floating structure

TenCate Geotube ® : example

- Creation of an anchored floating structure: Sediment Storer



TenCate Geotube ® : example

- Sediment storing second possibility

TenCate Geotube ® : example

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- Sediment storing second possibility

Tube dewatering: examples

- Creation of protective dams against the potential effects of earthquakes

Project: Embraport Brasil

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The Challenge

- 50% of project area are wetlands and tidal zones
- 600,000 m3 of contaminated sediments
- Insufficient inland disposal area
- Large volume of imported select fill required
- Traditional engineering solutions threaten economic viability of project

Project: Embraport Brasil

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The Solution

- Use the 650,000 m3 of contaminated sediments
- To form the required 450.000m³ of select fill
- Use 3 dredges
- Pumping 1.500m³/hr total
- In @36,6m tubes

Project Location

Embraport Terminal

Project: Embraport

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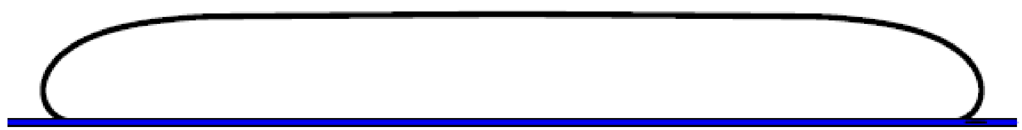
Geotube® Simulator
Cross Section



1/17/10	Project:	Embraport Geotube Cross Section

Units:	Metric		Circumferential Tensile Force (T) =	16.96	kN/m
Water Level:	Fully Emerged		Geotube® Base Contact Width (B) =	15.84	m
			Geotube® Filled Width (W) =	17.24	m
Geotube® Height (H) =	2.2	m	Geotube® Cross Section Area (A) =	35.21	sq m
Geotube® Circumference (C) =	36.5	m	Geotube® Volume Per Unit of Length (V) =	35.21	cu m/m
Relative Density of Fill Material =	1.4	sg	FS of Circumferential Failure =	4.6	FS
Geotube® Fabric Type:	GT500		Axial Direction FS (AFS) =	4.4	FS
Geotube® Fabric Type:	Rigid Mechanical		FS of Fill Port Failure =	4.7	FS

Project: Embraport

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Geotube® Estimator

Metric Units Input - Known Volume

Version 11.2A

Tom Stephens

Project Name:	Embraport Terminal
Location:	Santos, SP, Brazil
Contact:	Luiz Escobar, Leo Melo Casar
Date:	5/6/2007
Type of Material:	Marine Sedimants

Input		Units
Volume	680,000	Cubic Meters
Specific Gravity	2.65	
% Solids in Place	40.0%	
% Solids During Pumping	10.0%	
Target dewatered % Solids	63%	
% Coarse grain & sand*	20.0%	

* % Coarse grain & sand is removed from the calculation for volume reduction due to dewatering and added back in at the end in required Geotube® volume.

Output		Units
Total Volume Pumped	3,397,016,508	Liters
Wet Volume per day	8,639,994	Liters
Wet Volume per day	8,638.9	CM
Total Bone Dry Tons	289,639.0	Tons (metric)
Estimated Pumping Days	393.2	Days
Estimated Dewatered Volume	415,528.3	CM
Estimated Dewatered Weight	731,744.6	Tons (metric)

Production:

Pumping Rate (LPM)	10,000
Hours per Day	24.0
% Efficiency	60%

Estimated Geotube® Quantity:

Circumference X Pumping Height	*Meters*	
9.15m X 1.52m	93,433	
13.72m X 1.67m	51,995	
18.29m X 1.83m	34,276	
22.87m X 1.98m	24,640	
24.39m X 1.98m	22,836	
27.44m X 1.98m	19,920	
36.56m X 2.13m	13,425	
22.87m X 1.98m	24,640	Selectable

Material type:

Sand and/or Minerals

Percent of Maximum Filled Capacity

90%

For MDS Applications:

Legal Hauling Capacity	14	Tons

Estimated MDS Geotube® Units:

MDS Dimensions	*Each*
6.86m X 6.7m	59,276.0

Disclaimer: No warranty or guarantee expressed or implied is made regarding the performance of any product since the manner of handling and use is beyond our control. This document should not be construed as engineering advice, and the final design should be the responsibility of the project engineer and/or the project manager.

Project: Embraport

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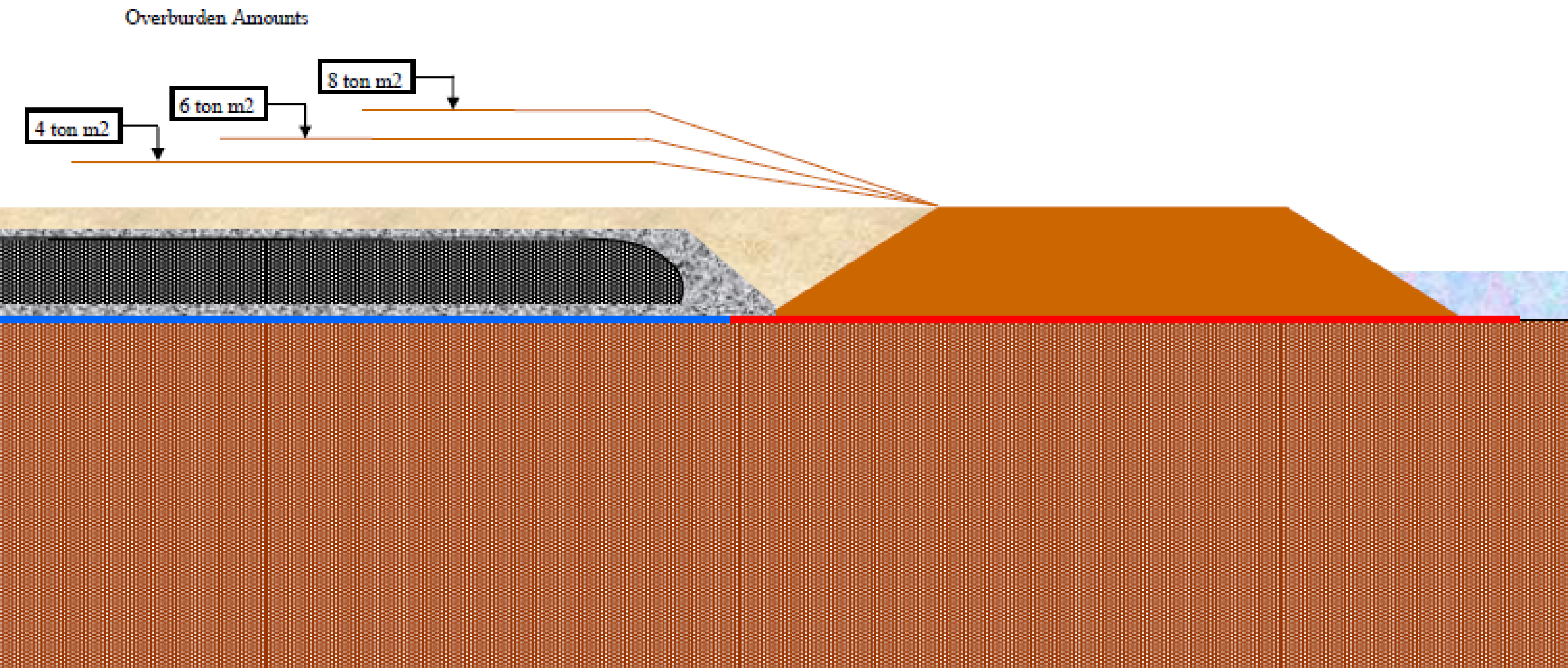
The Design



Project: Embraport

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Project: Embraport

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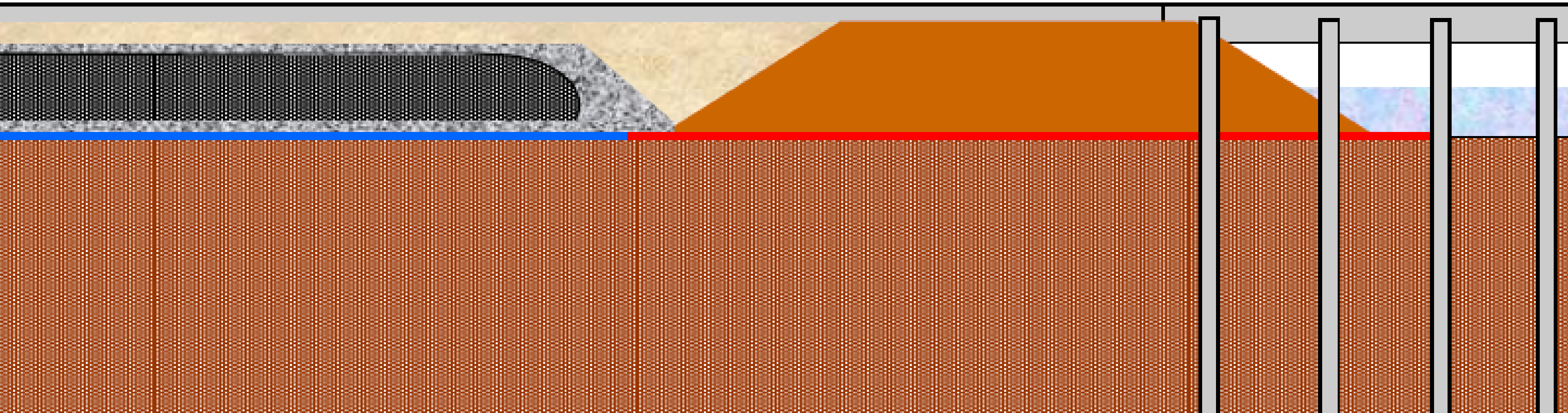
The Design



Project: Embraport

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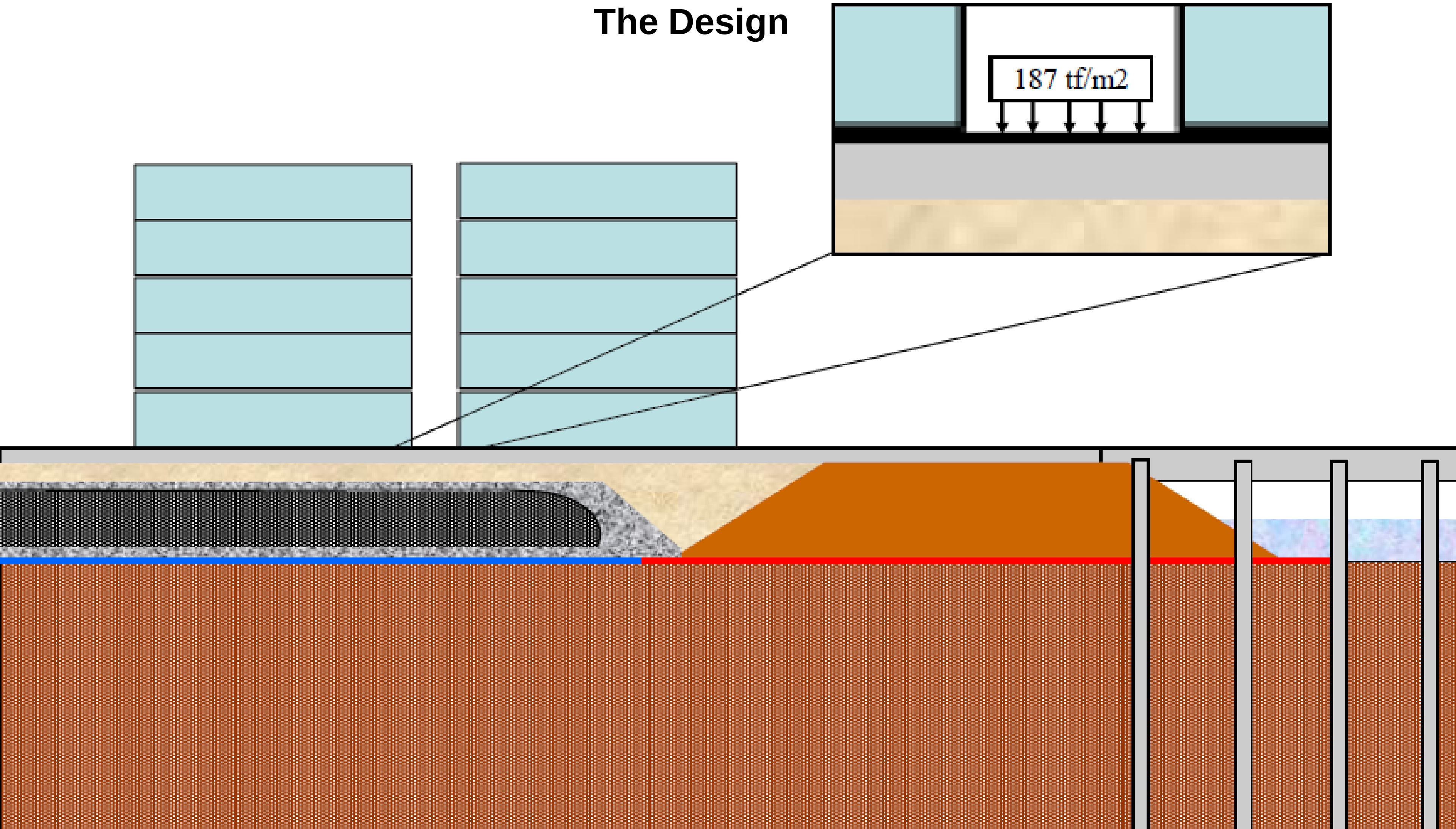
The Design



Project: Embraport

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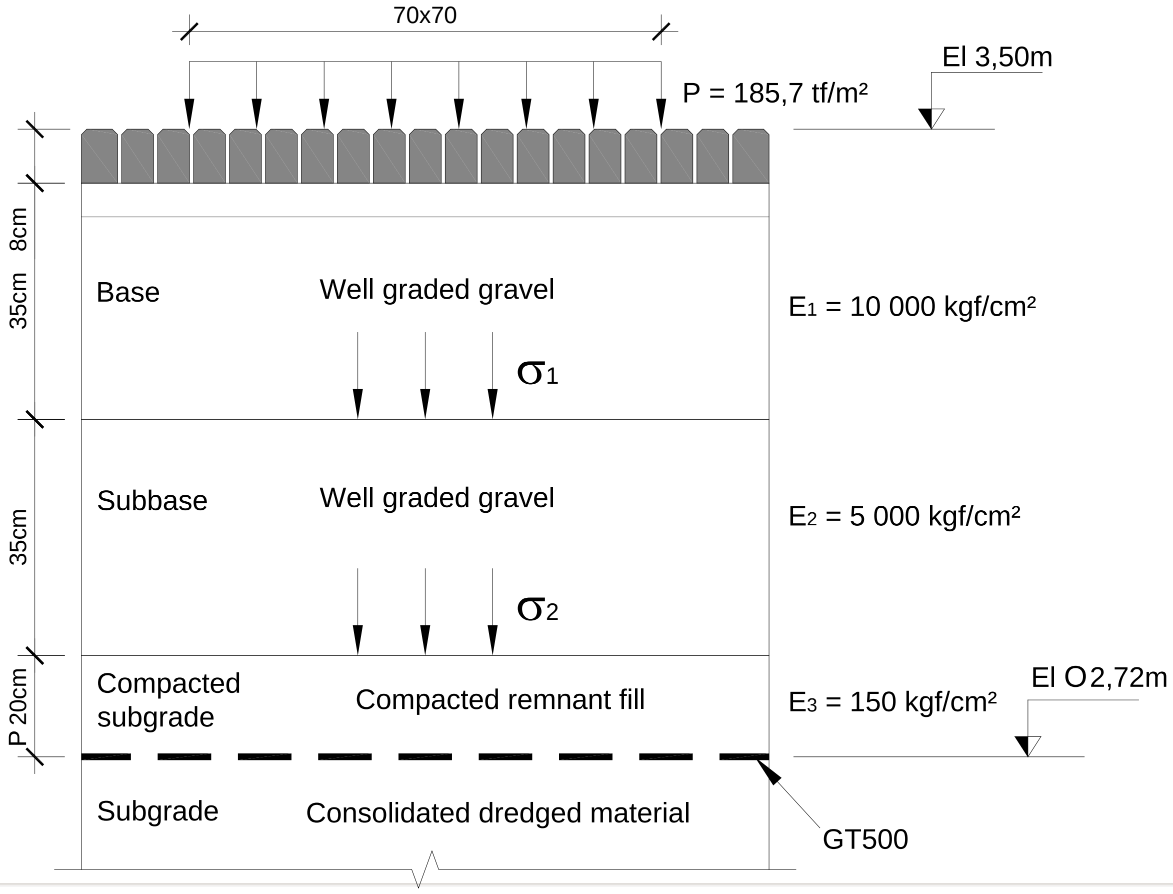
The Design



The Pavement Design

For verification, the gravel has no cohesion, therefore c = 0, and the footing is at surface level, therefore D = 0 and q = 0 which simplifies the formula to

Solve for the Allowable Bearing Capacity,

where B = 0,7m, γ = 2,1T/m², Sγ = 0,8 for a square footing as indicated by Terzaghi and Nγ = 763 for φ = 50º, giving:

$$q_u = 0{,}8 \times 2{,}1 \times 0{,}7 \times 763/2 = 448{,}6(T/m^2)$$

which leads to the safety factor:

Bearing Capacity FS = (448.6 / 185.7) = 2.42

Project: Embraport

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The Construction

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The Construction

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The Dewatering Operation

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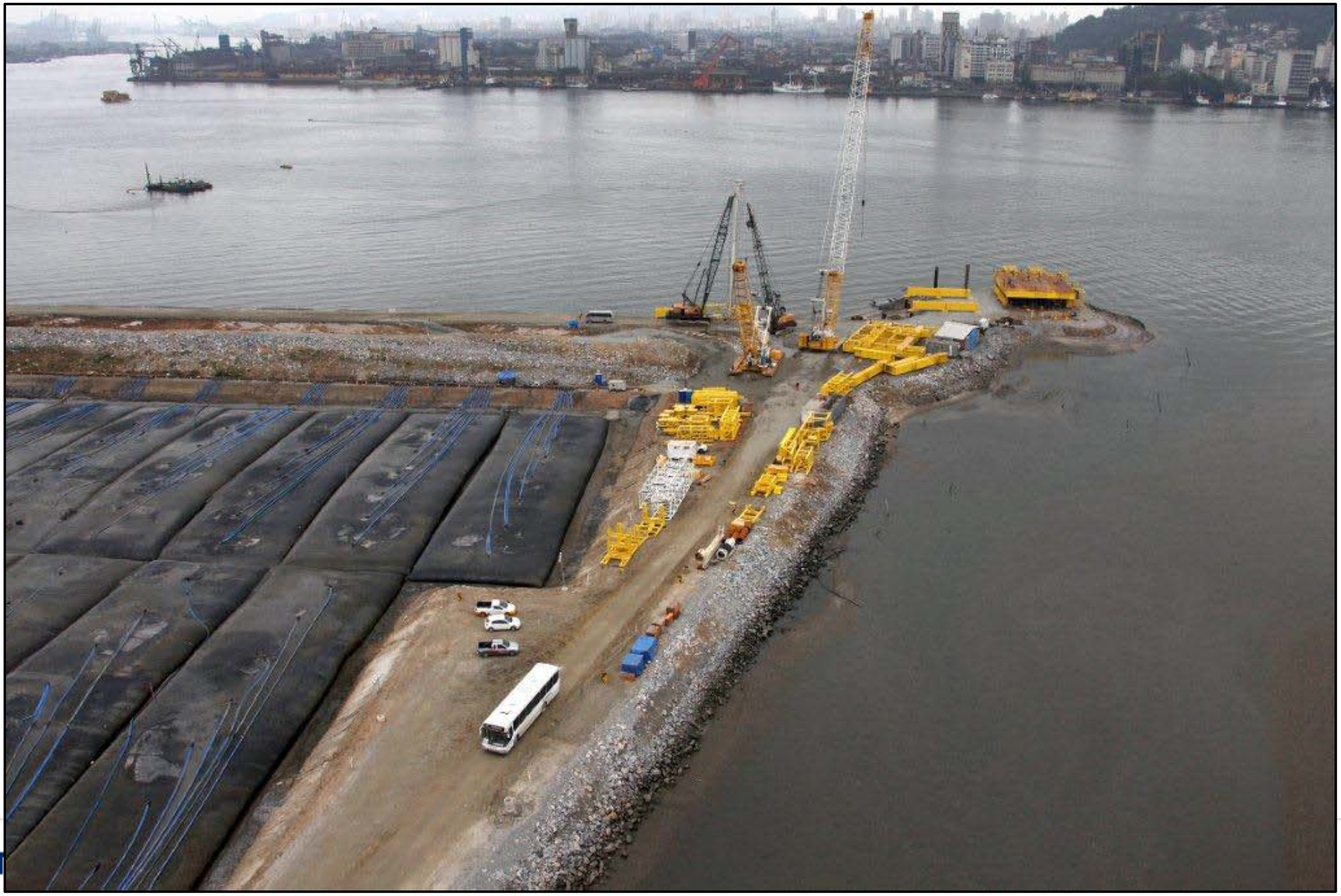
The Dewatering Operation



Project: Embraport

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The Conclusion

- Safe US$ 50M
- Create the biggest terminal in Latin America

The TenCate Geotube® carbon footprint calculator explained. Frontpage after opening the calculator

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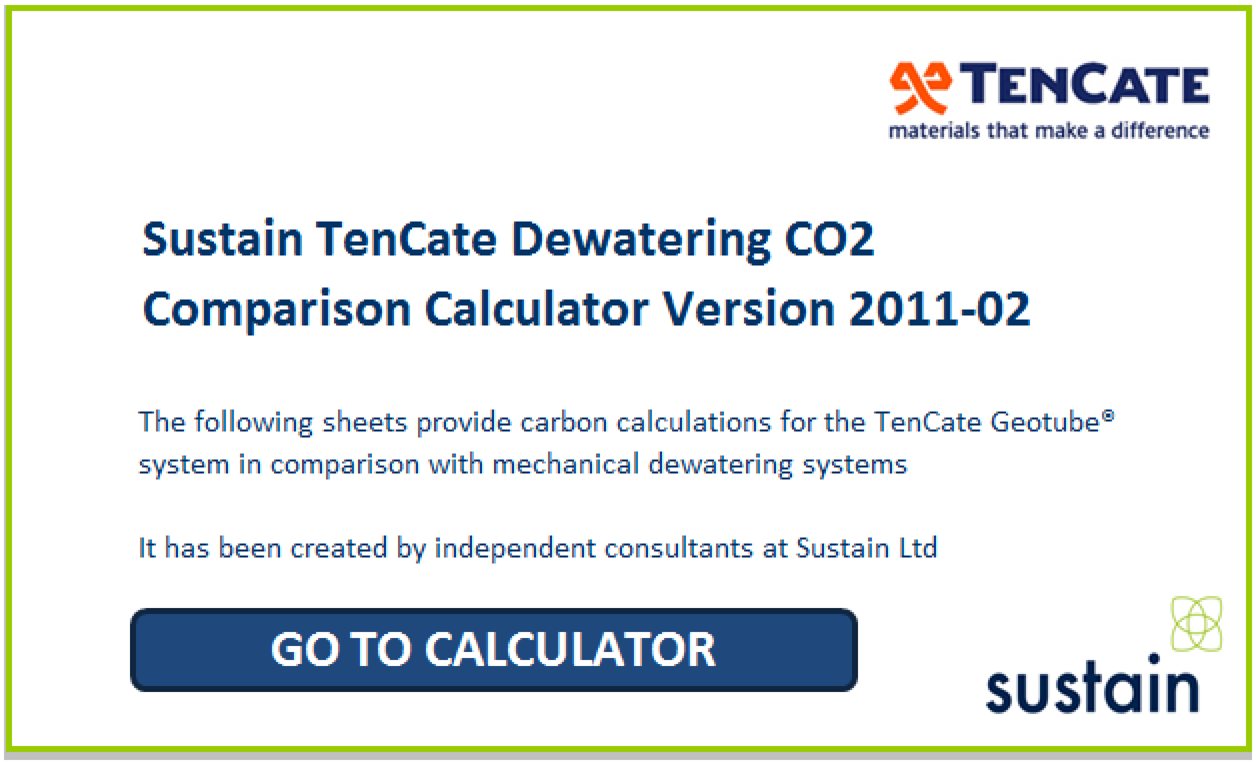

Martigues

CO_2 een voorbeeld

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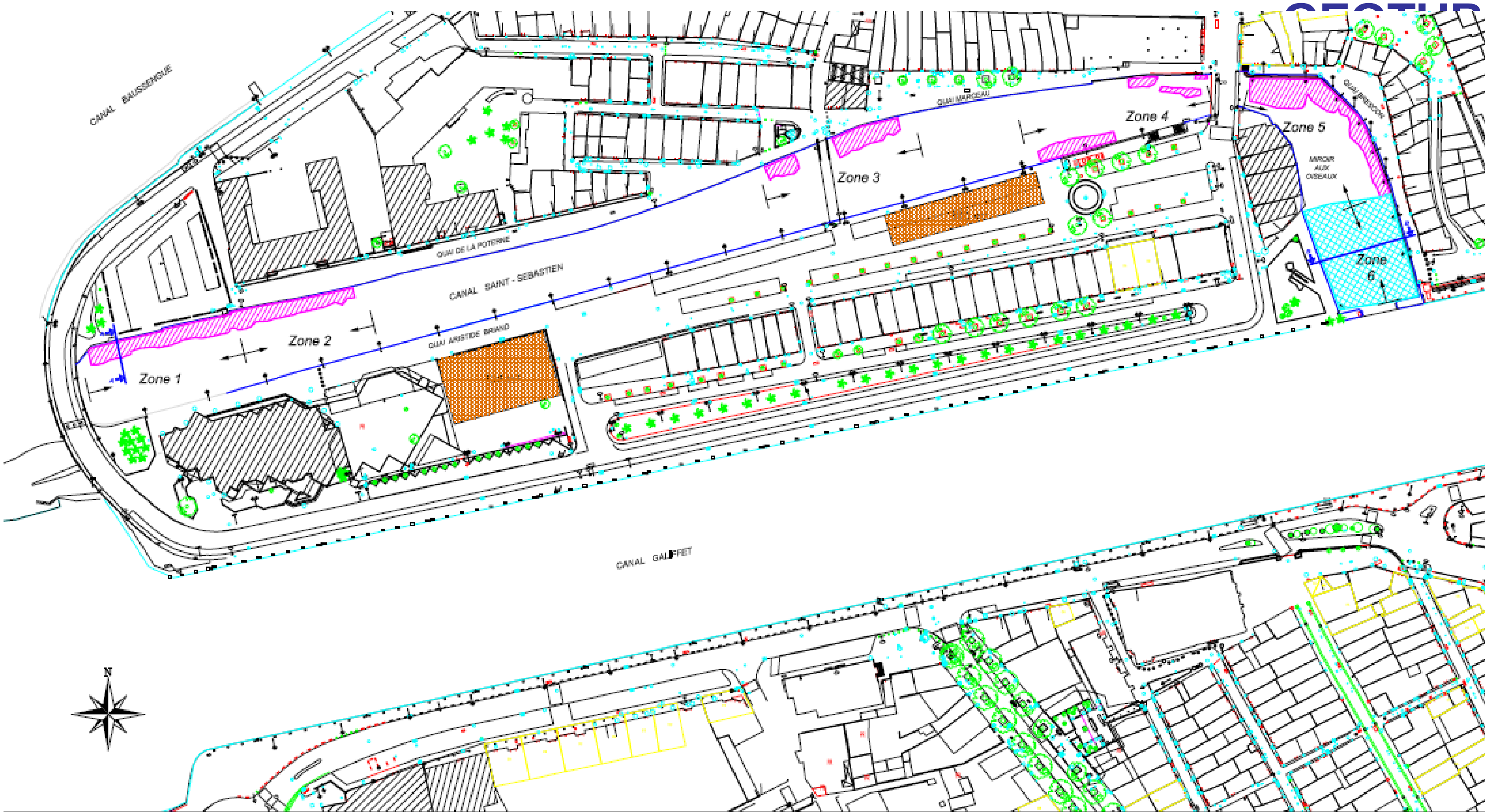

Désignation	6-g	Echelle: 1/ 1250e Date: Août 2010 Par: MATHIEU MICHEL Réf: C/Martigues-ST-Sébastien Dragages-2010 /Plan des zones de ressuyage.dwg	Christian BRÄNDLI Chef de Pôle Aménagement Durable du Littoral Marseille le	Direction Départementale des Territoires et de la Mer des Bouches-du-Rhône Service de la Mer et du Littoral Pôle Aménagement Durable du Littoral 16, rue Antoine ZATTARA 13 332 Marseille CEDEX 3 Téléphone : 04 91 28 54 83 Télécopie : 04 91 28 40 81
Commune de MARTIGUES Canal Saint - Sébastien Réalisation de dragages et réparation du quai Aristide Briand PLAN DES ZONES DE RESSUYAGE DE BOUES DE DRAGAGE				

0 10 25 50 m

Zone de ressuyage de boues de dragage

Martigues: platform op naastgelegen parking

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Martigues: op maat

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Martigues: het filtraat

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Martigues

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Martigues

Conclusion

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- Geotextile containment solutions have been successfully applied to manage and dispose of contaminated sediments in thousands of projects worldwide
- Geotextile containment solutions have gained acceptance in recent years to solve a wide variety of problems related to management and disposal of contaminated sediments
- Reuse of dredged sediments can lead to substantial savings to project owners
- Dredged sediments should be seen as valuable construction materials, rather than waste materials
- Engineers should use the knowledge about the possibilities of silts/sediments in combination with tube consolidation, use the extensive experience of companies like TenCate and embrace these new, creative techniques.

There is more possible than you may think.

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Or would she be dancing on a tube ?

Thanks you for your attention!