Special sessions on Geosynthetics, ICID Conference in Marrakech, November 25, 2021

Experiences on the combined use of gabions, mattresses and geomats for erosion control in natural and artificial water courses

MACCAFERRI

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Paolo Di Pietro is currently Senior Technical Education & Know-How Manager at Officine Maccaferri, Corporate Headquarters in Bologna, Italy.

With a degree in civil hydraulic engineering and over 34 years as a professional in design and construction of geotechnical and hydraulic engineering works, as project engineer, supervising feasibility and final design studies, overseeing construction sites, and later serving for 4 years in the USA as technical director for North America and later, for another 4 years, as technical head of the German operation in Berlin, his responsibilities included research, development and innovation of new steel wire and geosynthetic systems as well.

Since 2001, Paolo holds frequent seminars and workshops to design engineers, contractors and state officials in geotechnical and slope stabilization, river and erosion control works, and best management practices on soil bioengineering systems. He is also an active member of international standards (ASTM, EN, DIN), and author of several papers at international conferences.

SUMMARY OF TOPICS

MODERN RIVER ENGINEERING PRINCIPLES

TYPICAL SOLUTIONS FOR EROSION CONTROL

CASE STUDY: OMBRONE RIVER LEVEE, ITALY

CASE STUDY: HATTA WADI RESERVOIR, DUBAI

CASE STUDY: JABEL HAFFEET POND, U.A.E.

OTHER EXPERIENCES

SOIL BIOENGINEERING APPLIED

CONCLUSIONS (LESSONS LEARNED)

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PRINCIPLES OF MODERN ENGINEERING

LESSONS LEARNED

HYDRAULIC REQUIREMENTS

- *Geotechnical and hydraulic stability*
- *Sound engineering principles*
- *Design criteria on risk assessment*
- *Erosion impacting on environment*

ENVIRONMENTAL REQUIREMENTS

- *River is a dynamic environment*
- *Introduce minimal disturbance*
- *Sustainable systems*
- *Balance the eco-system*

ID	Bed materials	Roughness	Rock d50 [m]	Cu	Castoro	X-Ties	Geotextile	Time [h]	Shear Stress [N/m²] Allowed	Shear Stress [N/m²] Calculated		Velocity Under Lining [m/s]	Length [m]
1	Coarse gravel	0.025					-		32.00	43.36	✗	0.00	6.71
2	Coarse gravel	0.025					-		32.00	84.70	✗	0.00	8.00
3	Cobbles and shingles	0.035					-		52.60	204.23	✗	0.00	7.21
4	Cobbles and shingles	0.035					-		52.60	272.31	✗	0.00	42.80
5	Cobbles and shingles	0.035					-		52.60	204.23	✗	0.00	7.21
6	Cobbles and shingles	0.035					-		52.60	89.96	✗	0.00	12.00
7	Cobbles and shingles	0.035					-		52.60	46.05	✓	0.00	6.71

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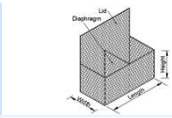
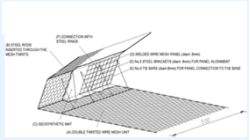
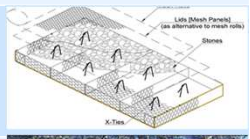
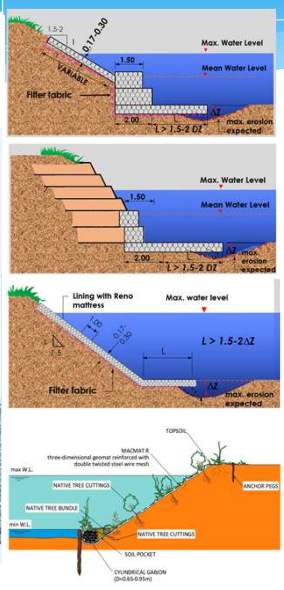
SOLUTIONS FOR EROSION CONTROL

BANK STABILIZATION SYSTEMS

FUNCTION	APPLICATION	EROSION CONTROL SYSTEMS	
EARTH RETAINING SYSTEMS	GRAVITY WALLS	GABIONS + BIO/GEOMATS	
	MSE STRUCTURES	TERRAMESH + GEOGRIDS	
LININGS	HEAVY DUTY	RENO MATTRESS PLUS + BIO/GEOMATS	
	R.E.C.P. EROSION CONTROL SYSTEMS	MACMAT R (TRM)	



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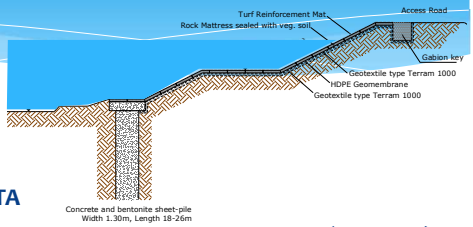
THE OMBRONE RIVER LEVEE, ITALY

PROJECT REQUIREMENTS

Waterproofing of the embankment

Verify hydraulic & geotechnical stability of the levee;

Use modern engineering principles (Natural Reserve).



PROJECT DATA

- Flood simulations under different scenarios (HEC-RAS)
- Design discharge of 4000-5000 m3/s (200 yrs recurrency);
- Water velocities 2.5 – 10 m/s and water level up to 10m;
- Evidence of silt-clay pockets at 6-7m below the ground.

SOLUTION

- Waterproofing : concrete sheet pile at the toe, HDPE geomembrane till embankment top,
- Reno mattress protection (erosion control)
- Vegetative topsoil, TRM Geomat reinforced steel mesh
- Hydroseeding treatment

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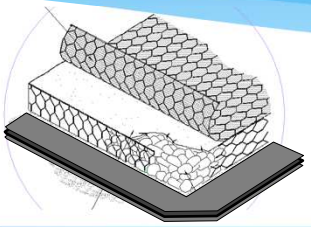
THE OMBRONE RIVER LEVEE, ITALY



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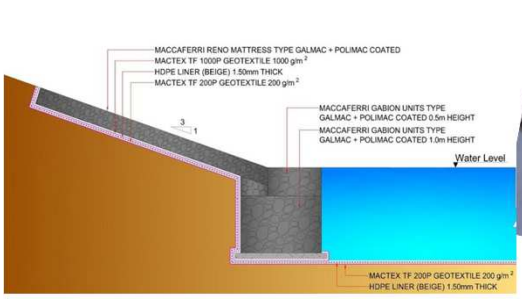
THE HATTA WADI (LEEM RESERVOIR), DUBAI



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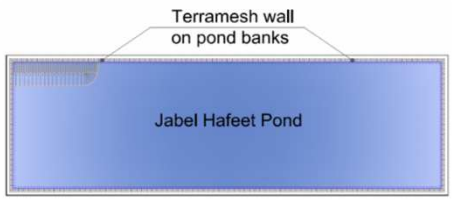
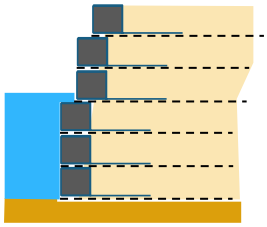
JABEL HAFEET POND IN AL AIN, U.A.E.





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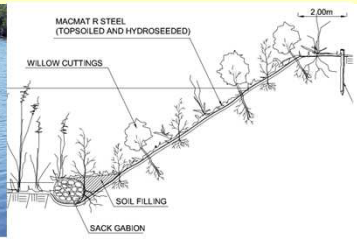
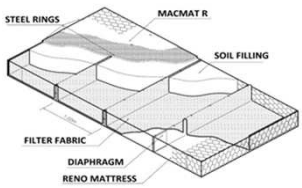
Other experiences for slope revegetation…

Canal Morto (Venezia) Italy

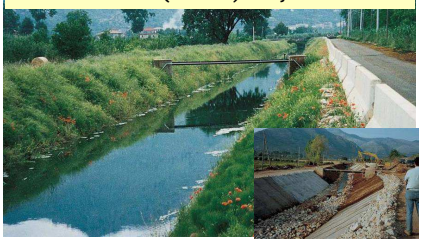


France – canal lining using mattresses filled with soil



Razaza channel, Iraq

Canal at Fondi (Latina) Italy



Loch Caron Foreshore (UK)

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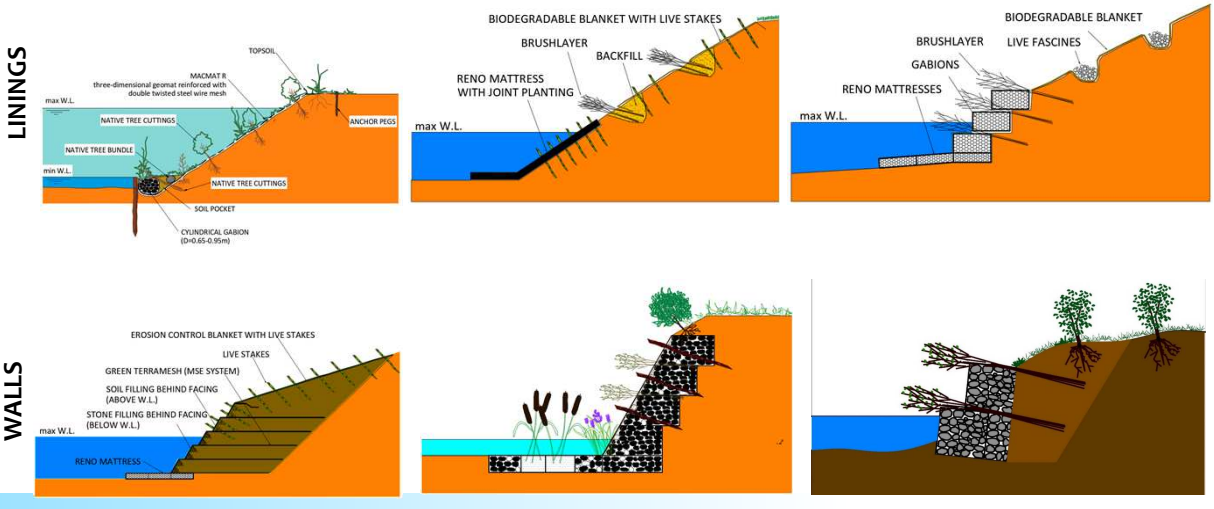
Other experiences for slope revegetation…

ENVIRONMENTAL FRIENDLINESS



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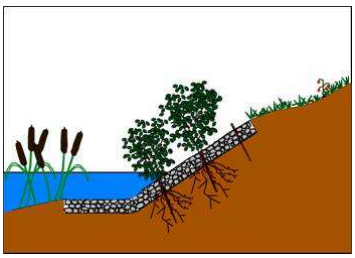
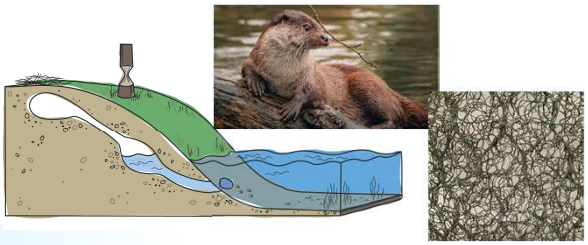
CONCLUSIONS (LESSONS LEARNED)

Geosynthetics combined with gabions and Reno mattresses in water courses provide...

- a natural integration with the surrounding environment in short terms re-establishing the initial natural conditions
- a successful incorporation of soil bioengineering techniques
- protection against the intrusion of rodents through the embankment structure in levees or dams, causing dangerous instability.

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