

Ecosystem Accounting for the Laguna de Bay Basin

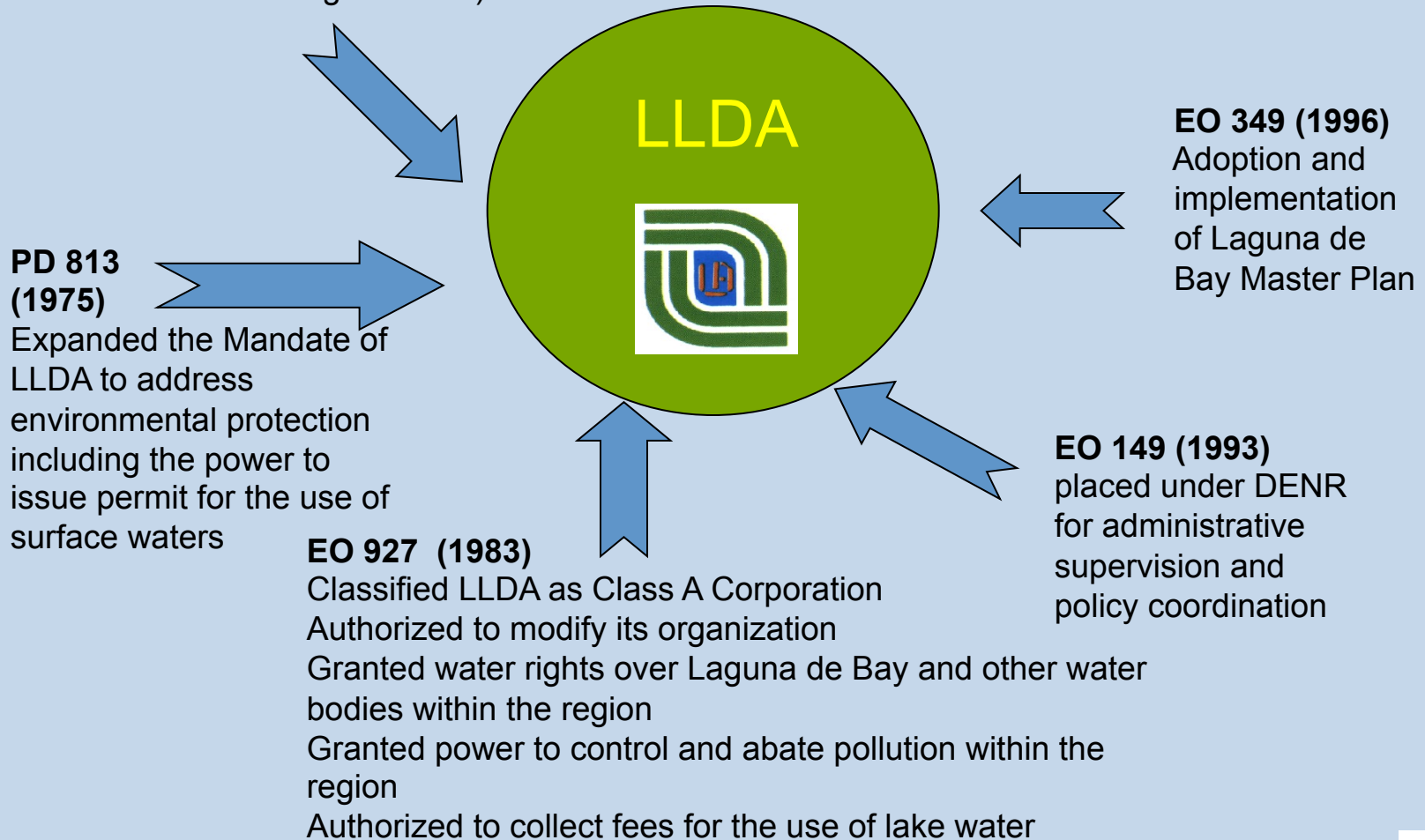
Jocelyn G. Sta. Ana
Focal Person – LLDA WAVES

SEARCA, Los Banos, Laguna
February 26, 2015



LAGUNA LAKE DEVELOPMENT AUTHORITY

RA 4850 (1966)...to promote and accelerate the development and balanced growth....with due regard for environmental management....)



Salient Features of Laguna de Bay



- total surface area = some 900 km²
- average volume = 2,250,000,000 m³
- shoreline length = some 220 kilometers
- watershed area = approx. 3,820 km²
- catchment total human population = about 15 million
- divided into 24 hydrological sub-basins with some 100 streams that drain into the lake
- three distinct bays: West Bay, Central Bay and East Bay
- average depth of the lake is 2.5 m
- Pasig River is the only outlet of the lake



Existing Lake Uses



Fisheries



Drinking Water Supply



Irrigation



Transport Route



Recreation



Power Supply



Industrial Cooling



Flood Reservoir



Issues: Pollution



Domestic Wastewater



Industrial Wastewater



Agricultural Wastes



Issues: Siltation



Four million tons of suspended sediment are estimated to enter the lake annually (0.5 cm per year) resulting to sediment delta that extends into the lake



Issues: Flooding



Policy Issues identified in the Stakeholders consultation

- Priority uses for the lake
- Fishery resource management, valuation of the contribution of Laguna de Bay to total fish production in the country
- Priority areas for protection where law enforcement could be more extensive – pollution, sediment loading
- Water pricing
- Land development planning – integrate green development, urban design



Initial Steps

- Creation of Technical Working Group - water, land and fishery accounts
- Data availability and gap assessment
- Use DPSI table (drivers, pressures, state, impacts)
- Develop a framework



Challenges on Data Collection

- Different data formats – tables, graphs, maps
- Different survey methodologies
- Different time periods
- Fee for certain data
- Takes some time to gather data
- Hesitation to release data on production costs (apprehension that the user fees will increase)



Solutions

- Training on Data Processing
- Training on GIS Mapping and Processing
- Conduct Focus Group Discussions and Meetings with concerned agencies
- Memorandum of Understanding /Agreement with partner agencies
- Communications Plan/ Report to the stakeholders



Trainings Conducted

SedNet Modelling

- Biodiversity and Management Bureau
- February 10 to 12, 2015
- Conducted by Mr. Arnan Araza, Verna Duque and Engr. Emil Hernandez
- Participants – 6 LLDA, 3 DENR, 1 NEDA

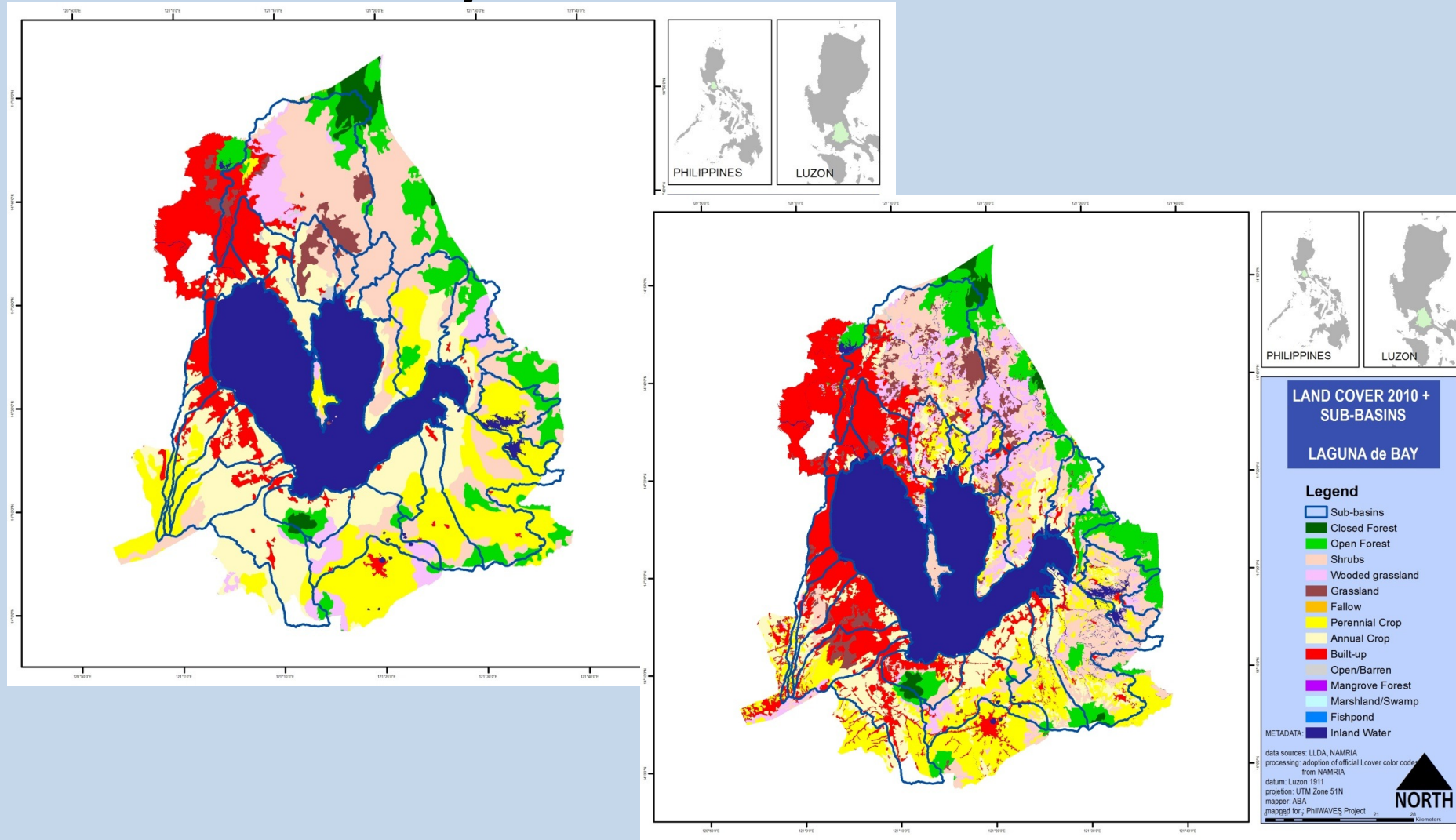


Results

- Currently: finalising results first phase (1 year)
- Results include:
 - Analysis of land use change 2003-2010 by municipality and by sub-basin
 - Analysis of discharges and water quality
 - Upland services: erosion control
 - Lake services: fisheries (capture + aquaculture), water supply and flood retention
- Focus has been on physical services, monetary analysis planned in coming months



Preliminary results 1: Land Account



Results 2: Land use change matrix

Land Cover	Area (ha) in 2010	Area Percentage	Area in Hectares 2003	Area Percentage	Change in ha (+,-)	% (+,-)
Annual Crop	57359	12	94087	19	-36727	-7.41
Built-up	92894	19	51968	10	40926	8.26
Closed Forest	5263	1	7844	2	-2581	-0.52
Fallow			26	0	-26	-0.01
Fishpond	76	0			76	0.02
Grassland	19932	4	9630	2	10302	2.08
Inland Water	96495	19	2965	1	93530	18.87
Lake			90723	18	-90723	-18.30
Mangrove Forest	1	0	35	0	-33	-0.01
Marshland/Swamp	4	0			4	0.00
Open Forest	40705	8	41770	8	-1065	-0.21
Open/Barren	702	0	801	0	-99	-0.02
Perennial Crop	67055	14	84579	17	-17523	-3.53
Shrubs	77897	16	89584	18	-11688	-2.36
Wooded grassland	37348	8	21731		15617	
Grand Total	495732	100	495743			



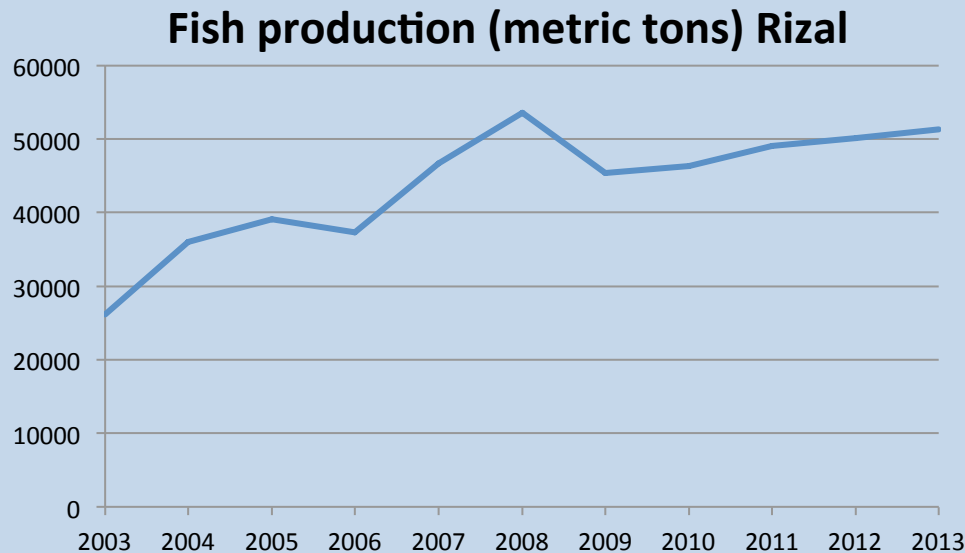
Results 3. Water discharges (by PSIC)

2003	Industries (PSIC Code)					House holds	Rest of Philippines	TOTAL
	Agriculture (PSIC section A)	Manufacturing (PSIC Section C)	Water supply, Sewerage and waste management (PSIC section E)	Accommodation, food service activities (PSIC Section I)	Other (all other PSIC sections)			
1. Gross emissions (BOD, metric tonnes)		266,919	2,778	7,977	487,542	*		827,554
1a. Direct emissions to water								
1a.1 Without treatment								
1a.2 After onsite treatment								
1a.i to inland water resources								
1a. ii to the sea								
1b. To Sewerage								
2. Reallocation of emissions by sewerage ind.								
3. Net emissions (1a +2)								



Results 4: Aquaculture (Rizal)

2003 TO 2013 FISH PRODUCTION - AQUACULTURE (in metric tons)											
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
RIZAL											
Fishcages											
Tilapia	641	702	675	539	1802	1945	1659	1590	1694	1736	1784
Carp	237	395	384	393	1061	1143	819	774	828	855	871
Fishpens											
Milkfish	13516	17778	16181	15027	17610	21317	18628	18334	19642	20062	20454
Tilapia	3622	4576	6218	6481	8773	11396	10986	11141	11769	11998	12299
Carp	8079	12541	15583	14830	17457	17802	13313	14434	15067	15438	15937



But: ecosystem
condition
accounts show a
need to verify fish
(food safety)
quality

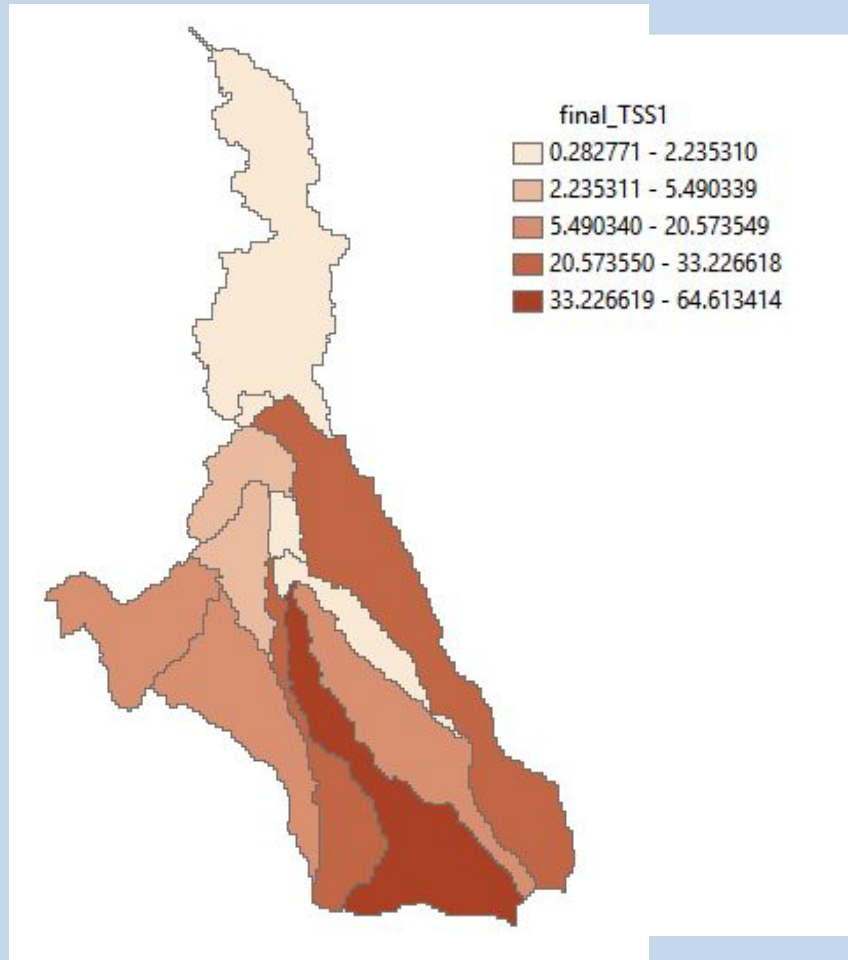


Results 5: erosion control

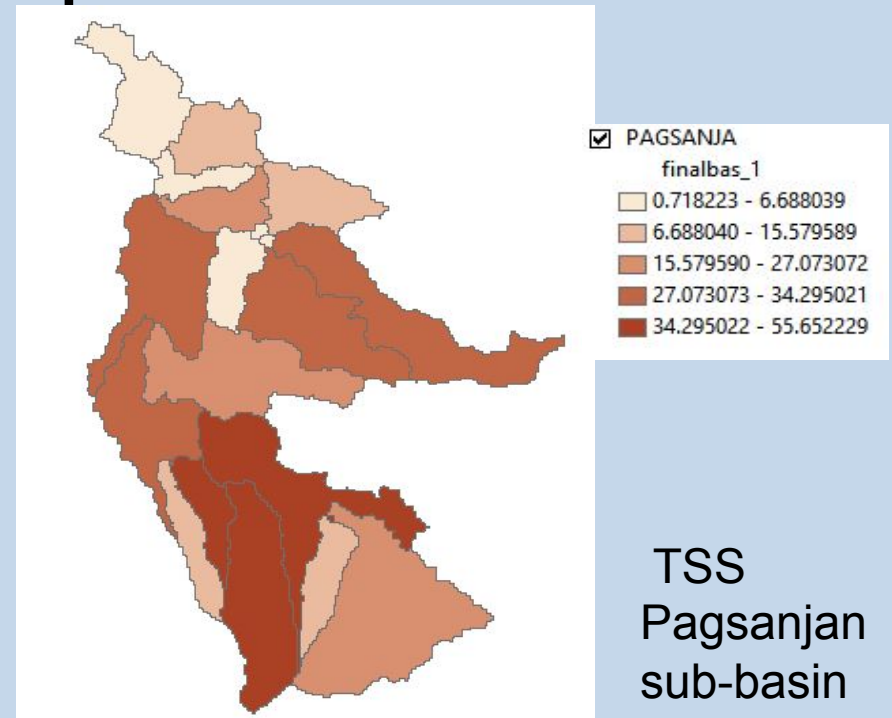
S u b - watershed	A r e a (km2)	Sediment generated under 2010 land cover (kton sediment/year)	Sediment that would be generated under bare land cover (kton sediment/year)	E c o s y s t e m service (avoided erosion) (kton sediment/year)
unit		(kton sediment/year)	(kton sediment/year)	(kton sediment/year)
1 Marikina	535	530	3238	2708
2 Calauan	160	49	167	118
3. Pagsanjan	278	434	1007	573
4 . S a n Cristobal	147	46	79	33
5. San Juan	192	46	259	213
6. St. Cruz	129	202	785	583
7. San Pedro	52	9	11	2
TOTAL	1493	1316	5546	4230



Sedimentation loads per sub-watershed



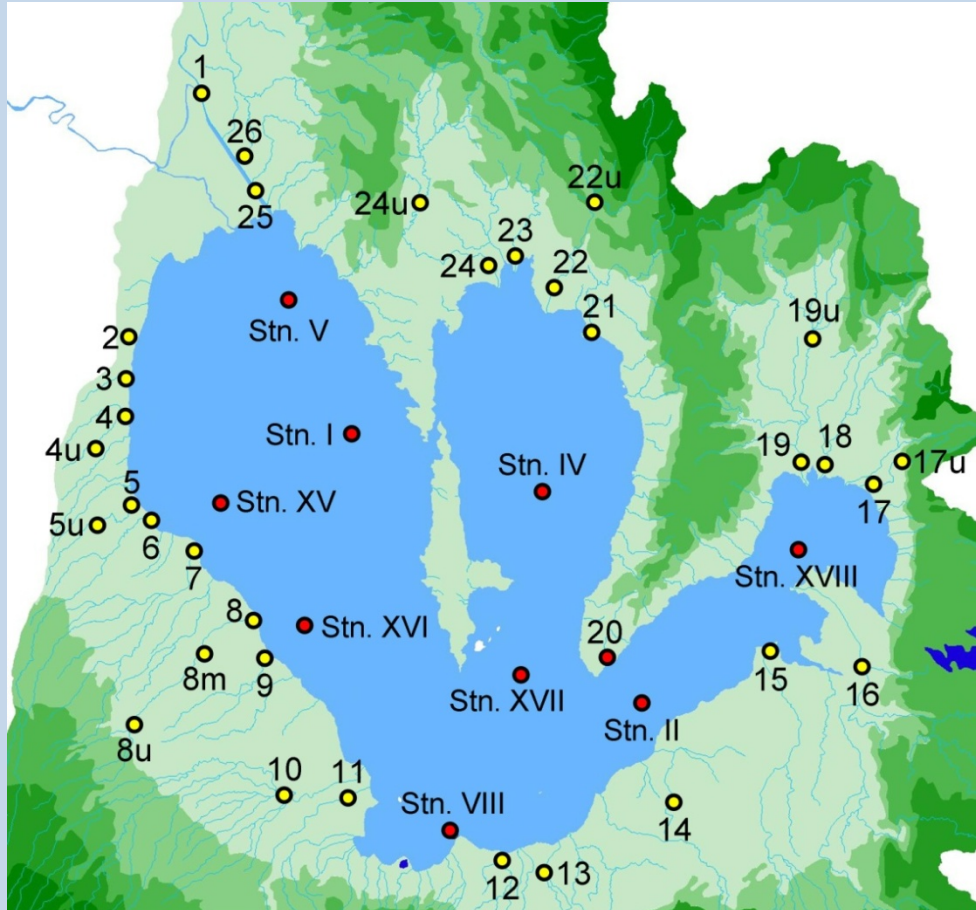
TSS of Santa Cruz sub-basin



Detailed information on areas
generating sediment loads affecting
water retention service

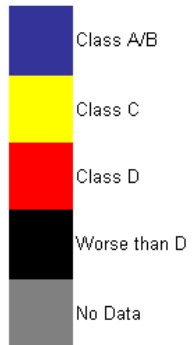


Results 6 : Water Quality

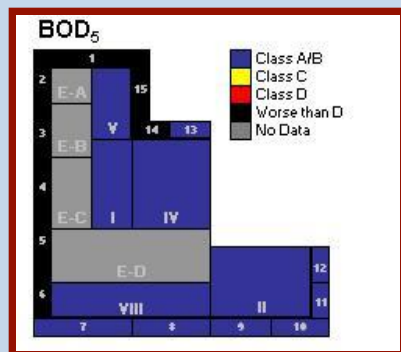


BOD₅

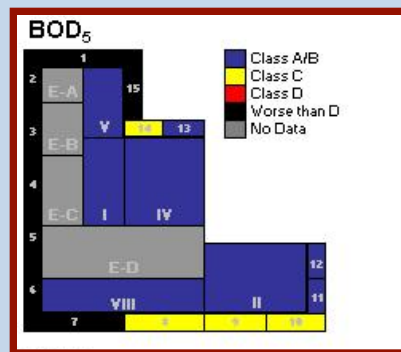
2			1	26	25				
3			V		24	24u			
4u	4								
5u	5		XV	I	23				
6					IV	22	22u		
7						21			
8u	8m	8				20			
9			XVII			19	19u		
10			VIII					18	
11			12	13	14	15	16	17	17u



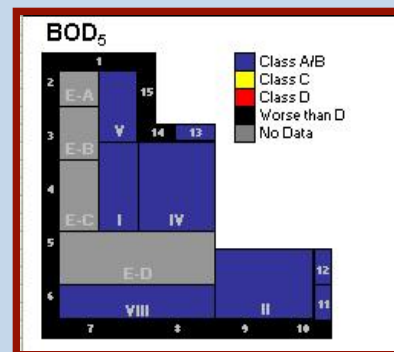
Biochemical Oxygen Demand (2011)



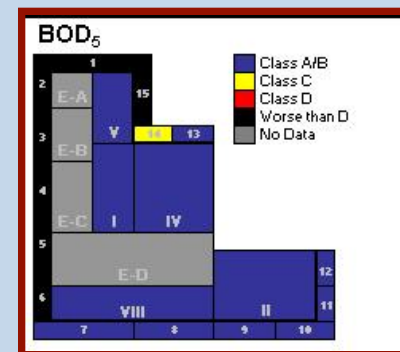
January



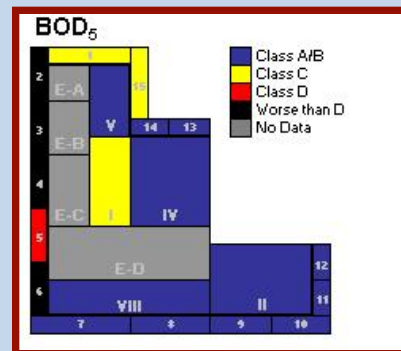
February



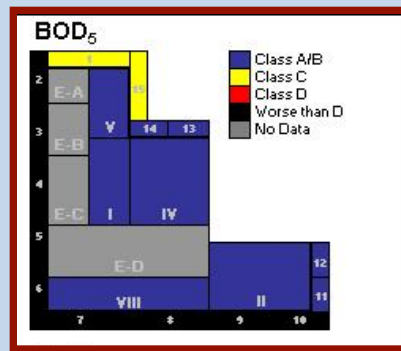
March



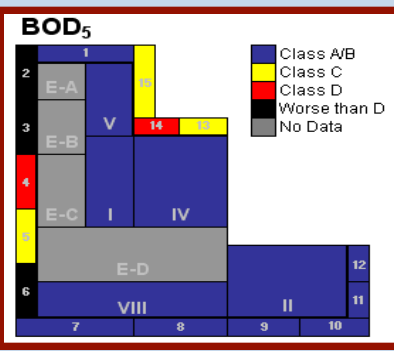
April



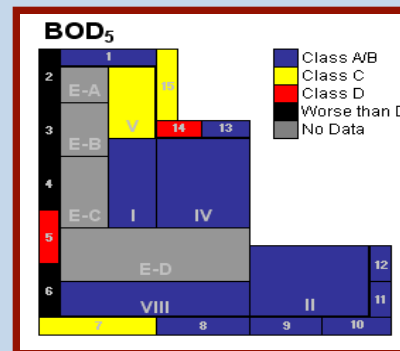
May



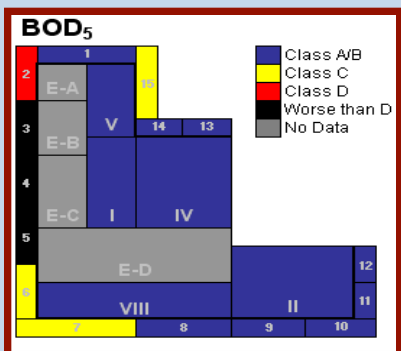
June



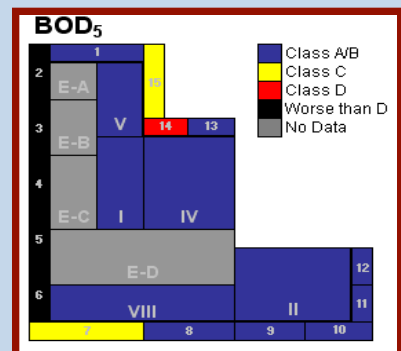
July



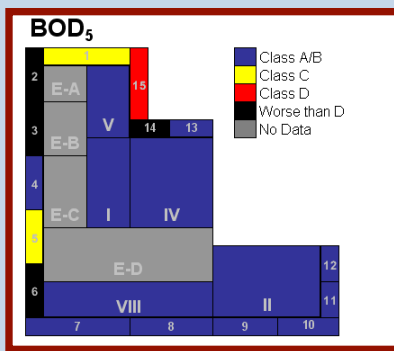
August



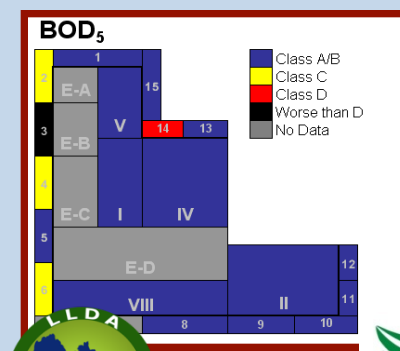
September



October



November



December



Monthly Over-all Status

Station	Location	April				October		
		2003	2010	2013		2003	2010	2013
I	Central West Bay							
II	East Bay							
IV	Central Bay							
V	Northern West Bay							
VIII	South Bay							
XV	San Pedro (West Bay)							
XVI	Sta. Rosa (West Bay)							
XVII	Sanctuary (Central Bay)							
XVIII	Pagsanjan (East Bay)							
1	Marikina River							
2	Bagumbayan River							
3	Buli Creek							
4	Mangagate River Downstream							
4u	Mangagate River Upstream							
5	Tunasan River Downstream							
5u	Tunasan River Upstream							
6	San Pedro River							
7	Biliran River							
8	Sta. Rosa River Downstream							
8m	Sta. Rosa River Midstream							
8u	Sta. Rosa River Upstream							
9	Cabuyao River							
10	San Cristobal River							
11	San Juan River							
12	Molawin Creek							
13	Bay River							
14	Pila River							
15	Sta. Cruz River							
16	Pagsanjan River							
17	Pangil River Downstream							
17u	Pangil River Upstream							
18	Sinloan River							
19	Sta. Maria River Downstream							
19u	Sta. Maria River Upstream							
20	Jala Jala River							
21	Pillila River							
22	Tanay River Downstream							
22u	Tanay River Upstream							
23	Baras River							
24	Morong River Downstream							
24u	Morong River Upstream							
25	Manggahan Floodway							
26	Sapang Baho River							



Water Quality

April (dry season)

	2003 Water Quality Classification						2010 Water Quality Classification						2013 Water Quality classification					
	A	B	C	D	BD	ND	A	B	C	D	BD	ND	A	B	C	D	BD	ND
Rivers	0	0	1	6	6	3	0	0	0	6	9	0	0	0	0	6	8	1
Lake	0	0	1	4	0	0	0	0	2	3	0	0	1	0	2	2	0	0

October (dry season)

	2003 Water Quality Classification						2010 Water Quality Classification						2013 Water Quality classification					
	A	B	C	D	BD	ND	A	B	C	D	BD	ND	A	B	C	D	BD	ND
Rivers	0	0	0	6	9	0	0	0	0	5	10	0	0	0	0	6	8	1
Lake	3	0	2	0	0	0	3	0	2	0	0	0	4	1	0	0	0	0



Water Quality Changes

April (dry season)													
	Change from 2003 to 2010						Change from 2010 to 2013						
	A	B	C	D	BD	ND	A	B	C	D	BD	ND	
Rivers	0	0	-1	0	3	-3	0	0	0	0	-1	1	
Lake	0	0	1	-1	0	0	1	0	0	-1	0	0	
October (dry season)													
	Change from 2003 to 2010						Change from 2010 to 2013						
	A	B	C	D	BD	ND	A	B	C	D	BD	ND	
Rivers	0	0	0	-1	1	0	0	0	0	1	-2	1	
Lake	0	0	0	0	0	0	1	1	-2	0	0	0	



Next steps (by March)

- Analysis of flood zones and flood risks in number of households
- Monetary valuation of flood risk
- Fisheries survey for monetary valuation fisheries service



Thank you!

