

# **Kangaré – Water**

## **An Introduction to Environmental –Economic Accounts for Water (SEEA-Water)**

5 September 2012

## BACKGROUND INFORMATION

### THE COUNTRY CALLED KANGARÉ

Kangaré could be anywhere...

It is a small republic, with a population made up largely of farmers - who produce enough agricultural produce to feed all the inhabitants - and employees working in industry. The country's industry consists of petroleum extraction and refining, the manufacture of basic chemicals and the canning of food products. There are also civil servants and quite a few unemployed.

Kangaré has only **two natural resources: agriculture and petroleum**. All agricultural output comes from individual small holdings on which farmers do not employ any paid workers. Some of this output is processed on the spot by the "**General Canning**" corporation. The **International Oil Corporation (IOC)** is a foreign concern with a local kind-of-activity unit, **IOC 1**, which produces oil. It exports most of the crude oil but a second local unit, **IOC 2**, also refines some, most of which is used locally. IOC2 also makes basic chemical products for export. All the other industrial products used in Kangaré - consumer and capital goods - are imported.

The State plays an important role in the country's economy. As well as being responsible for all the usual administrative tasks (police, army, justice, education, etc.), it runs a Treasury which acts as a "central" bank - and which is, in fact, the only bank in the Republic. Note that households in Kangaré do not pay any income tax. The only tax collected by the State is on corporate profits.

As we have seen, the economy of Kangaré is based on agriculture and petroleum. It is dependent on other countries, on both the IOC, which controls the main industrial activity in the country, and suppliers of manufactures. Kangaré also has substantial unemployment.

### THE KANGARIAN GOVERNMENT'S PLAN

The current situation has led to the government's decision to launch a two-year development plan. In the first year, the accent will be on industrialisation, with the purchase of a consumer goods factory. In the second year, the objectives will be to raise the population's standard of living, develop local amenities, mechanise agriculture and increase oil production capacity.

To assess the impact of these plans on the country's economy, the government has decided to compile national accounts for Kangaré for the year just past,  $t_0$ . These accounts will then form the basis for calculations forecasting the outlook for the economy in the two years of the plan,  $t_1$  and  $t_2$ .

Once this work is complete, it will be possible to measure the likely impact of the development plan, so that the government can judge whether certain charges are acceptable and, if necessary, revise its initial plans.

## THE WORK TO BE DONE

Compile the accounts to assist the government in evaluating its plan. The following set of documents provides all the information required.

### DOCUMENT FOR STAGE A – YEAR $t_0$

Accounting and statistical data available for year  $t_0$

#### 1. Public accounts (unit: K million)

##### Non-financial account

Expenditure		Receipts	
Purchases of supplies	1.0	Profit taxes	17.4
Wages and salaries	4.0		
Unemployment benefits paid	3.8		
Balance on non-financial accounts	8.6		
<b>Total</b>	<b>17.4</b>	<b>Total</b>	<b>17.4</b>

##### Treasury account

Accounts receivable		Accounts payable	
Foreign currency	+10.9	Current accounts (residents)	+3.9
Loans	+2.5	Bonds	+0.9

#### 2. Customs statistics (unit: K million)

Products	Imports	Exports
Agricultural products		1.2
Crude oil		34.2
Refined petroleum		2.4
Chemicals		1.1
Other industrial products	27.2	
<b>Total</b>	<b>27.2</b>	<b>38.9</b>

### 3. Results of the “agriculture” survey (unit: K million)

Output of agricultural products	5.1
Purchases of seeds and fodder	0.1
Purchases of refined petroleum	0.5
Investment	0.4

There are no paid employees in agriculture.

### 4. Results of the household consumption survey (unit: K million)

Agricultural products	3.2
Refined petroleum products	4.5
Other industrial products	12.8

### 5. Data on corporations (unit: K million)

#### Extracts from the International Oil Corporation (IOC) annual report

Sales		42.7
Of which:		
	crude oil	34.2
	refined petroleum	7.4
	chemical products	1.1
Internal deliveries (crude oil supplied by IOC 1 to IOC 2)		
	For refined petroleum	1.6
	For the manufacture of chemical products	0.4
Purchases of consumables		4.0
Of which:		
	For petroleum extraction	2.2
	For the refinery	1.4
	For the chemical works	0.4
Wages and salaries		11.8
(of which 2.0 for refinery workers and 0.1 for those in the chemical works)		
Interest (on loans from foreign suppliers)		0.2
Dividends (paid to the parent corporation abroad)		0.6
Investments		10.2
Depreciation expense		5.0
Pre-tax profit		21.7
(Profit tax		17.4)
Loan received		2.5
Issue of shares (acquired by households)		0.4
Acquisition of Bonds		0.9

Remaining cash assets are kept in a current account at the Treasury

**Extracts from the General Canning's annual report**

Turnover		1.9
Manufacturing costs		
	-purchases of agricultural products	0.6
	-purchases of other industrial products	0.7
	-wages and salaries	0.3
	-depreciation expense	0.1
	-profit	0.2

## **INCLUDING WATER SUPPLY AND SANITATION IN KANGARÉ**

In the previous accounts of the Republic of Kangaré there was no information about the establishments that provide the services of drinking water and sewerage. These services are important for the Republic of Kangaré and therefore information was collected to be included in the accounts. The data collected is the following:

The establishments in charge of providing the drinking water services have sales of drinking water of 1.1 million Ks and they have to purchase imported industrial products for 0.3 million Ks. They pay 0.8 million Ks in salaries to the workers. The establishments collect 0.81 million Ks from the sales of 20 million cubic meters of water to the households of Kangaré during the year. They also collect 0.28 million Ks from the sales of 7 million cubic meters of water to the “General Canning” corporation during the year.

Different establishments are in charge of providing the sewerage services. They receive 0.9 million Ks for the concept of providing the sanitation service and they have to purchase imported industrial products for 0.4 million Ks. They pay 0.4 million Ks in salaries to the workers. The establishments collect 0.72 million Ks for collecting 16 million cubic meters of wastewater from the households of Kangaré during the year. They also collect 0.18 million Ks for collecting 4 million cubic meters of wastewater from the “General Canning” corporation during the year.

The establishments in charge of providing the sewerage service treat all the wastewater before discharging it to the rivers.

## **THE WORK TO BE DONE**

With this information correct the diagrams and the supply and use tables.

## WATER IN KANGARE

The Republic of Kangaré has a population of 301 500 inhabitants. The country is in an area of 2 592 km<sup>2</sup>. There are four river basins with the areas shown in the table below (see the map attached). Kangaré receives an almost constant inflow of 1 m<sup>3</sup>/s from a river that originates in a neighboring territory, as measured reported by Kangaré's Government, which monitors the flow with several stream gages installed throughout the country.

Precipitation is measured daily in several climatologic stations. The normal precipitation (1971-2000) has been calculated using the Thiessen polygons for each watershed. According to the characteristics of the soil in the different watersheds there are estimates of the surface runoff and infiltration to the aquifers. The data is as follows:

Zone	Area	Normal Precipitation (1971-2000) (mm/year)	Runoff as percentage of precipitation (%)	Infiltration to aquifers as percentage of precipitation (%)
A	340	650	32	9
B	912	580	26	5
C	325	750	24	3
D	1 015	685	24	6

Thirty five percent of the water abstracted for the water supply networks is lost due to leaks.

There are 17 000 hectares of crops, to which a height of 300 mm of water are applied to complement the water received from the rain. Forty percent of the water abstracted for irrigation is lost when transported to the fields.

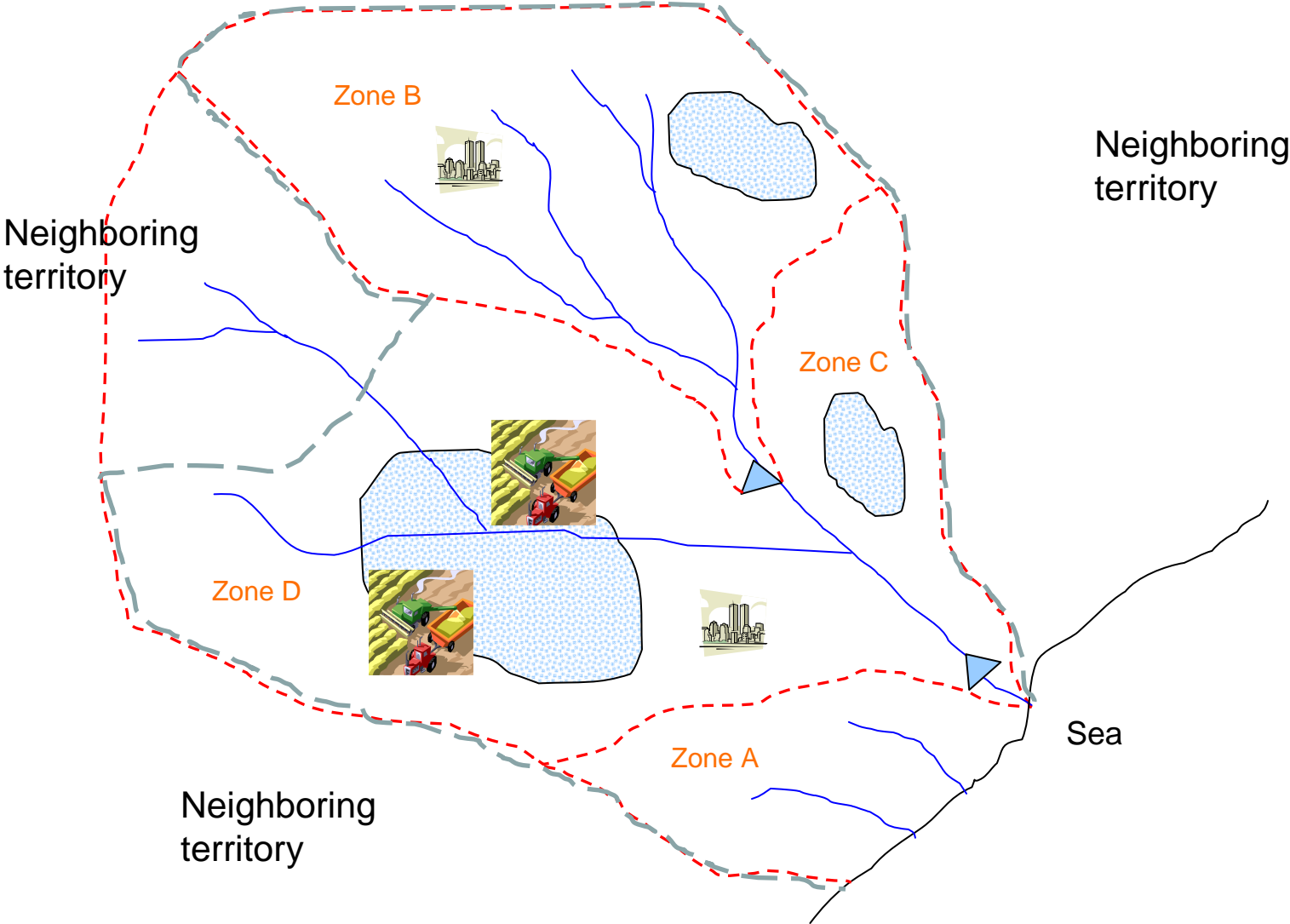
For its processes the refinery abstracts 31 million cubic meters of water each year from a nearby aquifer. For the abstraction of oil, sea water is used.

The outflow of water to the sea, according to stream gages located at the mouth of the rivers, is 20.6 m<sup>3</sup>/s (650 hm<sup>3</sup>/year) in average.

## THE WORK TO BE DONE

With this information compile the water accounts according to SEEA-Water to assist the government in evaluating its plan.

# Kangaré Watersheds (PLAN)





## **WATER POLLUTING EMISSIONS IN KANGARE**

### **Agriculture:**

With the help of a model the diffuse emissions of agriculture (in tons per year) were calculated to be

- BOD: 800 t/y
- COD: 1 600 t/y
- P: 150 t/y
- N: 2 500 t/y

This pollution results mainly from the use of fertilizers, wastewater from livestock, erosion and various uses of water for cleaning of products, equipment, etc. in the farms.

### **Households:**

The majority of households is connected to the sewer utility. Household wastewater mainly consists of organic pollution (measured in BOD and COD), nitrogen and phosphorus. With the help of emission factors and measurements at the inlet of the wastewater treatment plant it was possible to calculate the annual gross emissions of households as follows:

- BOD: 7 400 t/y
- COD: 16 500 t/y
- P: 430 t/y
- N: 1 300 t/y

### **General Canning Corporation:**

The wastewater of the canning company is collected and treated by the sewer utility. As the canning company is required to take daily samples concerning wastewater volumes and concentration of pollutants it was possible to determine the annual load of gross emission as follows:

- BOD: 800 t/y
- COD: 1 500 t/y
- P: 120 t/y
- N: 500 t/y

### **Sewer utility:**

The sewer utility operates a wastewater treatment plant which achieves the following treatment efficiency:

- BOD: 90%
- COD: 85%
- Phosphorus: 75%
- Nitrogen: 80%

There is a daily measurement of the discharged wastewater volume and the concentration of main pollutants (including some heavy metals). The annual load of pollutants discharged is

- BOD: 820 t/y
- COD: 2 700

- P: 138 t/y
- N: 360 t/y
- Cu: 0.05 t/y

The copper results from the collection of urban runoff which is also collected and treated by the sewer utility.

### **International Oil Corporation IOC**

Only one of the establishments of the IOC abstracts and discharges water from freshwater resources. IOC 1 only uses seawater.

IOC 2 makes measurements of the quality of the abstracted water and calculated an annual uptake of about 6 kg copper per year.

The annual emissions of pollutants (based on daily measurements) are the following:

- BOD: 300 t/y
- COD: 800 t/y
- P: 4 t/y
- N: 35 t/y
- Cu: 0.01 t/y (remark: only 4 kg/y were added by the production process, 6 kg/year result from background concentration)

### **THE WORK TO BE DONE**

With this information complete the water accounts according to SEEA-Water to include emissions.