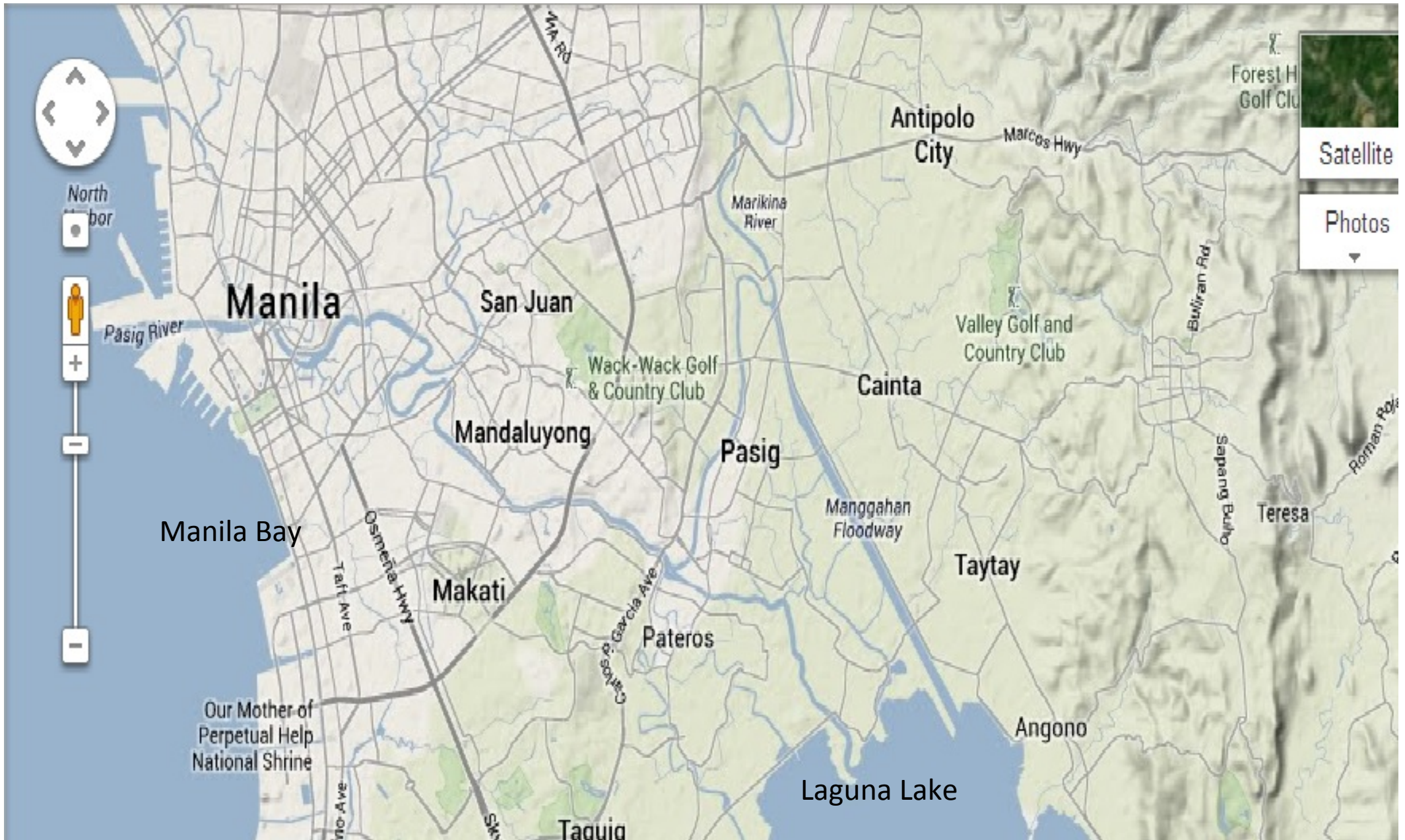




Water Quality Monitoring of *Estero de Paco, Manila*

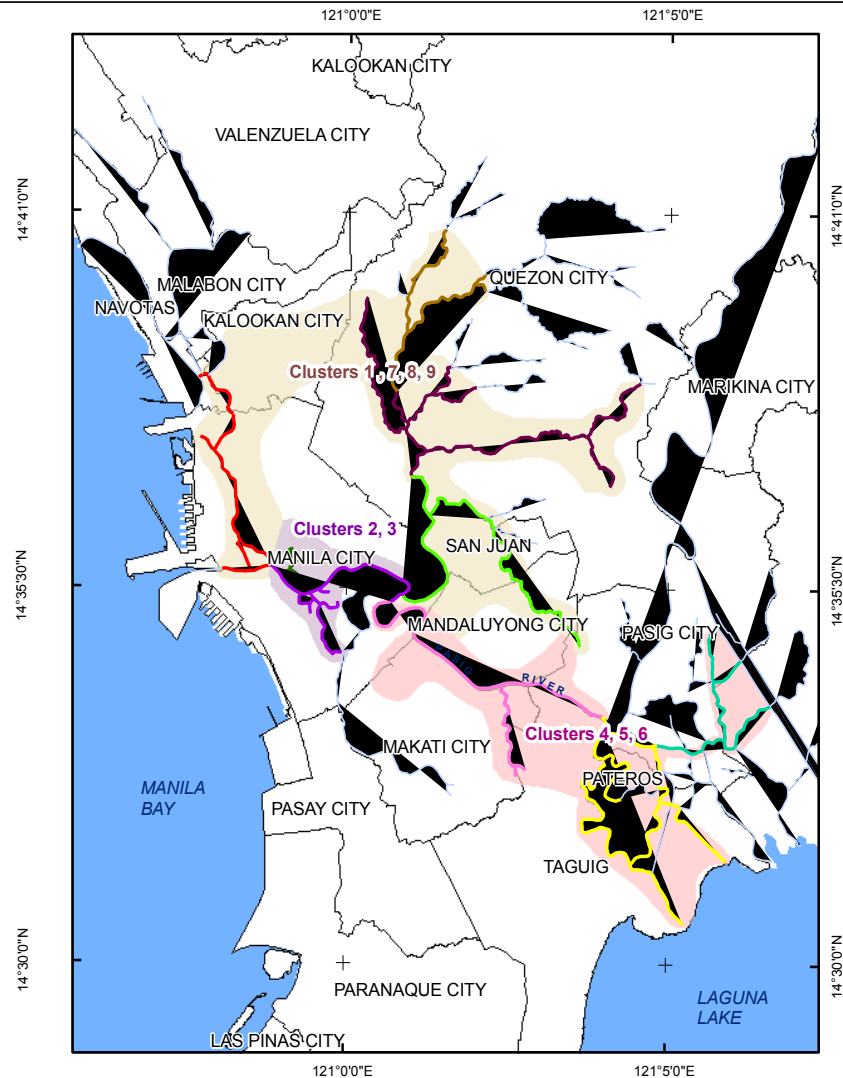
Maria Antonia N. Tanchuling
University of the Philippines

3E Nexus Project Kick-off Meeting
24 – 25 February 2014
Maldives



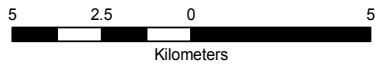
[Video of Pasig River](#)

Pasig River



Pasig River Patrol Clusters:

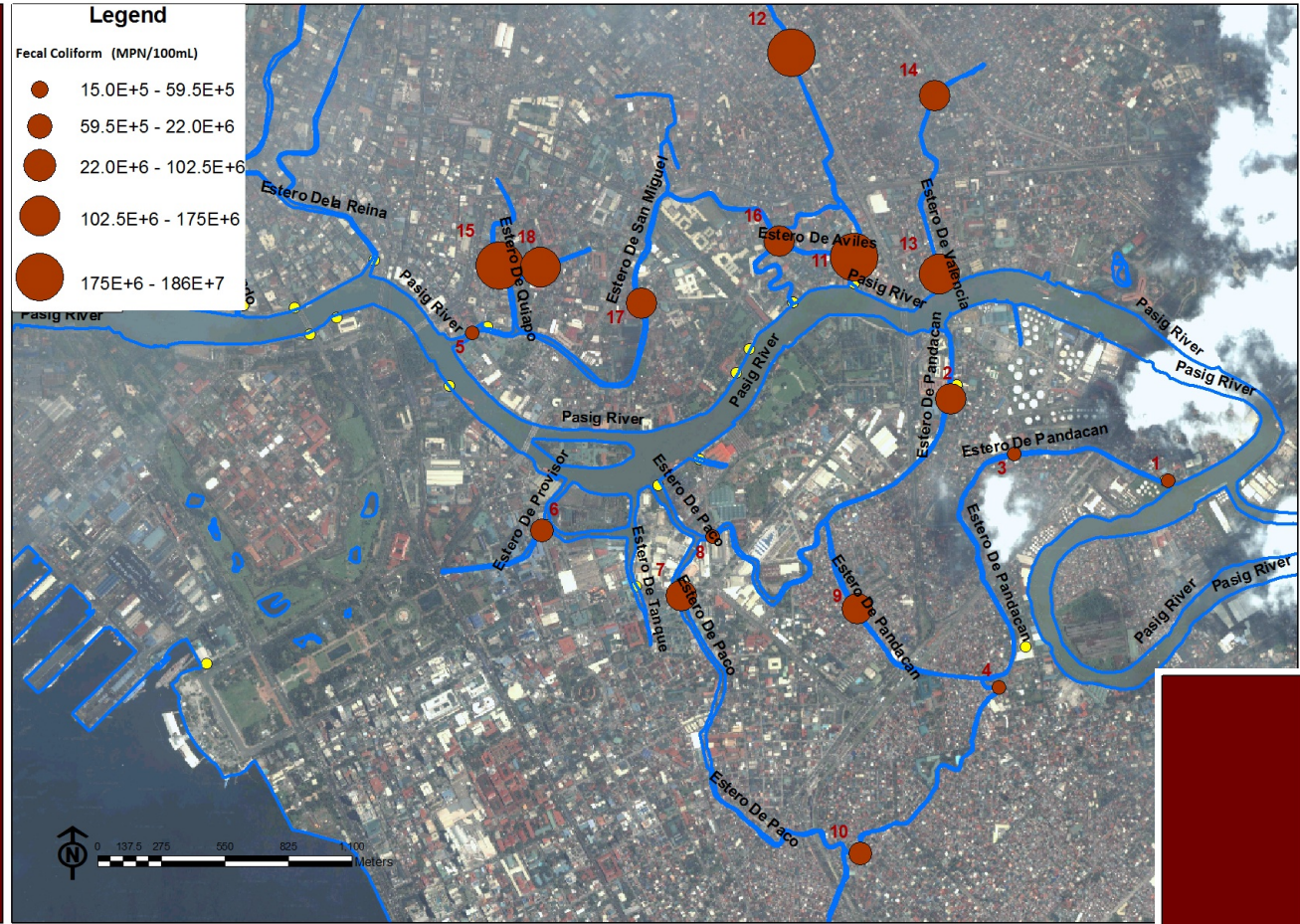
- | | |
|-----------|-------------|
| Cluster 1 | Cluster 6 |
| Cluster 2 | Cluster 7 |
| Cluster 3 | Cluster 8 |
| Cluster 4 | Cluster 9 |
| Cluster 5 | Unclustered |



- Considered biologically dead for 20 years now
- Pasig River Rehabilitation Commission (PRRC) was established to restore quality of the river, at least to Class C Standard (DENR) in 1999
- Composed of 47 major tributaries (called *estero*), with a total length of 124 kms
- To restore the river, the water quality of the esteros needs to be restored first
- The first *estero* to be rehabilitated was Estero de Paco, in 2010

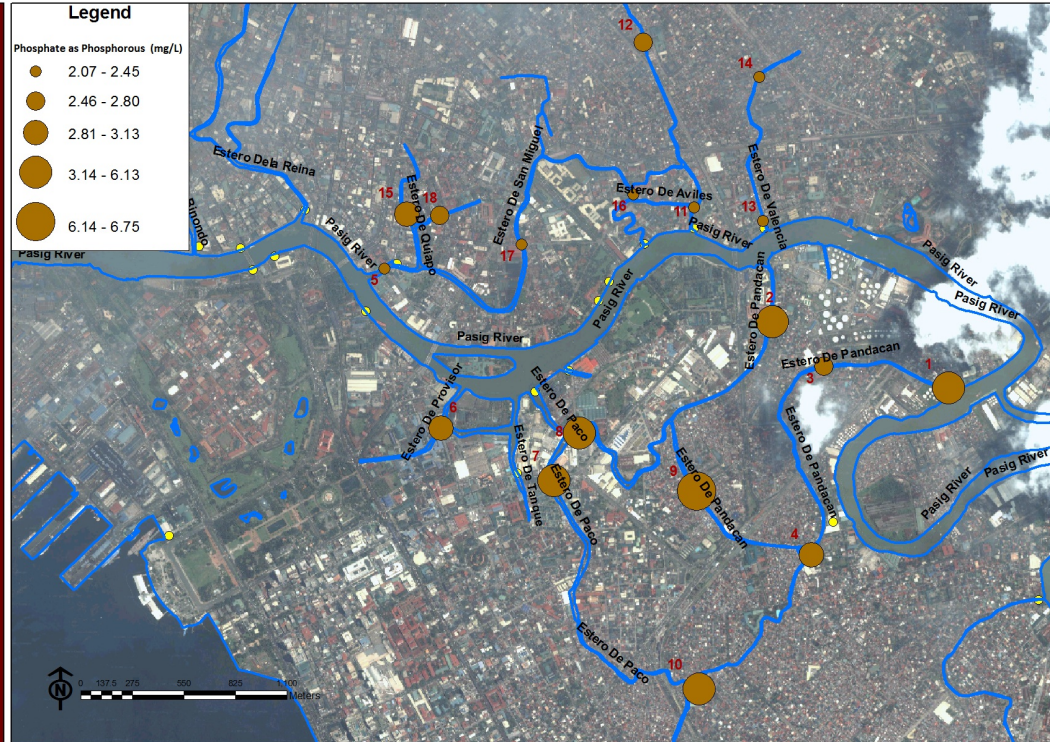
Station	Estero	Subcatchment Area (sq. m.)
1	Estero de Pandacan	304744.3
2	Estero de Pandacan	373945.1
3	Estero de Pandacan	542120.3
4	Estero de Tripa de Gallina	758354.7
5	Estero de Pandacan	240117.9
6	Estero de Balete	240134.9
7	Estero de Paco	1142225.4
8	Estero de Paco	443971.6
9	Estero de Pandacan	155774.1
10	Estero de Tripa de Gallina	---
11	Estero de Aviles 2	461752.5
12	Estero de Avies 1	243786.9
13	Estero de Valencia	333626
14	Estero de Valencia	1197715.3
15	Estero de Quiapo	493959.4
16	Estero de Aviles	301932.4
17	Estero de San Miguel	259261.2
18	Estero de San Sebastian	71619
19	Estero de San Miguel	252683.9

Fecal Coliform



2010 water quality data

Phosphate as Phosphorous





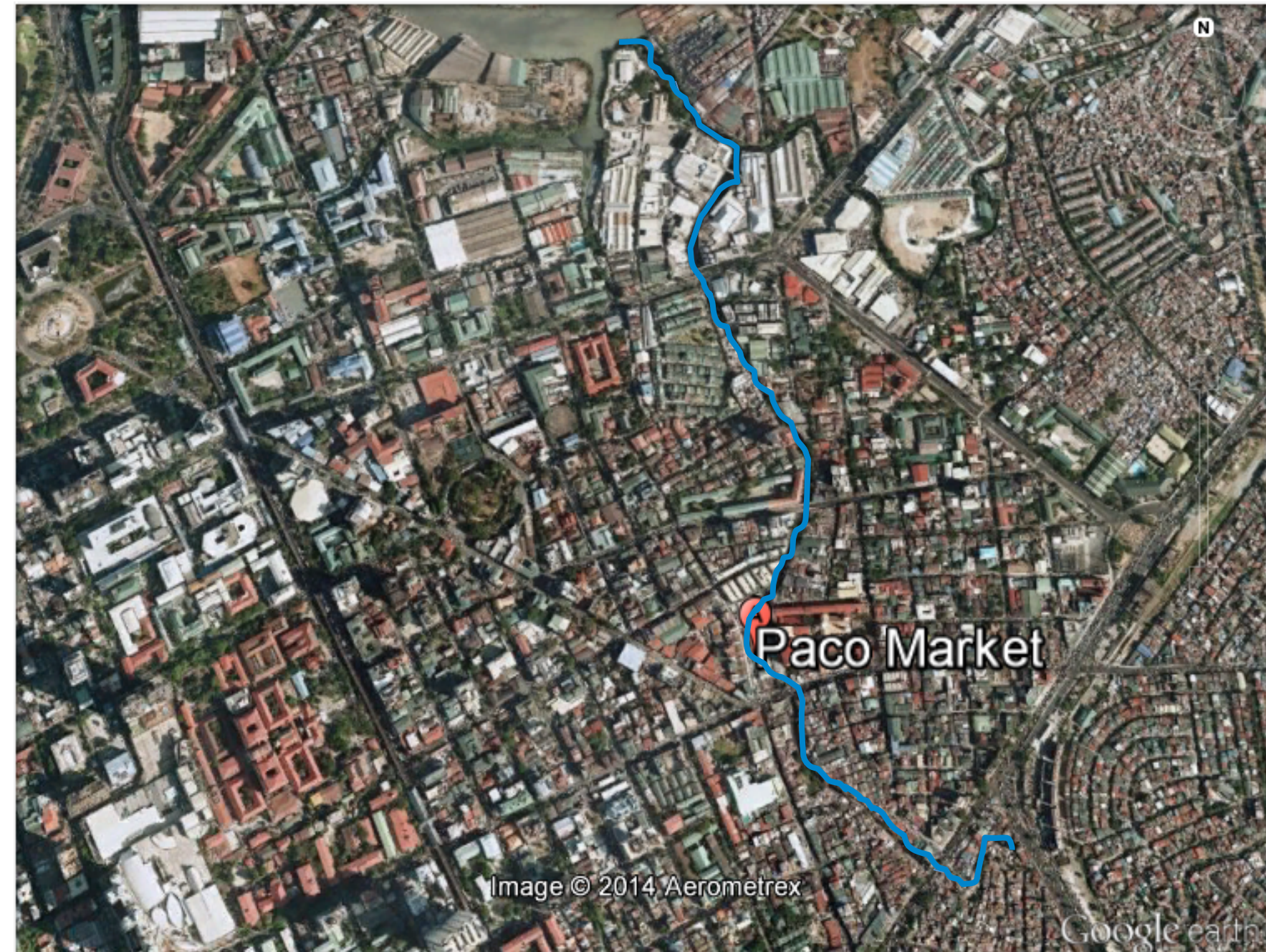
GENERAL OBJECTIVES

- To contribute information for the build-up of a possible remediation technique and simulation of management strategies for the Pasig River System
- To set up a model showing the effect of pollution loadings on the river quality in order to promote stewardship among the dwellers in the vicinity of the 3-meter easement along the Estero.
- To use the information to educate the community for the sustainability of the clean-up project.

OBJECTIVES

1. To gather baseline information regarding wastewater dischargers, and other land uses that are critical to the water quality of the estero
2. To conduct water and river sediment quality assessment along the stretch of the Estero de Paco, and evaluate whether installed treatment systems are effective
3. To quantify the amount of wastewater being discharged to Pasig River
4. To recommend management strategies to improve water quality of the estero

RESULTS AND DISCUSSION



Population within 0.5 km from each side of the creek: 32,200

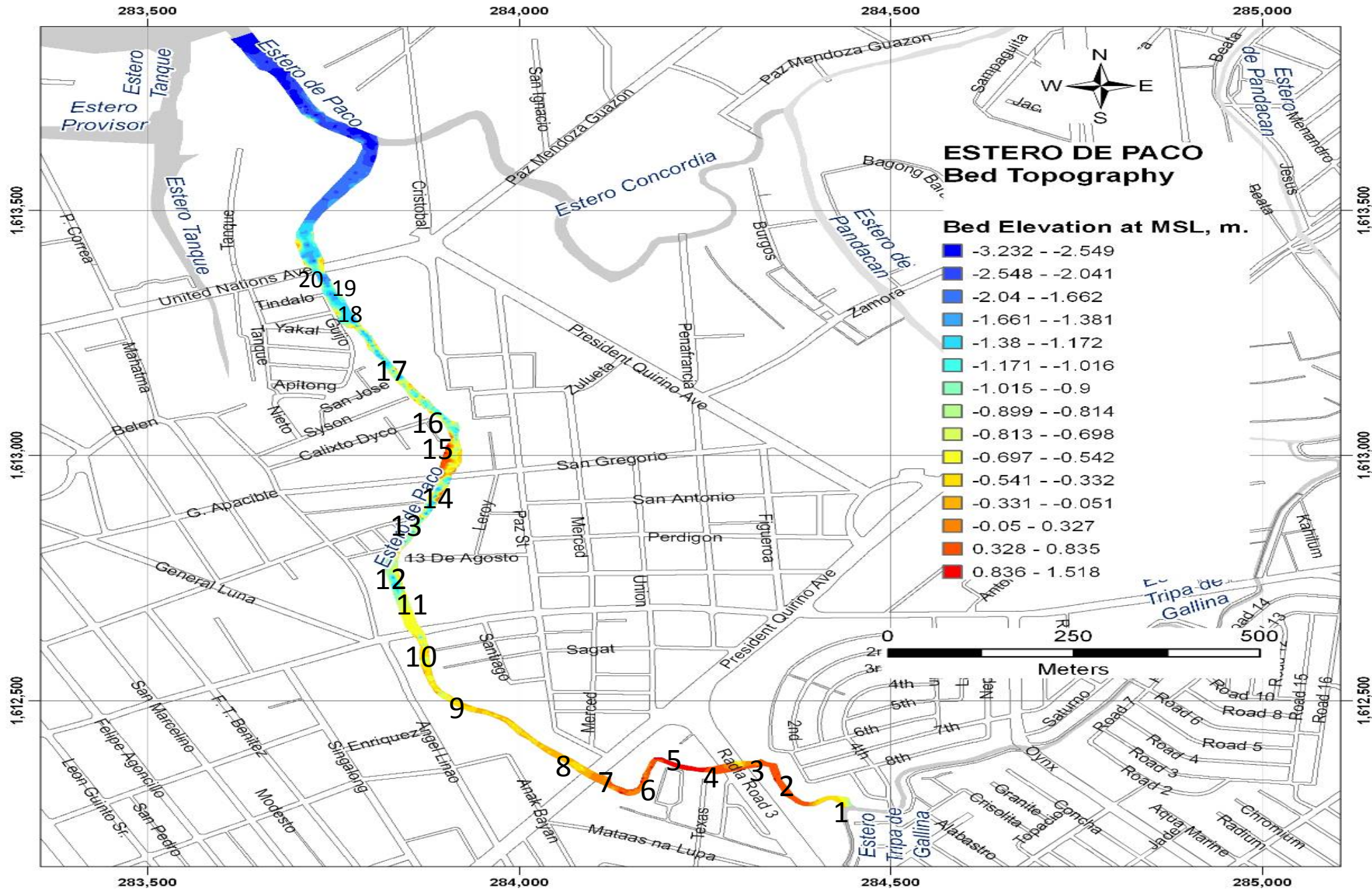
3 barangays from Malate, 2 from Sta. Ana and 16 barangays from Paco

2 barangays are directly along the river with 1,626 people

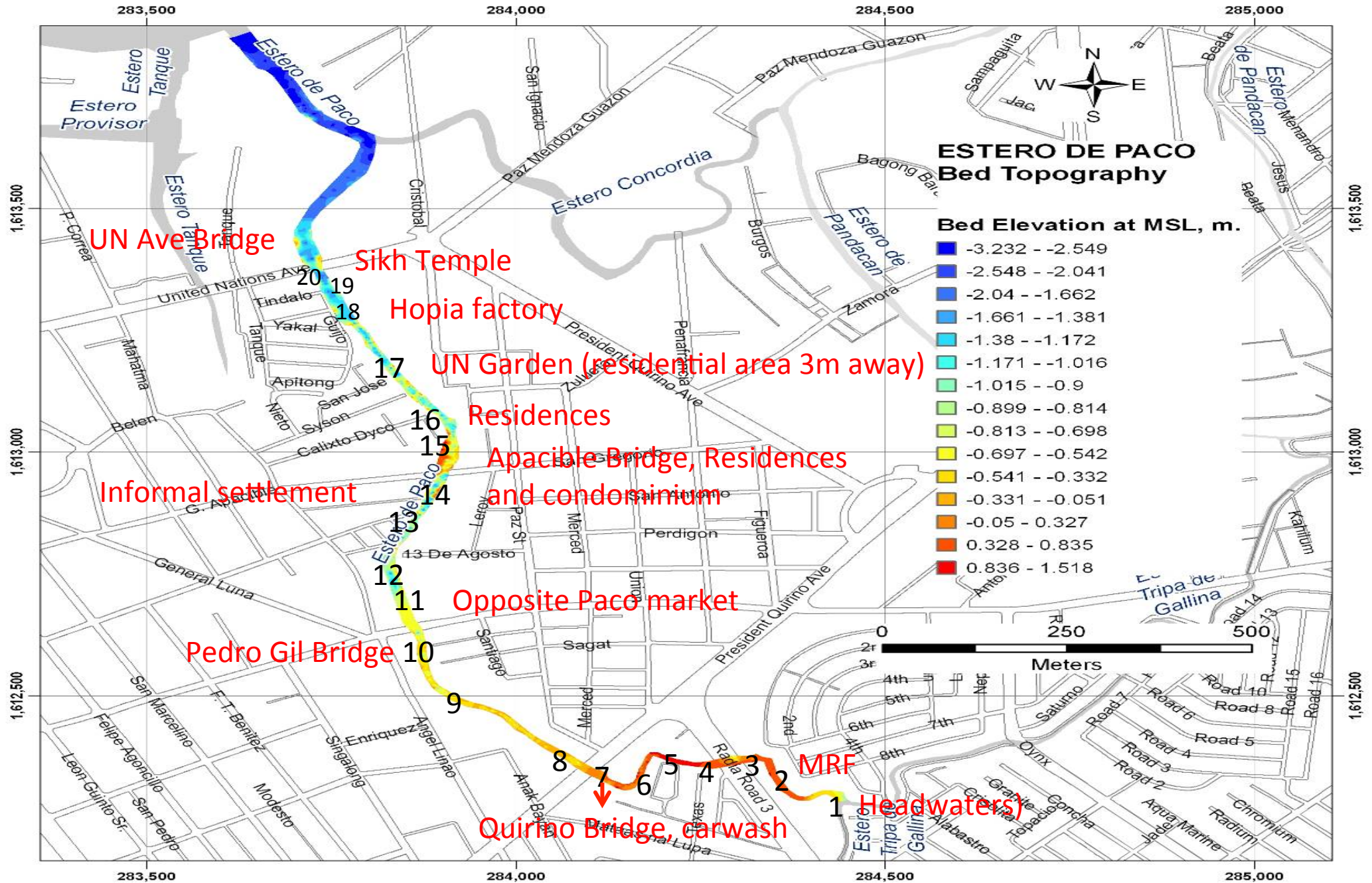
Solid waste: mostly plastic, paper, cigarette butts, tarpaulin, bottles (plastic and glass)

Along the easement: washing of clothes, washing kitchen utensils, car washing

Sampling stations

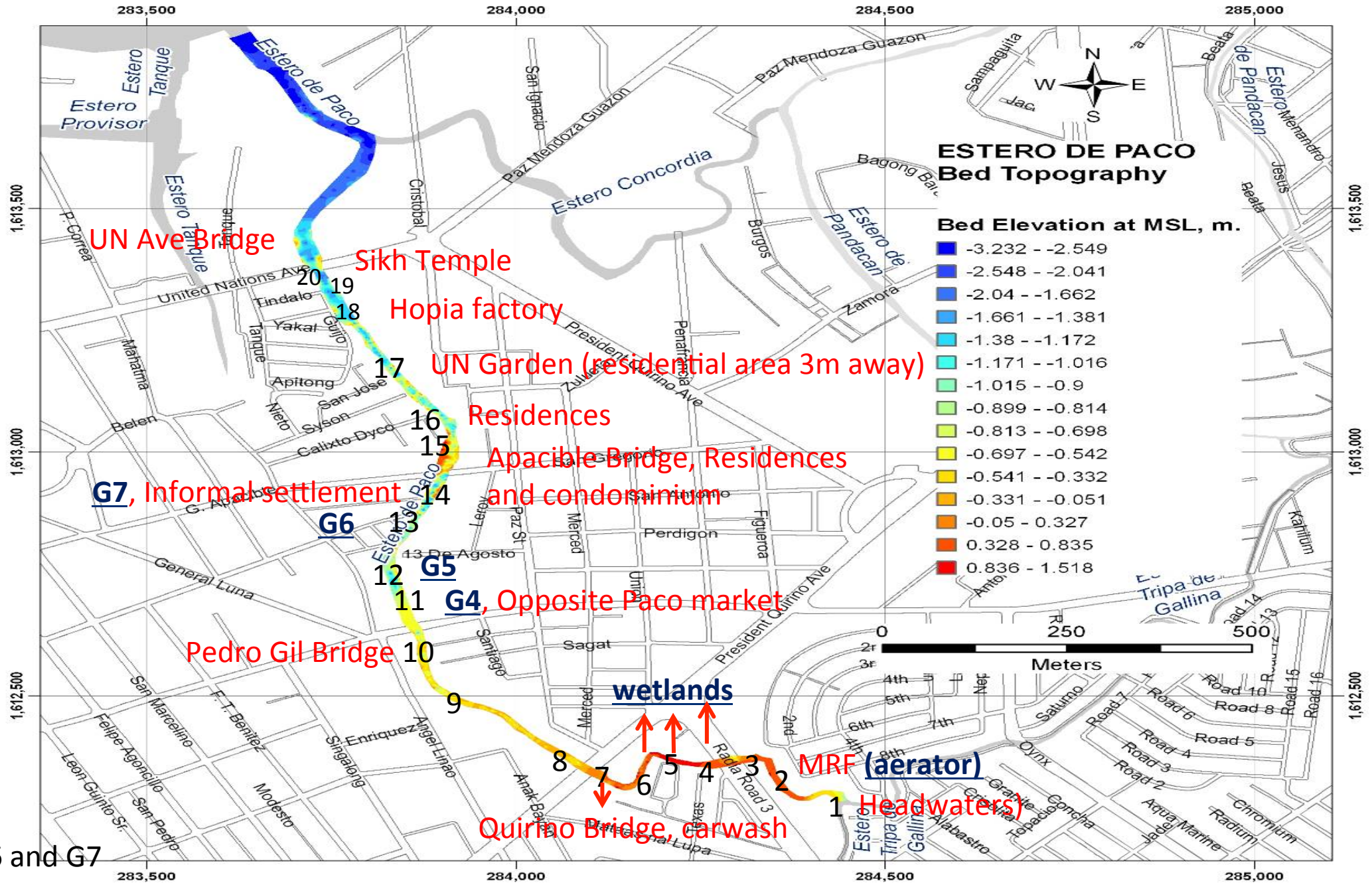


Sources of discharges and land uses



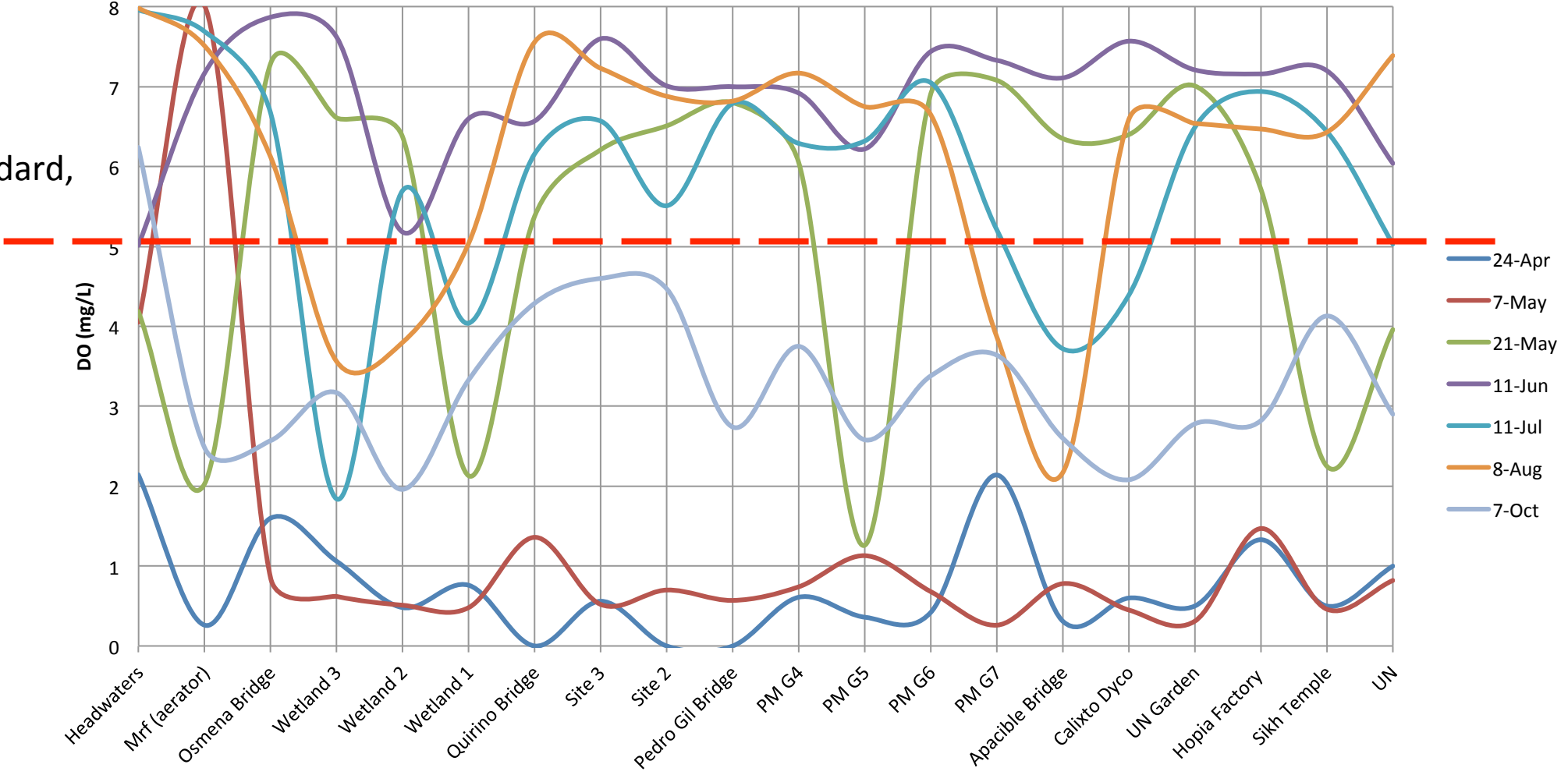
Treatment process installed

Legend:
G4, G5, G6 and G7
are island reactors



DO per station (2013)

Class C Standard,
DENR

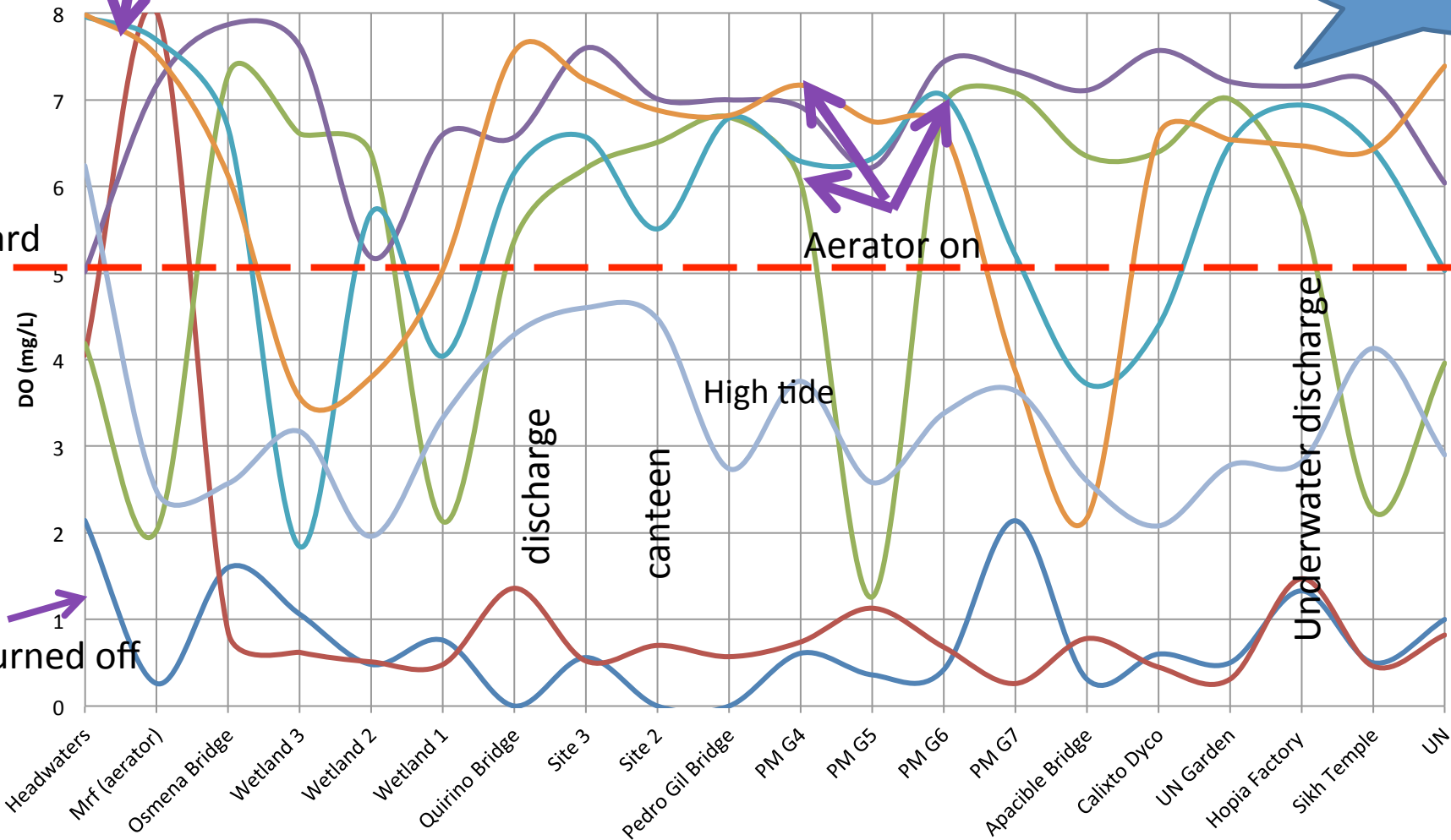


DO per station (2013)

MRF aerator on

All aerators are turned on

Class C Standard



All turned off

Aerator on

discharge

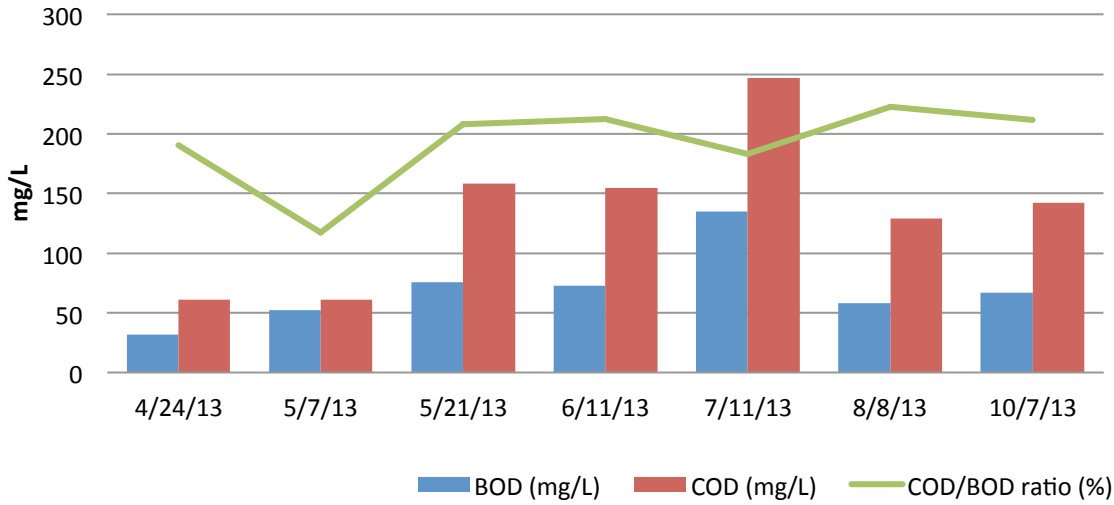
canteen

High tide

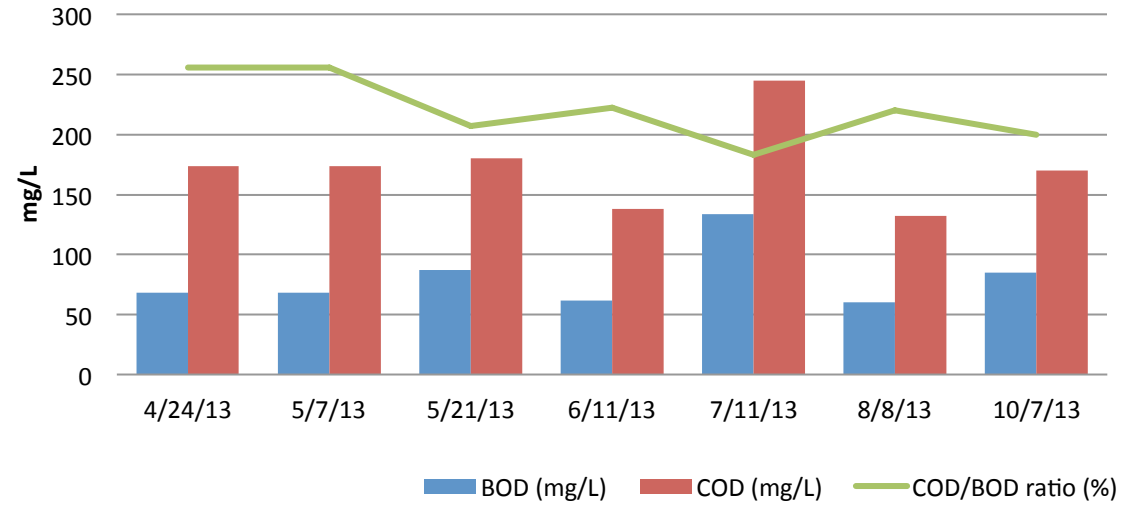
Underwater discharge

- 24-Apr
- 7-May
- 21-May
- 11-Jun
- 11-Jul
- 8-Aug
- 7-Oct

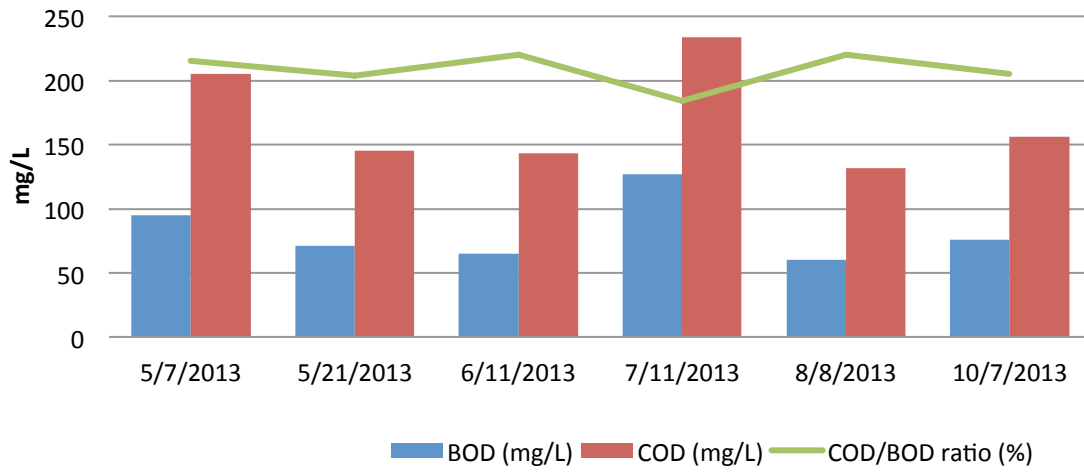
HEADWATER



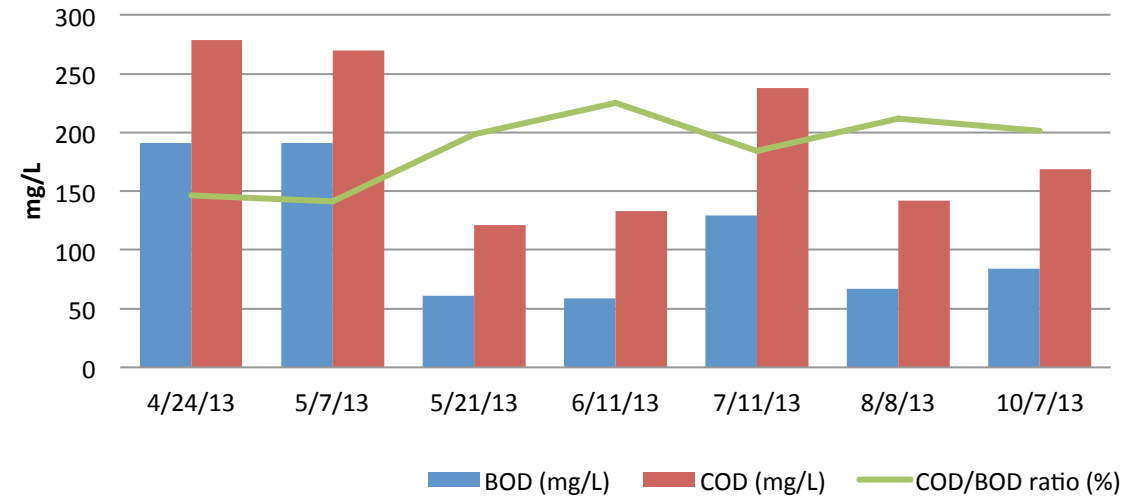
MRF



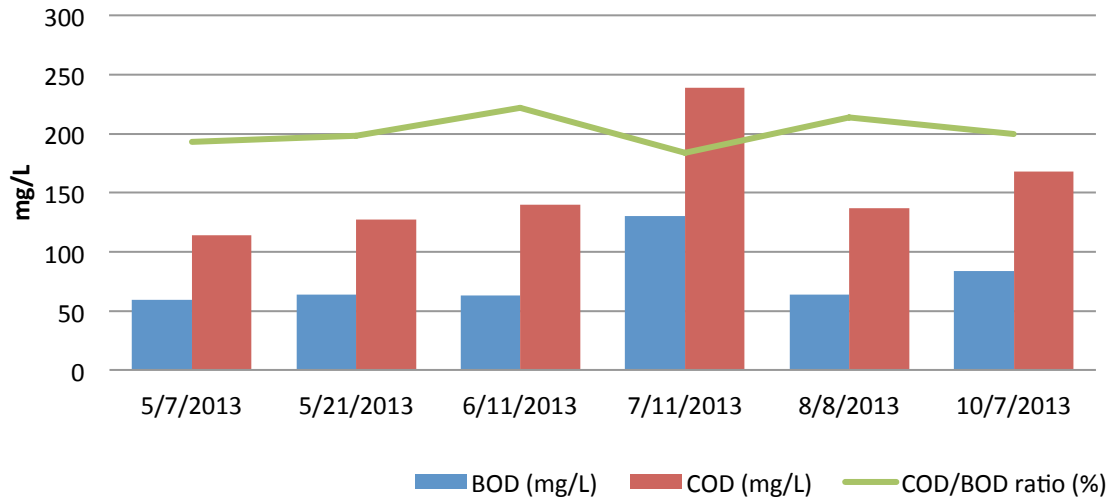
QUIRINO BRIDGE



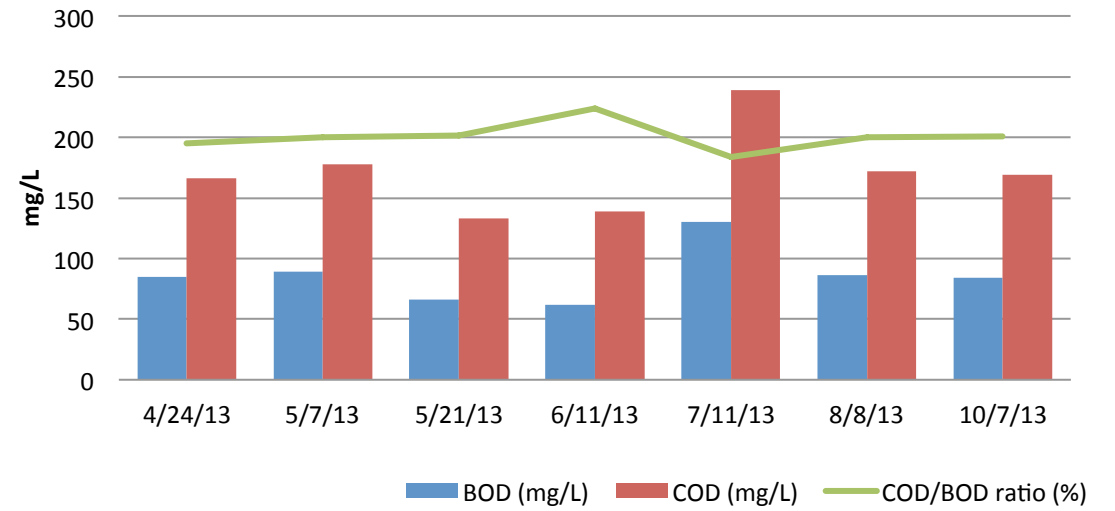
OSMENA BRIDGE



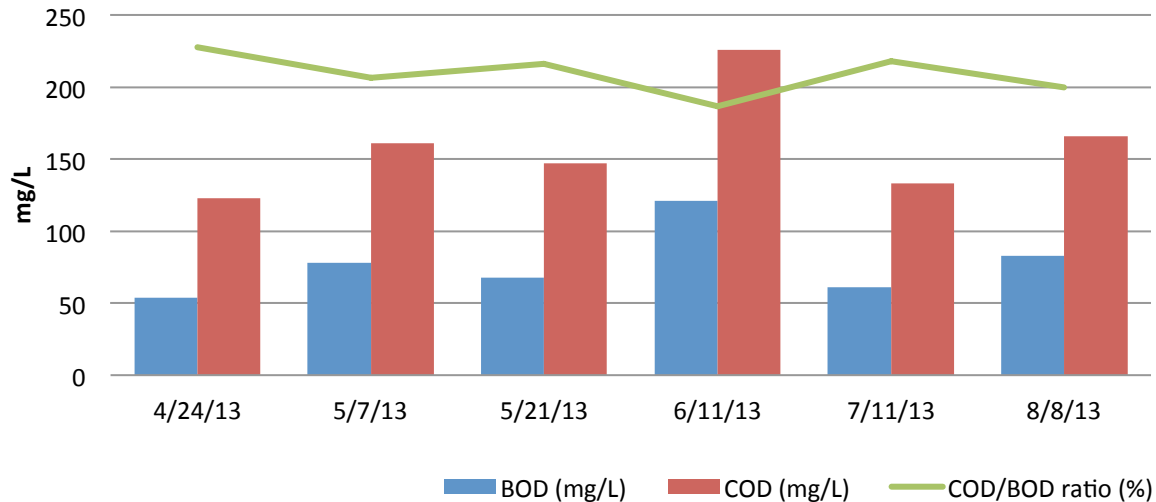
PEDRO GIL BRIDGE



APACIBLE BRIDGE

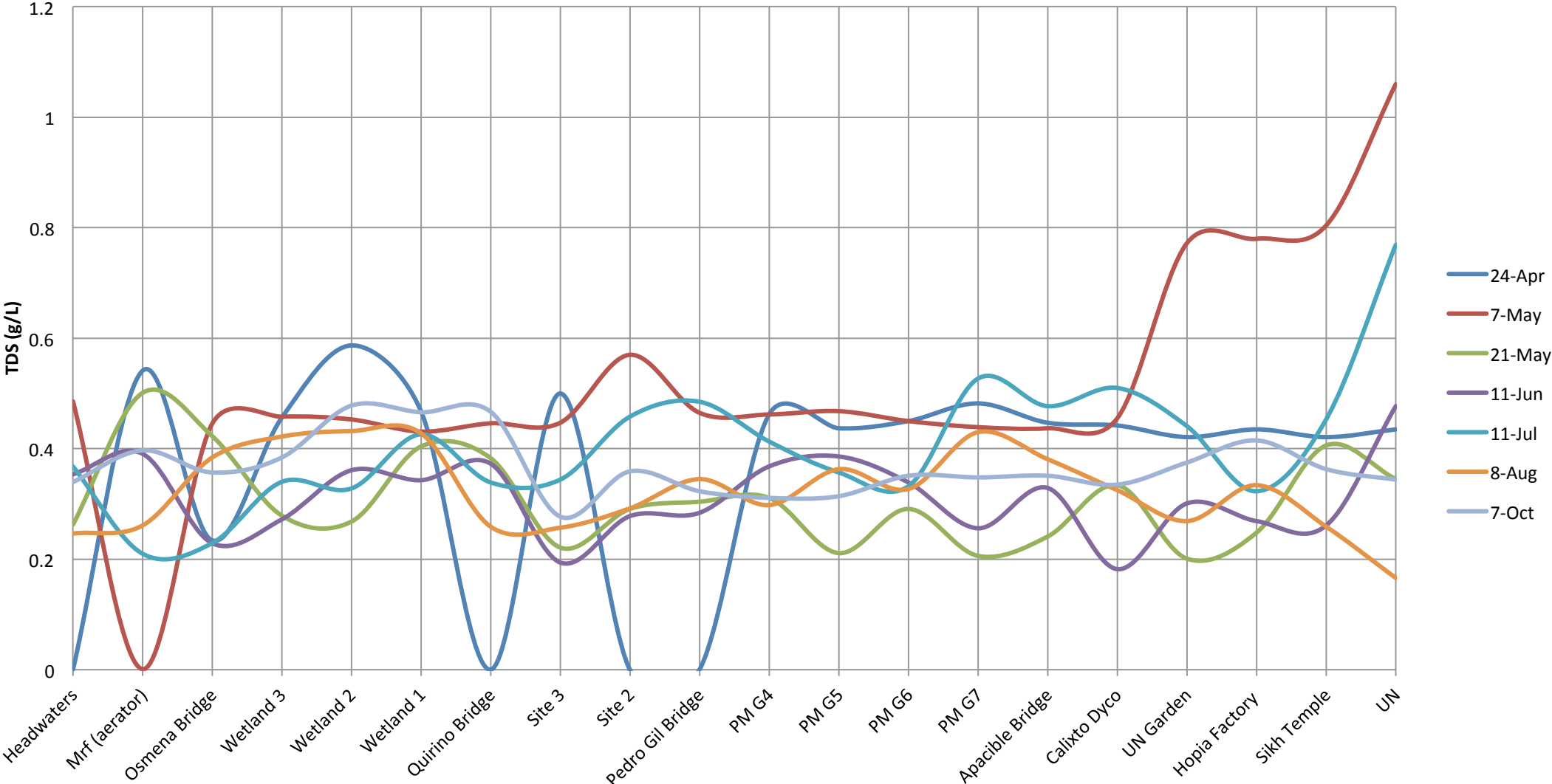


UN AVE BRIDGE

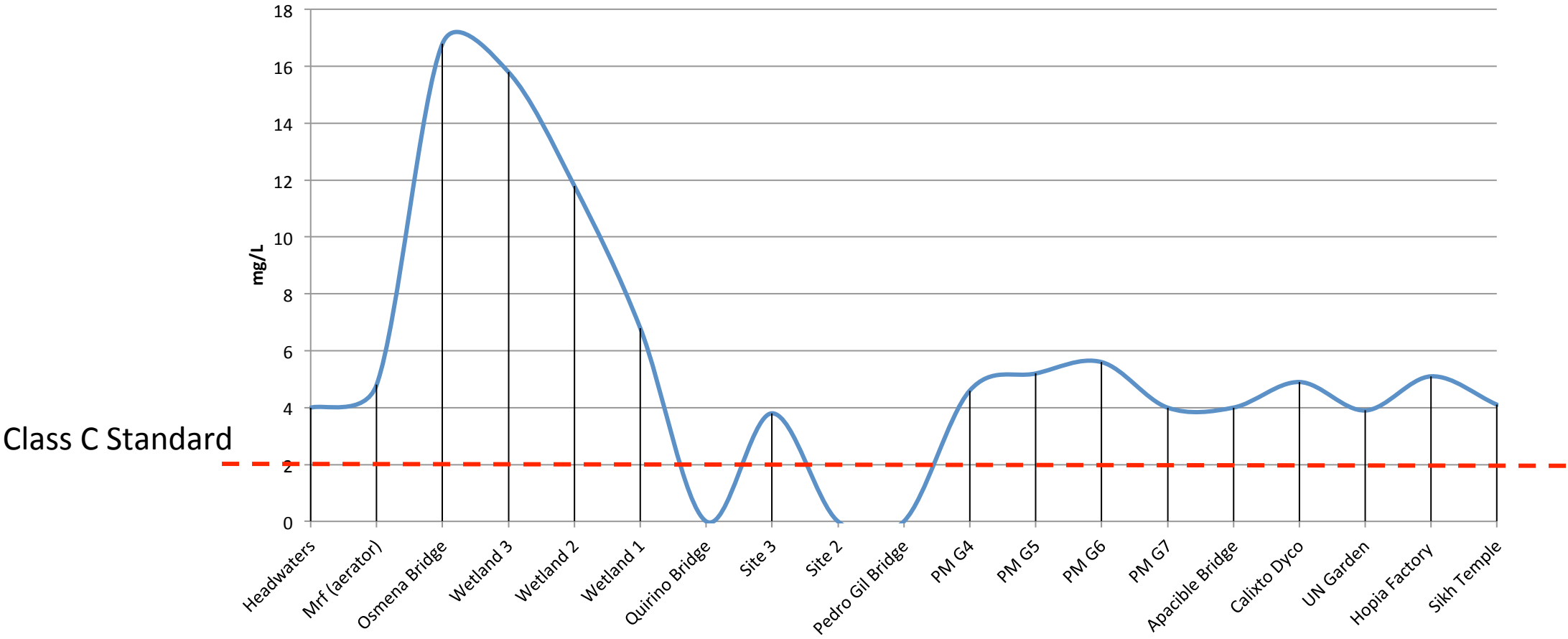


Average BOD	77.5	mg/L
Q	5.47	m3/s
Mass loading	13368.9	tons/year

TDS per station



Oil and Grease (April 2013)



Sludge and Sediment Quality (2012)



3. Pedro Gil



5.5 Between Apacible and UN



5. Apacible Bridge



4. 13 de Agosto



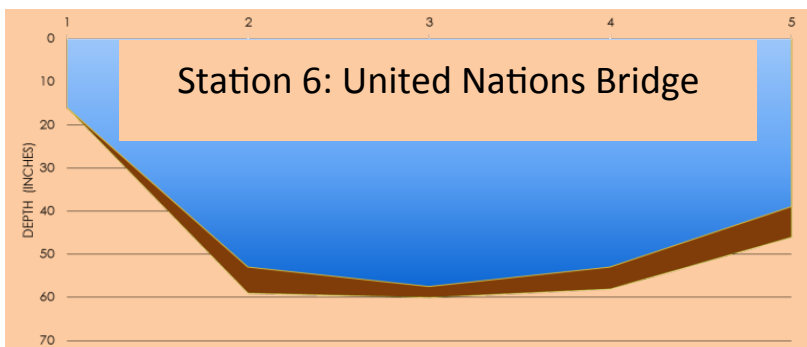
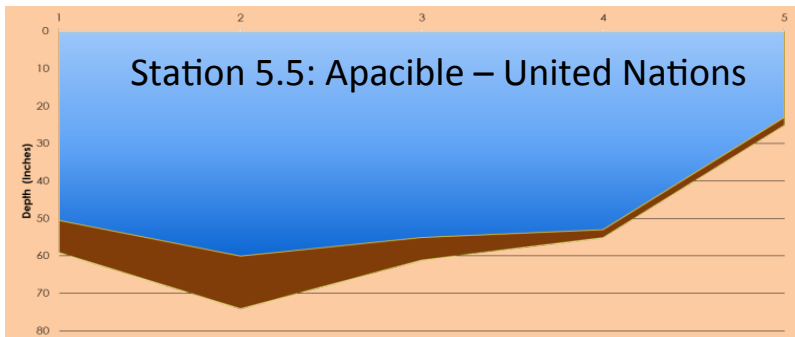
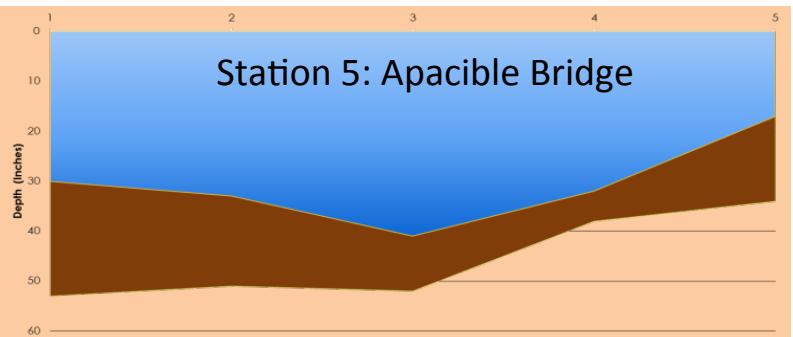
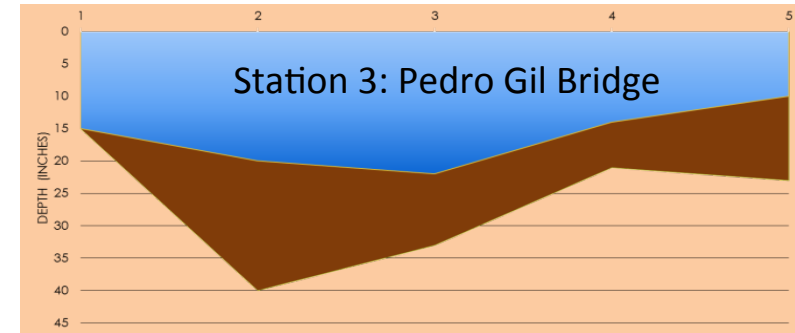
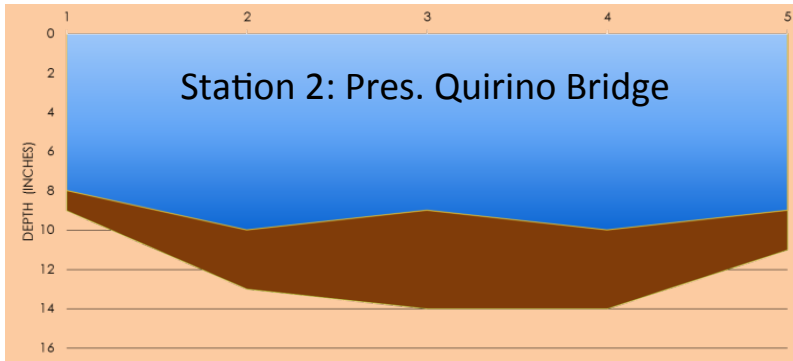
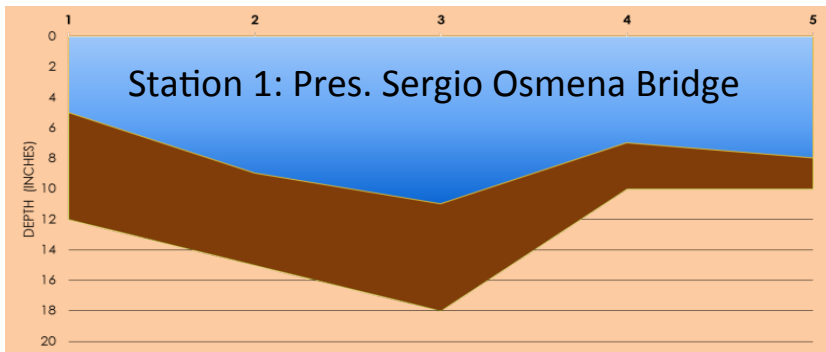
2. Quirino Bridge



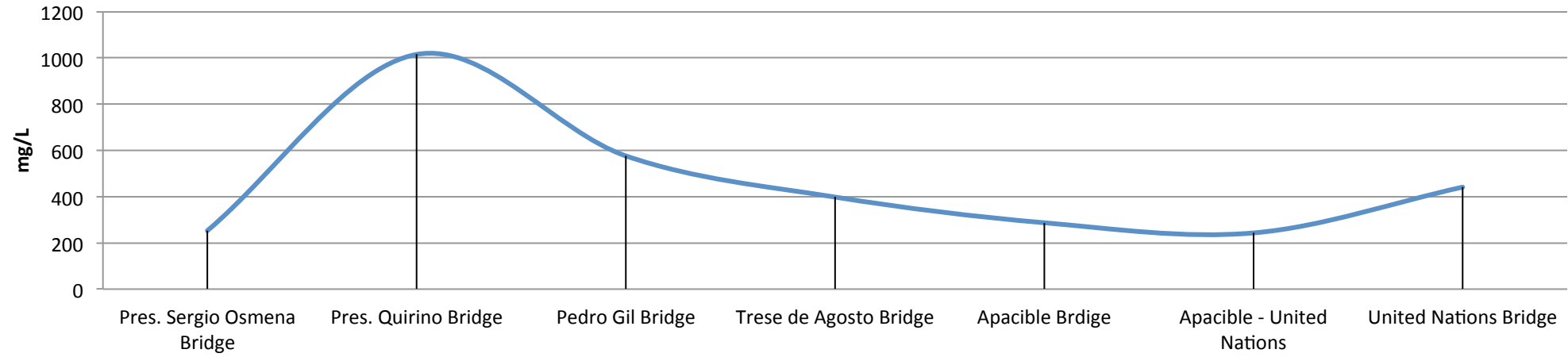
1. Osmena Bridge



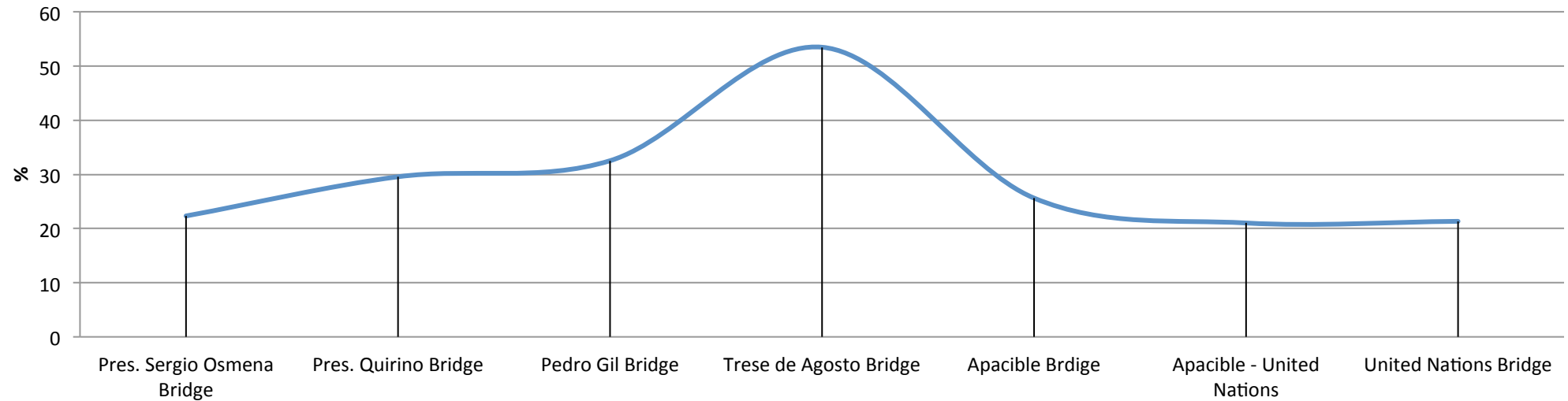
6. UN Avenue Bridge



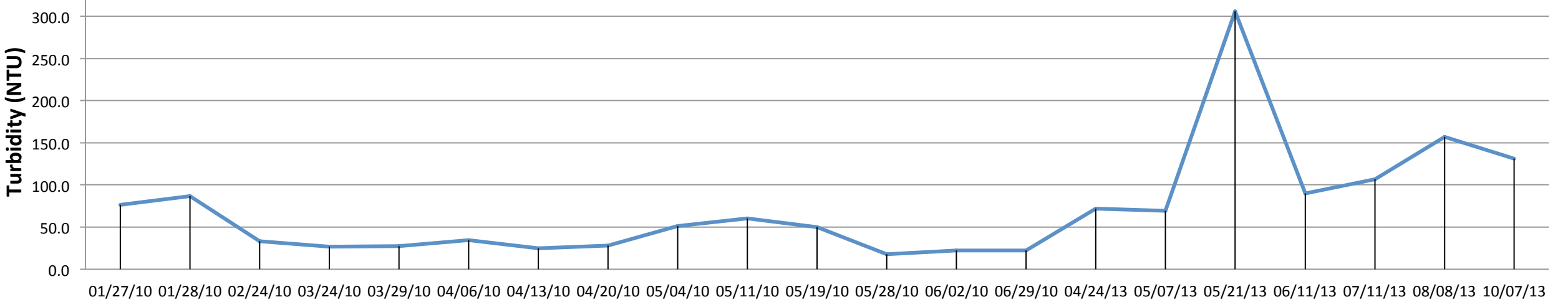
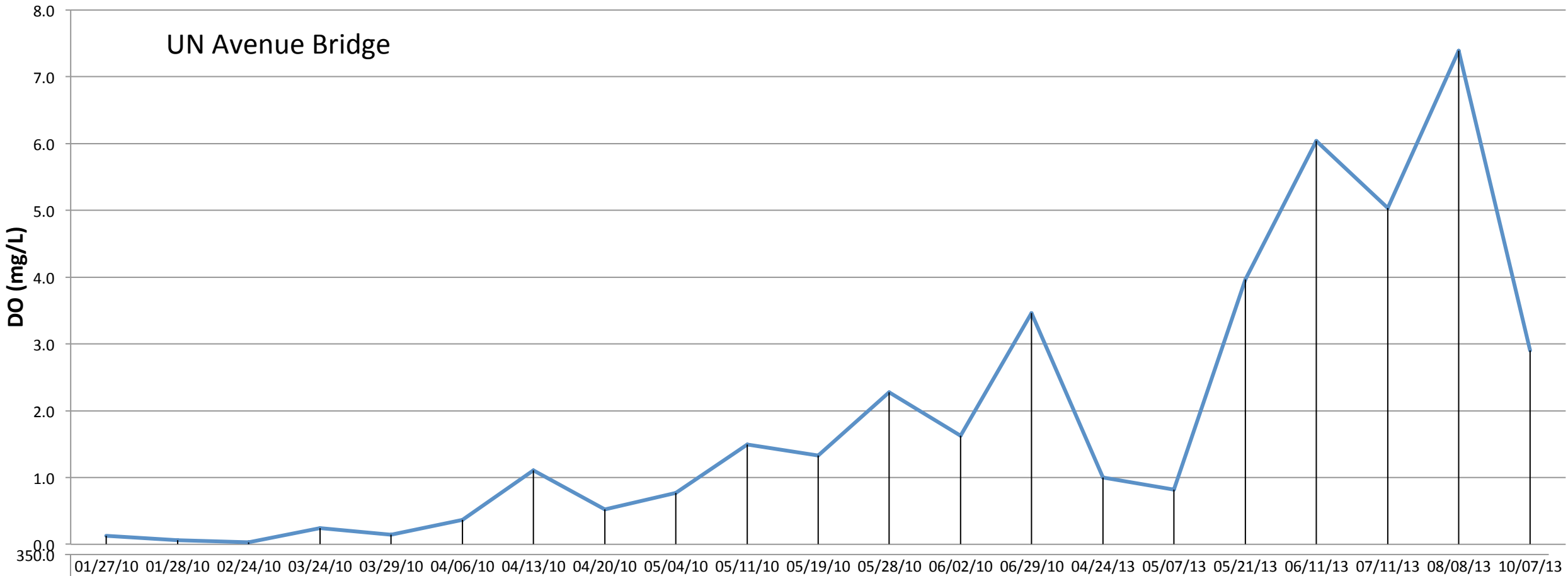
Oil and Grease



Organic Matter

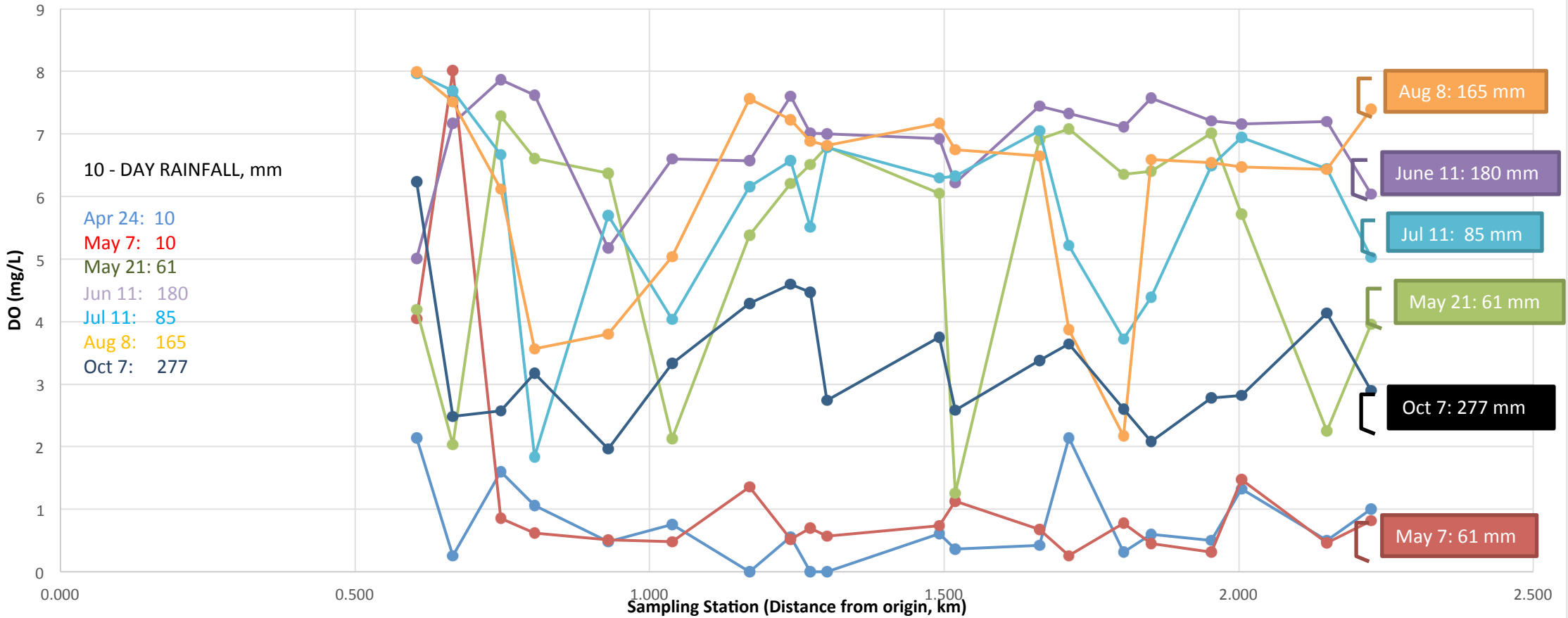


UN Avenue Bridge



Rainfall and Dissolved Oxygen

24-Apr 7-May 21-May 11-Jun 11-Jul 8-Aug 7-Oct



Concluding remarks

- Current treatment systems and other interventions were able to improve water quality but are inadequate to meet target quality of Class C waters
- For sustainability, no untreated discharge from residential and industrial sources should be allowed
- Aerators should be turned on
- More detailed analysis should be done prior to installation of any technology
- Oil and grease contamination needs to be addressed