Engineering Workshop – DRR and Infrastructure
Baguio, Oct 11-15, 2010

ENGINEERING SOLUTIONS IN PRACTICE: EROSION PROTECTION

Oct 11, 2010 Ingemar Saevfors, architect/planner


Bamboo gabions, Timor Leste, 2009

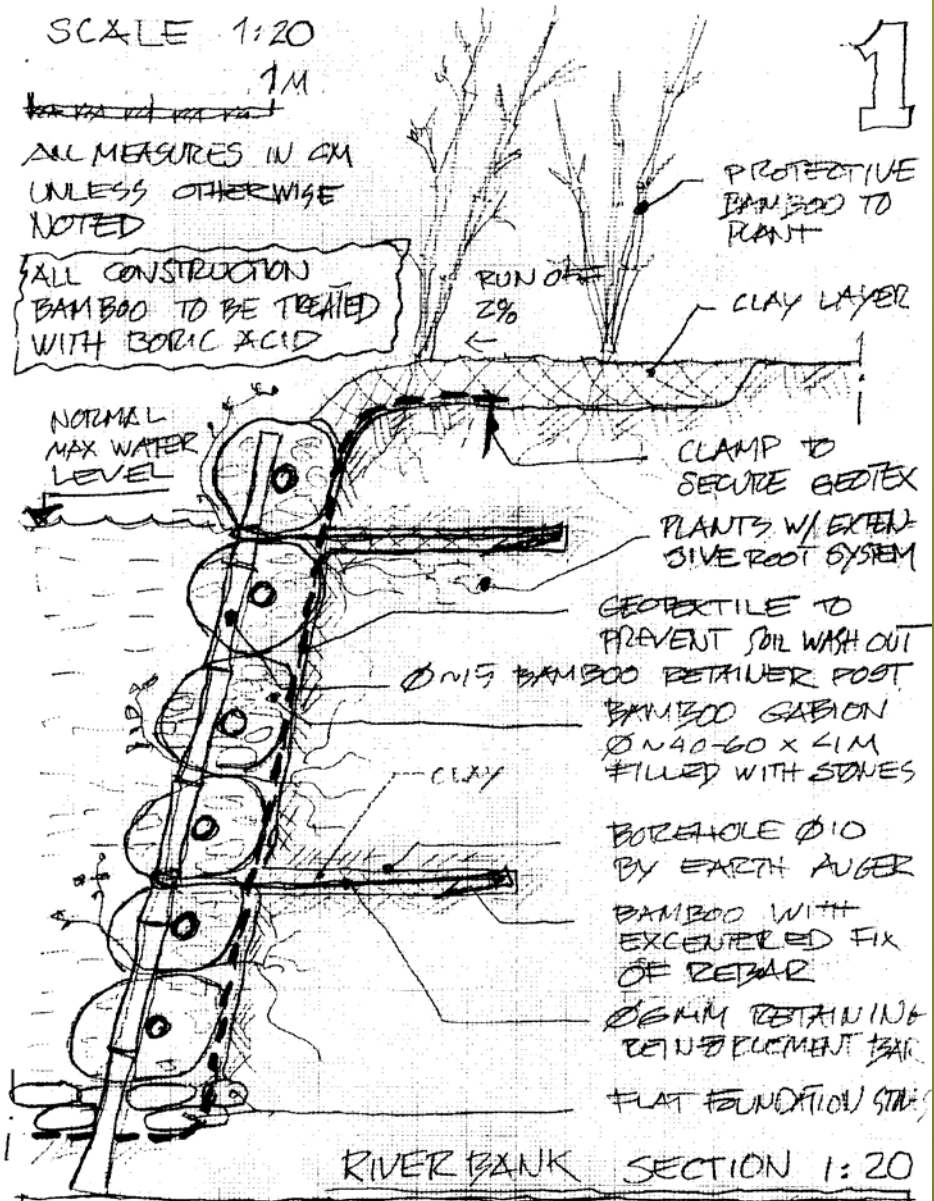
Elements at risk


Community power


Local materials?

Innovative design


Low cost versus maintenance challenges


SCALE 1:20
1M
1
ALL MEASURES IN CM UNLESS OTHERWISE NOTED
ALL CONSTRUCTION BAMBOO TO BE TREATED WITH BORIC ACID
RUN OFF 2%
PROTECTIVE BAMBOO TO PLANT
CLAY LAYER
NORMAL MAX WATER LEVEL
CLAMP TO SECURE GEOTEX
PLANTS W/ EXTENSIVE ROOT SYSTEM
GEOTEXTILE TO PREVENT SOIL WASH OUT
Ø N15 BAMBOO RETAINER POST
BAMBOO GABION Ø N40-60 x 1M FILLED WITH STONES
CLAY
BOREHOLE Ø10 BY EARTH AUGER
BAMBOO WITH EXCENTERED FIX OF REBAR
Ø6MM RETAINING REINFORCEMENT BAR
FLAT FOUNDATION STONE
RIVER BANK SECTION 1:20
DESIGN DRAWING #1
DRR - SCALE UP - CONCERN
ECO GABION
BAMBOO BASED CONCEPT FOR STRUCTURAL MITIGATION OF EROSION
SAEVFORS CONSULTING
LOSPALOS, TIMOR LESTE
1/5/09 saevfors@gmail.com

Local manufacture


Multiple bracing connections
providing remarkable strength

Boron + waste oil treatment

Auger drilling for retainer system

Retainer anchor

Retaining poles

Geotextile setup

Foundations for gabions


Next step :
Planting of soil protective plants,

Stacking of gabions

FOLHA DE OBRA - SITE SHEET STRUCTURAL MITIGATION FUAT 1, ILIOMAR SUBDISTRICT

F1

CONCERN-DISPECHO: DRR Scale up, Lautem, Timor Leste, May 22, 2009 Ingemar Saevfors file name: FolhaF1.doc

ISSUES	MITIGATION WORK	BENEF HSEH	START END
Major village drainage stream eroding land close to houses. Previous attempts to reduce water velocity (crossing gabions) resulted in side bank erosion and collapsed gabions.	Bamboo gabions 100 m x 3 along eroding house plots	180	JUL /SEP 09

BUDGET 5085 bamboo gabions, spec A 16,95/m2	unit	qty	unit price	300 m2
Bamboo diam 7-8cm, per pole of 5-6m	pcs	337,5	2	675,00
Bamboo diam 12-15cm, per pole of 5-6m	pcs	37,5	3	112,50
Retainer: 6mm reinforcement bar	m1	450,0	0,5	225,00
Steel wire, 2mm	kg	56,3	2	112,50
Stones, trucked to site	m3	112,5	7	787,50
Clay	m3	300,0	0,25	75,00
Geotextiles	m2	300,0	2	600,00
Boric acid	m2	300,0	2,75	825,00
Labor (bamboo treatment ,manuf gabions& retainers, mount on site)	m2	300,0	1,5	450,00
Labor stone filling	m2	300,0	0,75	225,00
Planting protective species	m2	300,0	0,5	150,00
Misc labor, transports, etc +20%				847,50
Total				5085

	ACTIONS PRIOR TO DELIVERY OF IMPORTS:	STATUS
1	CLEAN SITE, CARE NOT TO DESTROY FAVOURABLE VEGETATION	
2	PEG OUT EXTENSION OF SITE WORKS	
3	TAKE EXACT MEASURES AND UPDATE SKETCH DRAWING	
4	DIG OUT NECESSARY EARTH VOLUMES	
5	STOCKPILE STONES IN STRATEGICALLY SPACED HEAPS	
6	SET UP BAMBOO TREATMENT PLANT, PREPARE WASTE OIL SUPPLIES	
7	PREPARE RETAINERS WITH PIECES OF BAMBOO TREATED IN LOSPALOS	
8	MAKE BOREHOLES, FASTEN RETAINERS AND FILL WITH CLAY	
9	PREPARE CLAMPS PIECES OF BAMBOO TREATED IN LOSPALOS	
10	PREPARE MODEL GABION	
11	(LOSPALOS:) MAKE AUGERS 120 X 12 DIAMETER	

	ACTIONS AFTER DELIVERY OF ALL SUPPLIES:	STATUS
12	MIX BORIC ACID TREATMENT DIP	
13	CUT BAMBOO , SLICE, BUILD GABIONS CAGES AND DIP	
14	CUT BAMBOO, DRILL HOLES IN RETAINER POSTS AND DIP	
	(DIP BAMBOO IN TREATMENT DITCHES, 1 BORIC ACID, 2 WASTE OIL)	
15	PLACE RETAINER POSTS USING AUGER TO BORE 50 CM DEEP INTO GROUND	
16	PUT GEOTEXTILE ON SITE WITH FOUNDATION STONES AND CLAMPS	
17	PUT BED OF FOUNDATIONS STONES	
18	PLACE FIRST ROW OF GABIONS FIXING THEM TO POSTS AND FILL WITH STONES	
19	PLANT SUITABLE VEGATATION MAKING SMALL HOLES IN GEOTEXTILE	
20	PLACE SECOND ROW WITH OVERLAP, FIX ALSO TO GABIONS UNDER NEATH	
21	REPEAT UNTIL REACHING RIM	
22	PLANT BAMBOO ON TOP AND FILL WITH CLAY ON RIM	

Canal lining

Conclusion:
Structural mitigation in large scale with local materials is undoubtedly possible if an empowered community is taking the responsability