Reuse of Wastewater in the Mediterranean as a mitigation of pollution

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  - Closed basin
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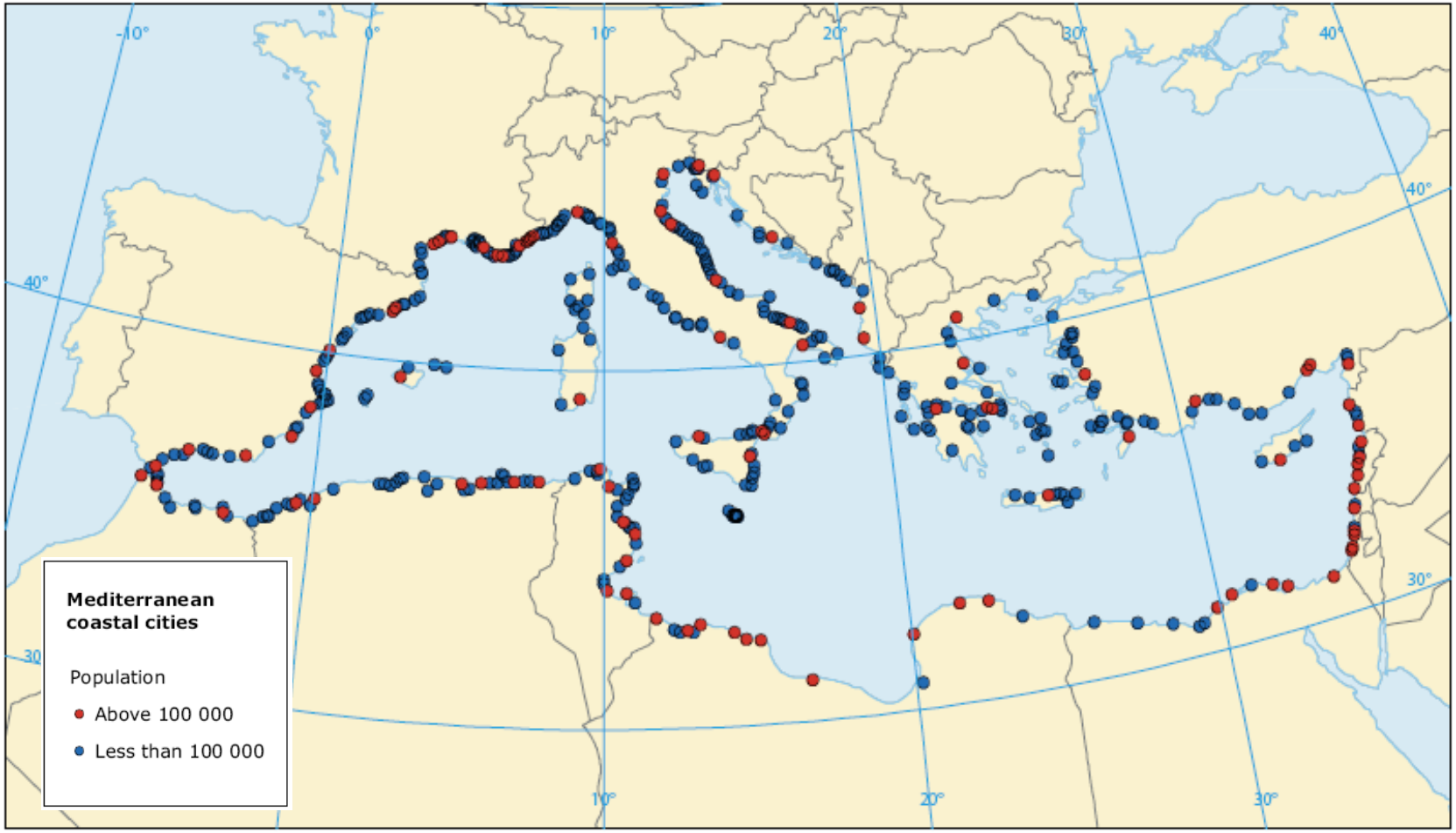
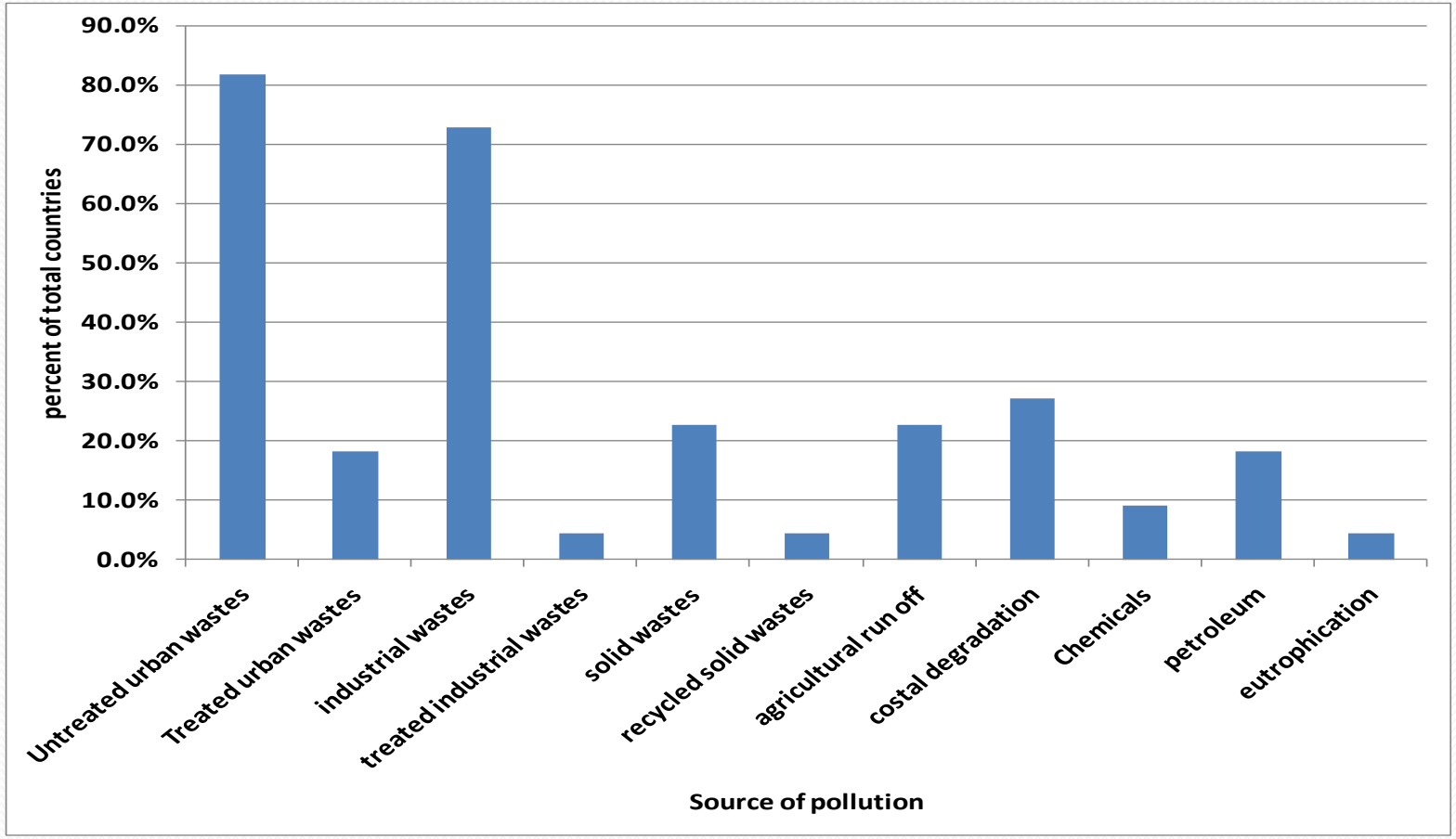
populated areas on the Mediterranean Sea



Mediterranean Countries Pollution nature

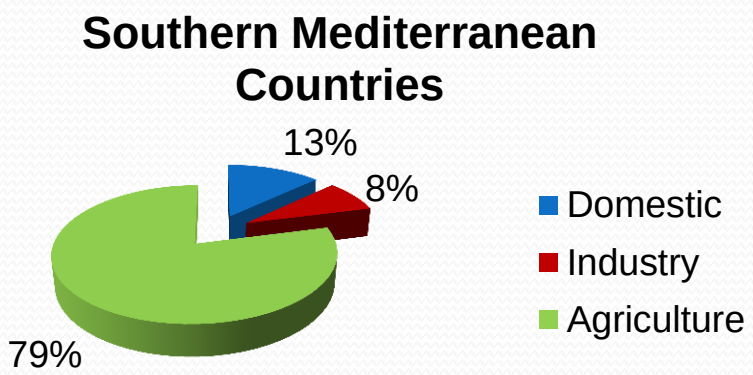


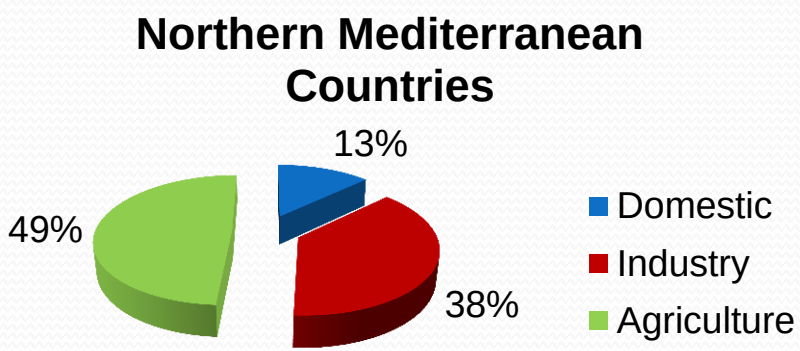
Why Wastewater Reuse in Mediterranean Region

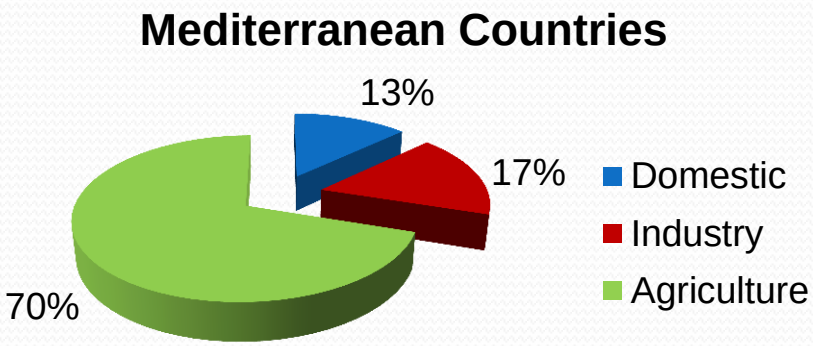
- Closing the Gap Between Supply and Demand
- Applying the Concept of Sustainability
- Prevents Fresh Water Resources and Water Bodies from Pollution
- Provides a Mitigation Solution to Water Scarcity and Climate Change
- Achieving Millennium Development Goals

Source: Waste Water Treatment and Reuse in the Mediterranean Region, Hdb Env Chem, DOI 10.1007/698_2010_76, Springer-Verlag Berlin Heidelberg 2010

Water use per sector in the Mediterranean (reflect the nature of produced pollution)





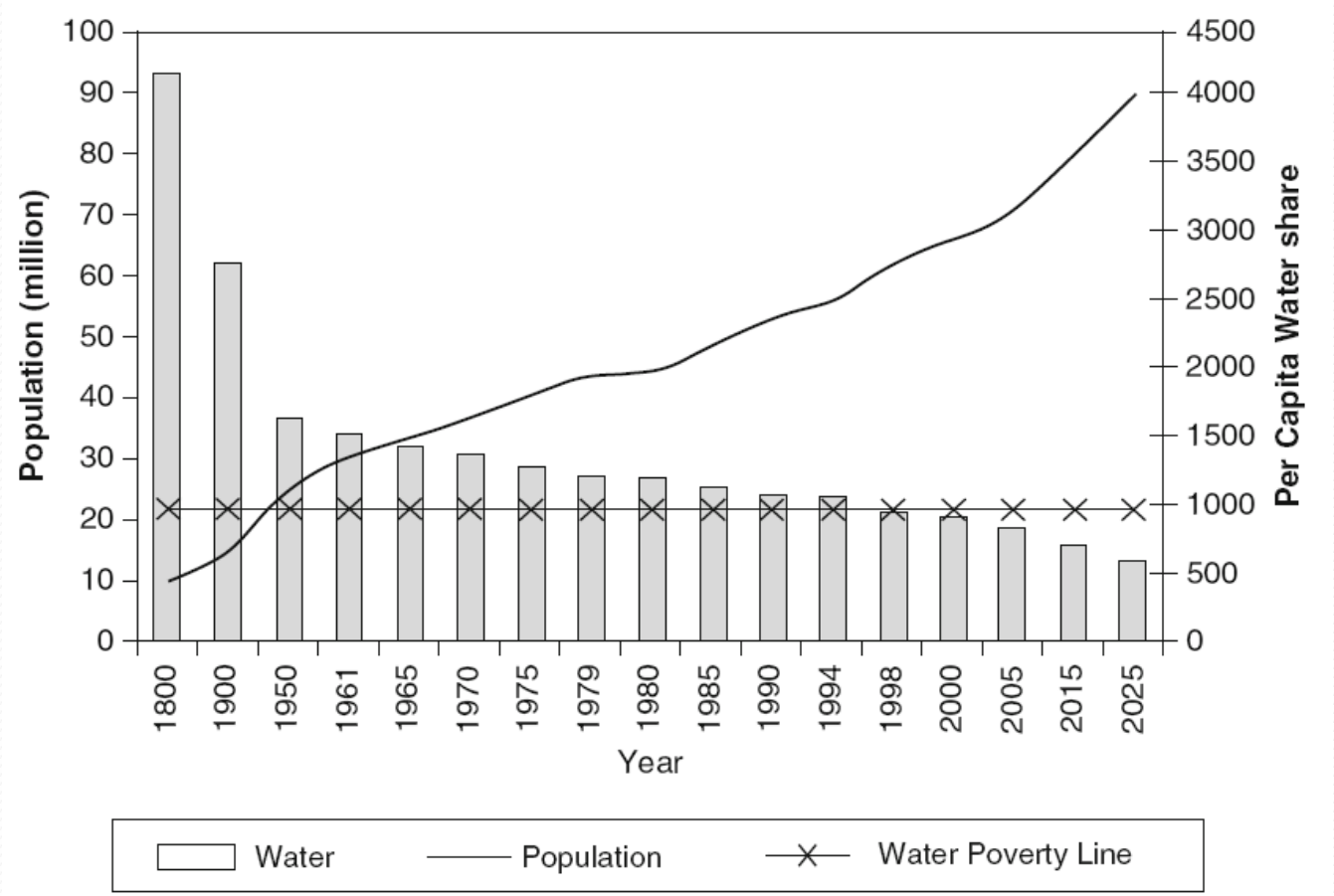


Source: *Options Méditerranéennes, Série A n. 65*, pp 29–48.

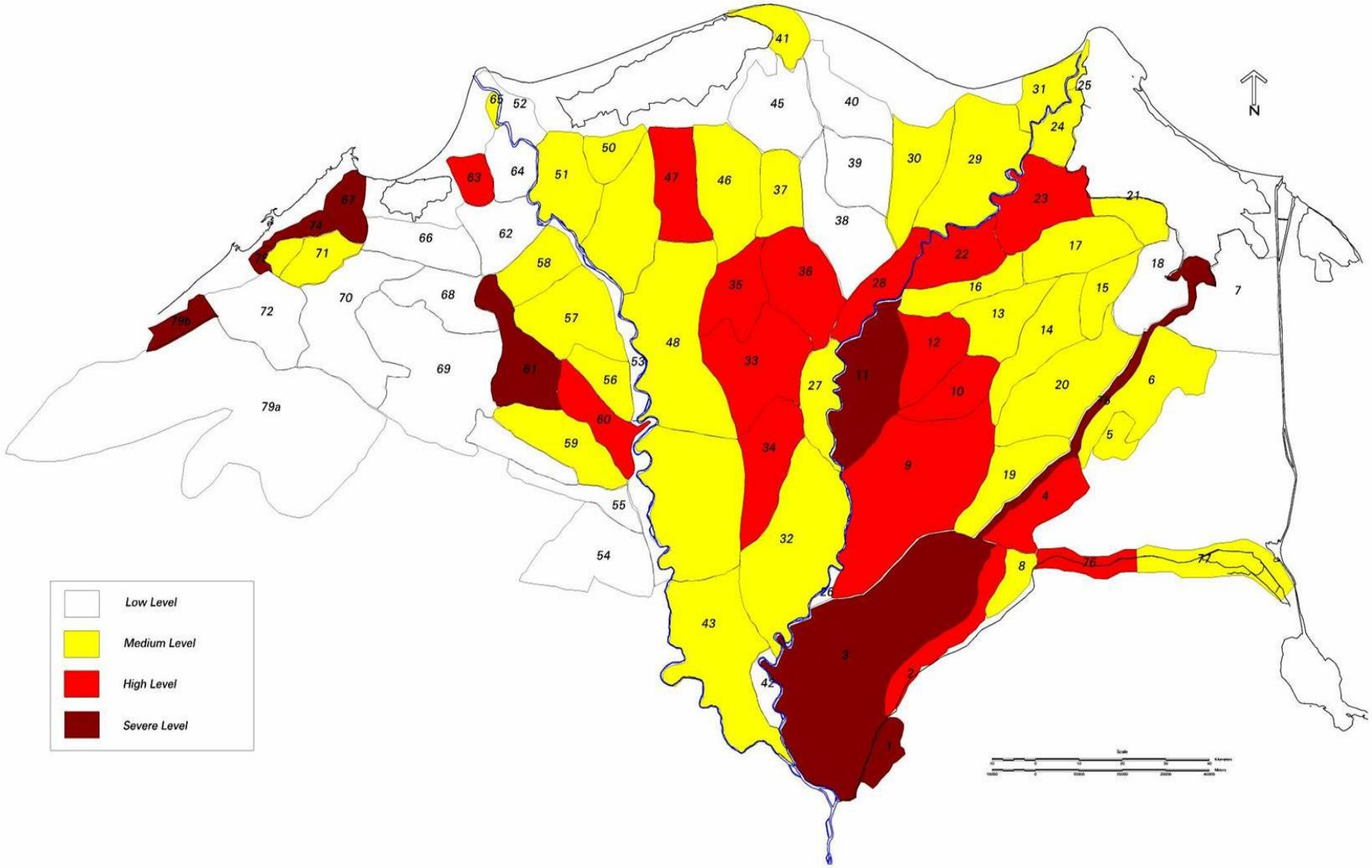
Egypt

Wastewater benefits and limitations

Population growth and per capita water share in Egypt (m3/year)



Source: Abdel-Gawad S (2008) Actualizing the right to water: an Egyptian perspective for an action plan. In: Water as a human right for the Middle East and North Africa. International Development Research Centre, Ottawa, Canada, pp 133–146.



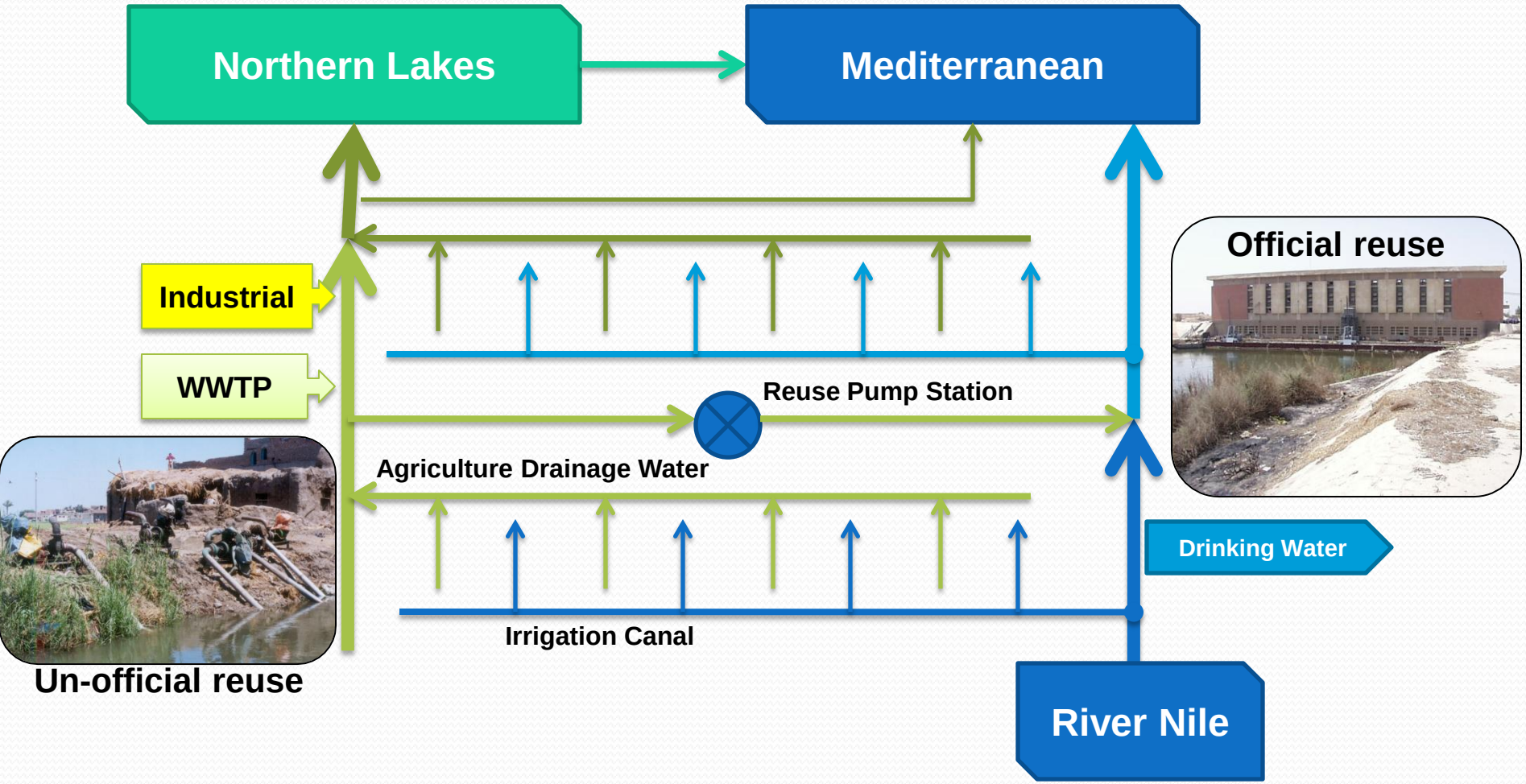
Population density in the Nile Delta

Wastewater benefits and limitations

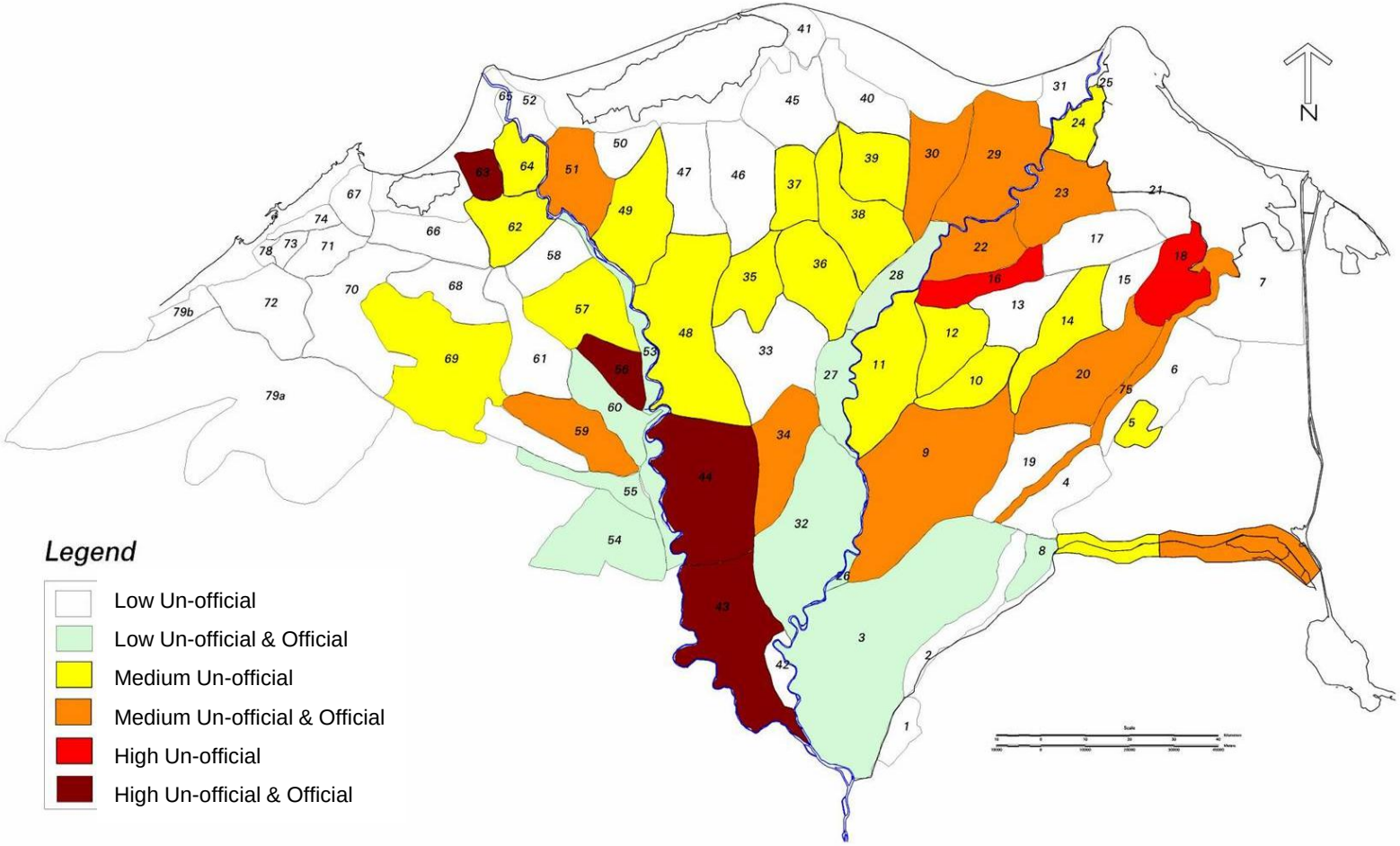
- Economic value of wastewater Reuse;
  - Nearby the agriculture land
  - Its nutrient value
  - Pollution control
  - Potential water resource

- Limitation of reusing wastewater
  - Reuse of wastewater depends on its quality
  - Cultivated plants tolerance to its constituents

Irrigation and Drainage Water Cycle in Egypt

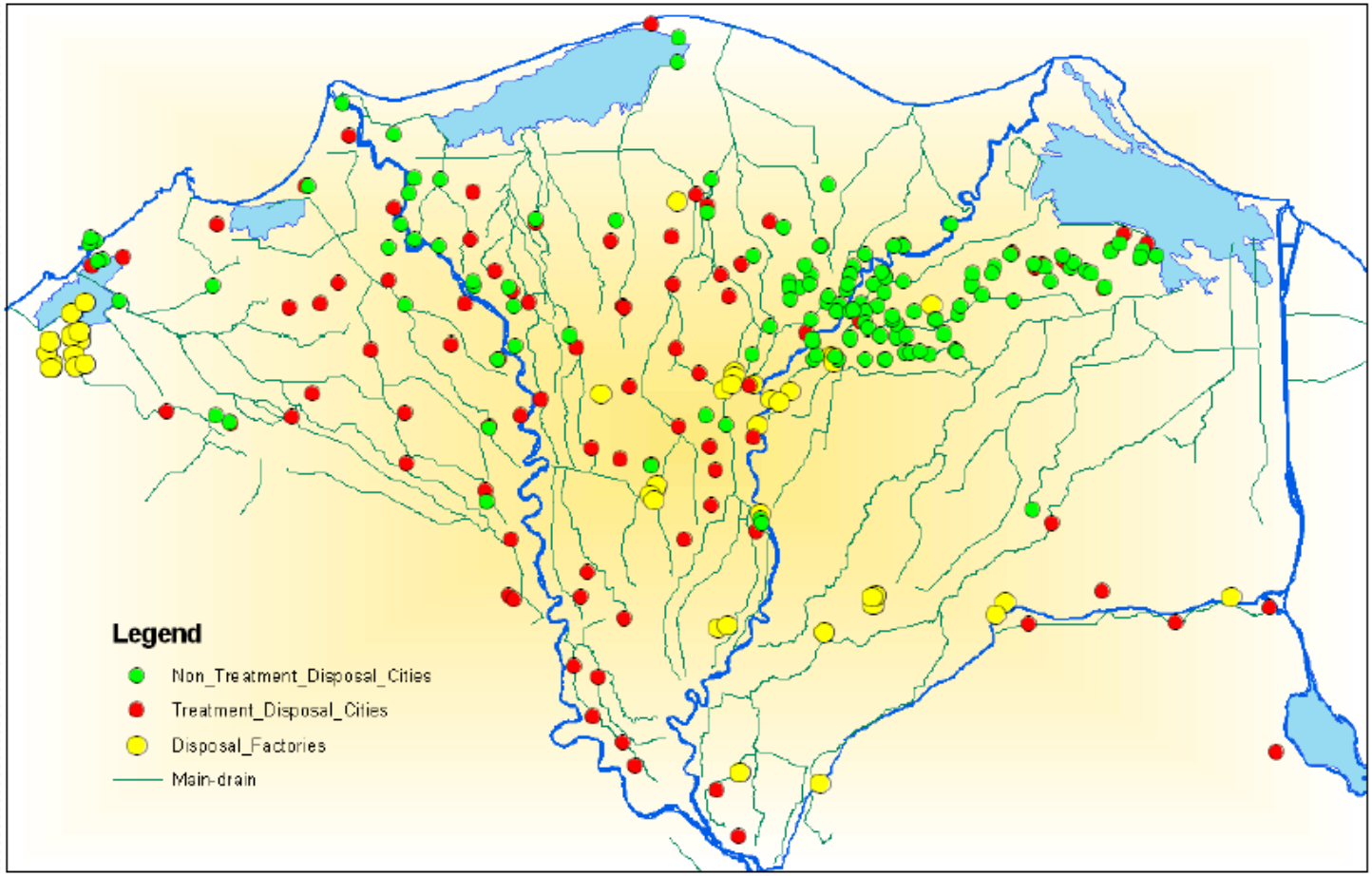


Reuse of drainage water in the Nile Delta



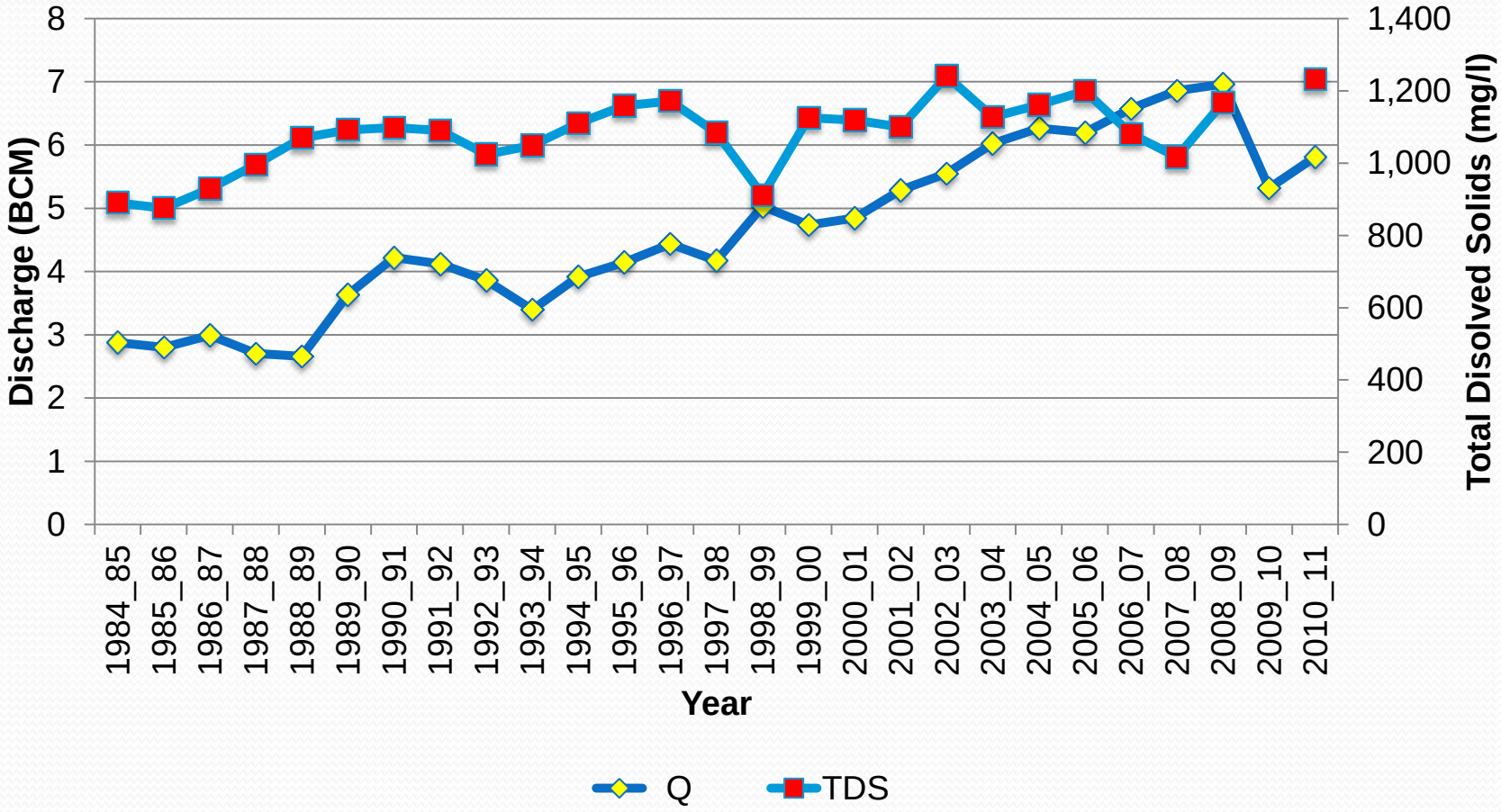
Catchments in the Nile Delta with Official and Unofficial Reuse

Pollution Point Sources in the Nile Delta of Egypt



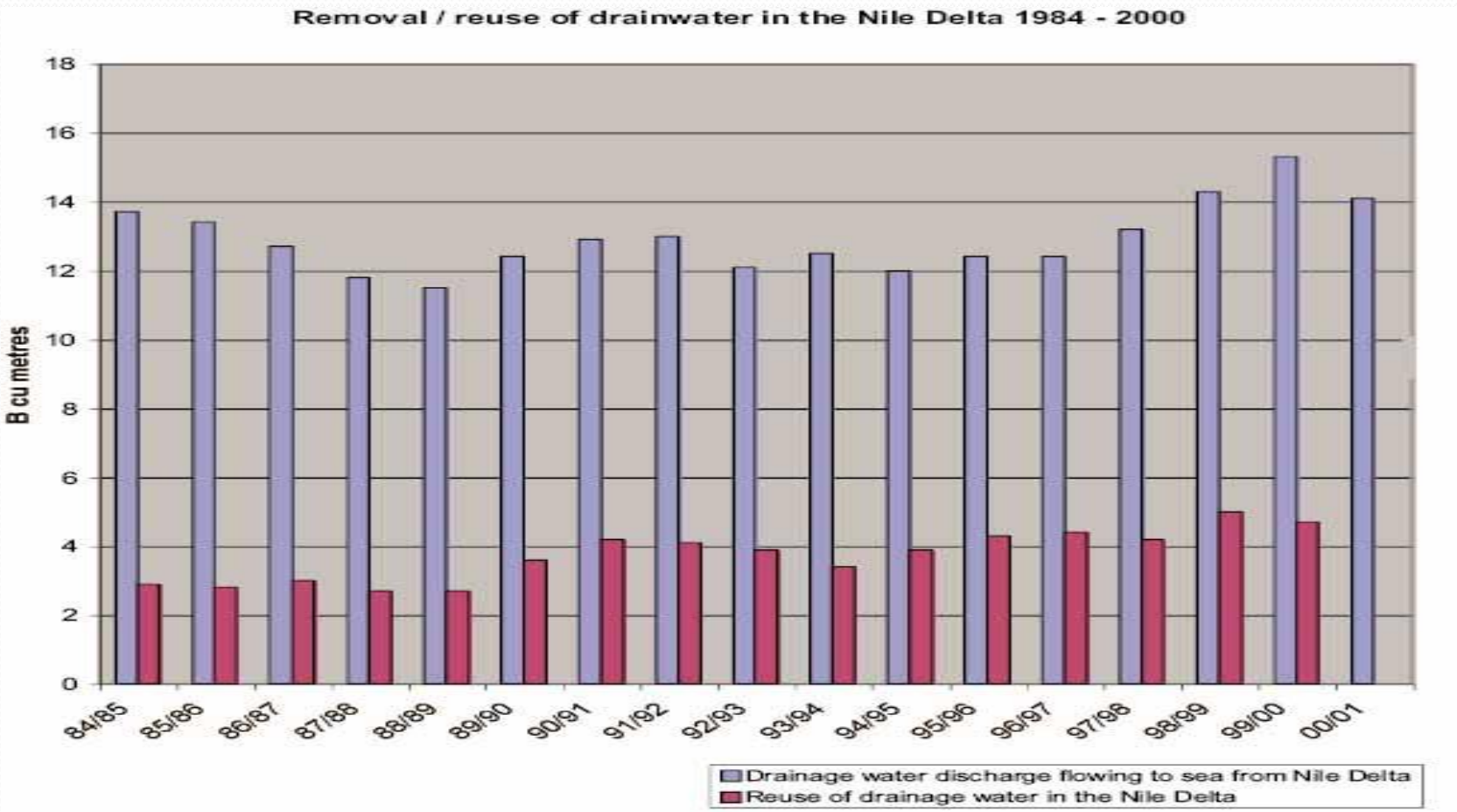
Source: Drainage Research Institute, NWRC, Egypt

Reuse of drainage water in the Nile Delta



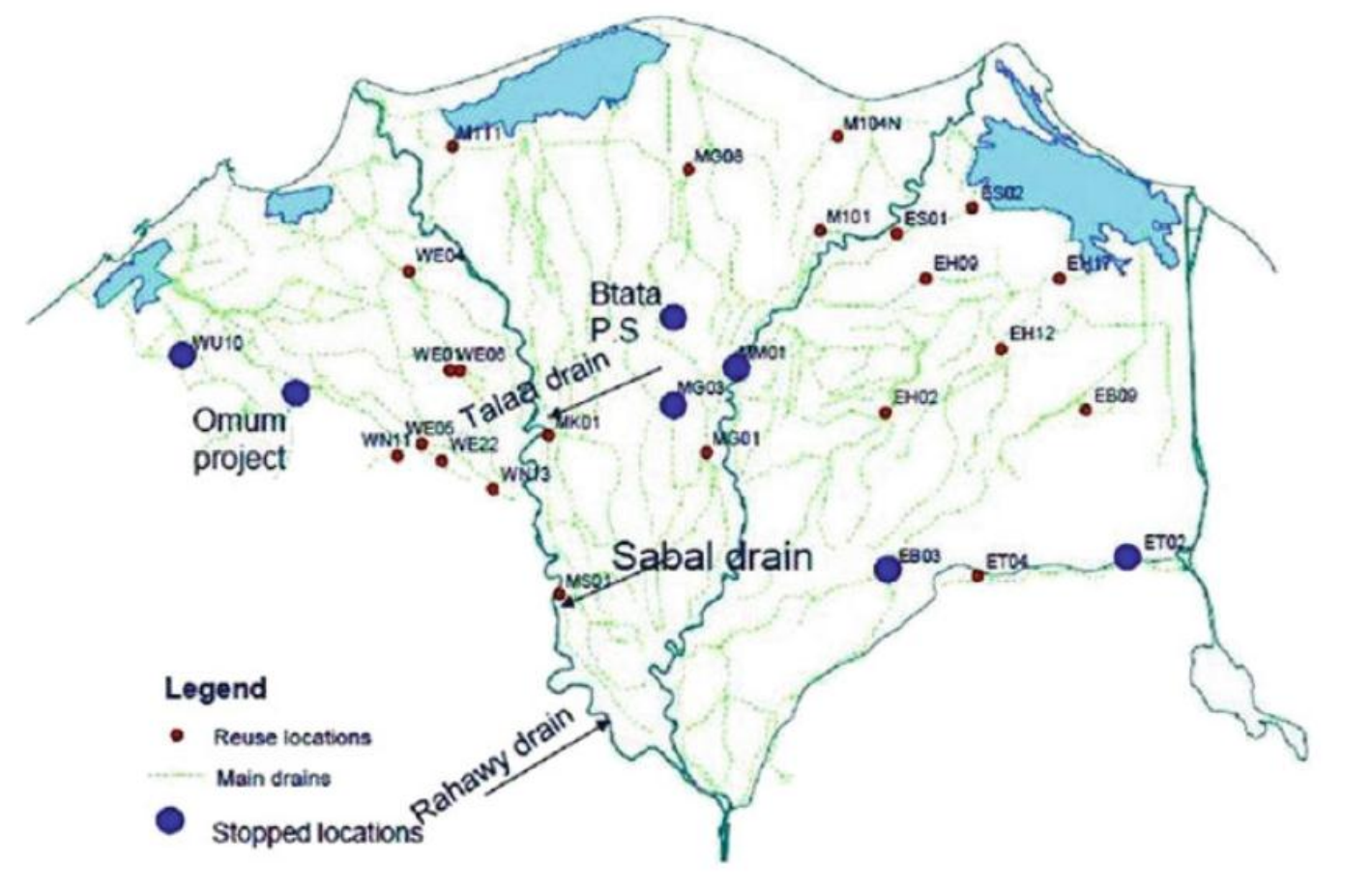
Source: National Water Research Center

Drainage water discharging into Sea



Source: FAO 2005 IPTRID Secretariat, Towards Integrated Planning Of Irrigation And Drainage In Egypt

Stopped Reuse Pumping Stations in the Nile Delta



Source: Drainage Research Institute, NWRC, Egypt

Wastewater-irrigated forest plantation pilot projects in Egypt

Site Names	Area (feddans) Feddan = 4200 m2	Soils	Irrigation methods
Ismalia	500	Desert sandy	Drip
Sadat	500	Desert sandy	Drip
Luxor	1,000	Desert sandy	Modified flood
Qena	500	Desert sandy	Modified flood
Edfu	500	Desert sandy	Modified flood
New Valley (El Kharga)	800	Desert sandy	Modified flood
New Valley (Paris)	50	Desert sandy	Modified flood
South Sinai	200	Desert sandy	Drip
Abu Rawash	50	Desert sandy	Modified flood

Source: (Ministry of Water Resources and Irrigation/US Agency for International Development) (2000)

Status of Manmade Forests Irrigated with Wastewater

No.	Forest Name	Governorate	Feddan*	Irrigation	Trees Grown
1	Alexandria, N9	Alexandria	70	Drip	Eucal, Casuarina, Safsaf
2	Gamassa	Dakahlia	100	Drip	Serwe, Eucal, Terminalia
3	Sadat Egypt/Chinese	Menofia	500	Drip	Serwe, Eucal, Pines, Casuarina, Ornamental Palm
4	Abu Rawash	Giza	80	Surface	Eucal, Casuarina, Zanzalaght
5	ElSaf	Giza	120	Drip	Khaya, Serwe
6	Arab AlMadabegh	Assiut	45	Drip	Khaya
7	Awalad Azaz	Sohag	267	Surface	Khaya
8	AlQola	Sohag	250	Drip	Jatropha
9	Luxor 1	Luxor	260	Surface	Jatropha, Muberry
10	Luxor 2	Luxor	700	Drip	Eucal, Khaya, Acacia
11	Qena	Qena	300	Surface	Khaya
12	Edfu	Aswan	300	Surface	Khaya
13	Ballana	Aswan	280	Drip	Khaya
14	Wadi ElAlaqi	Aswan	60	Drip	Khaya
15	Naser ElNuba	Aswan	100	Surface	Khaya
16	ElKharga	New Valley	300	Surface	Khaya, Neem, Casua, Terminalia
17	Paris	New Valley	60	Surface	Khaya
18	Mout	New Valley	160	Drip	Jatropha, Jojoba
19	ElRashda	New Valley	25	Surface	Eucal, Terminalia
20	Serabium	Ismailia	500	Drip	Serwe, Pines, Eucal, Khaya, Mulberry
21	Hurgada	Red Sea	200	Drip	Khaya, Casuarina
22	Sharm ElSheikh	Red Sea	20	Drip	Eucal, Casuarina
23	ElArish	North Sinai	80	Drip	Serwe, Pines
24	ElToor	South Sinai	200	Surface	Serwe, Eucal, Casua, Ornamental Palm

Source: Holding Company for Water & Wastewater (HCWW) and, Ministry of Water Resources & Irrigation (MWRI), Egypt

Crop/tree species Irrigated with Treated Wastewater in Egypt (example)

Governorate	Secondary Treatment Wastewater Plant	Degree of Treatment	Area (feddan)	Soil Type	Irrigation Method	Suitable Plants for Cultivation
6 October	Abu Rawash	Primary/Secondary	600	Sandy	Drip	Khaya, Cupressus, Eucalypyus
			30,000			Popular,Canola,Soyabeans, Sunflower
			45,000			Casuarina
			1,200			
	6 October		4,000			
Alexandria	Samouha		-	Loamy Sand/ Calcareous	Drip, Modified Surface	Sunflower, Loofa, Eucalyptus, Popular, Casuarina,Sisalana;Ornamental
	Wadian		-			Plants. Sweet Sorghum
	Amira		-			
	Agmi		-			
	Mobark		-			
	Km21		70,000			
El-Behira	Gaar		125	Loamy Sand/ Calcareous	Drip, Modified Surface	Soya Bean, Sunflower, Loofa;Sisalana
	Industrial Zone		500			Kenaf,jute,Ornamental Plants,Sweet sorghum
Matroh	Main Matrouh		2,055	Calcareous	Drip	Ornamental Plants, Casuarina
	Shahlem,Siwa		952			Eucalyptus
El-Menufia	Sadat	Primary/Secondary	1,600	Loamy Sand/ Sand	Drip, Modified Surface	Soya Bean,Eucalptus,Pinus,Acacia
	Garada		2,000			Cupressus,Casuarina,Sisalana,Morus
	Zarah		2,000			Ornamental Plants,Sweet Sorghum

Source: Holding Company for Water & Wastewater (HCWW) and, Ministry of Water Resources & Irrigation (MWRI), Egypt

Potential of Treated Sewage Reuse

In Greater Cairo, there are six wastewater treatment plants, with a total capacity of approximately 27 million m^3/day.

If with a suitable quality is potentially sufficient to irrigate about 100,000 feddans (feddan= 0.42 hectare)

Project Proposal

Cultivation the Green Belt for Southern Mediterranean cities by using the treated wastewater

Cultivation the Green Belt for Southern Mediterranean cities by using the treated wastewater

Objectives

- ***General***

  Reduction of the Mediterranean pollution resulting from land-based sources in the southern Mediterranean and solve the problem of wastewater treatment as it is an environmental problem.

- ***Specific***
  - preserve the ecosystem and protection of coastal habitats and wetlands from pollution.
  - agricultural economic returns of desert areas to take advantage of the wastewater treated instead of dumping in the Mediterranean
  - Conversion some desert areas to ecologically rich areas
  - Contribute to the purification of air pollutants and mitigation of climate factors as well in mostly desert areas.

Suggested activities

- Inventory of pollution sources on the Mediterranean coast
- Upgrade the sewage treatment plants on the coast or water bodies flow to the Mediterranean. And establish efficient sewage treatment plants to areas bordering the Mediterranean and have access to sanitation.
- Upgrade the industrial wastewater treatment plants and construct industrial waste water treatment for industrial complex areas
- Divert the course of the treatment plants to the desert areas to cultivate greenbelt of economic trees, around the cities at the Mediterranean coast.

Project Proposal (2)

Coastal Cities Treated Waste Water Reuse:
study of an underwater conveyance

Coastal Cities Treated Waste Water Reuse: study of an underwater conveyance

Background

- Egypt hosts several coastal cities (Port Fouad, Port Saïd, Damietta, Rosetta), beyond the Alexandria area. Their wastewater is poured into the Mediterranean, in most cases with very limited treatment.
- the drainage of the Nile Delta area pours also into the sea vast quantities of low quality water. In total, grey water polluting the Mediterranean from Egypt is considered to be several billions of cubic meters per year.

Why This Project

- Polluting of Mediterranean should be discontinued on environmental grounds, particularly in the context of the Mediterranean cleaning plan (Horizon 2020).
- It would seem advisable to reuse grey water as a potential resource, after due treatment to reach the required level as per WHO or FAO requirements as well as Egyptian regulations.

PROJECT phases

The envisioned project would consist of three phases at a prefeasibility level:

1. Audit of the existing treatment facilities for each of the main coastal outfalls of Egypt (cities, drains, etc.) and determination of requirements to reach appropriate WHO and/or FAO levels as well as Egyptian regulations for reuse.
2. Identification of areas in the surroundings of each of these outfalls and uses where such treated marginal water could be reused.
3. Preliminary evaluation of potential offshore projects to transport the treated wastewater to where it would be reused, identification of constraints and adaptation of technical solutions .