

# Multi Purpose Deep Tunnel (MPDT)

**An Integrated Solution for Flood Control, Water Supply, Waste Water, Road Tunnel and Public Utilities in the Jakarta Mega City**

**Presented to :**

**Singapore International Water Week (SIWW) 2008**

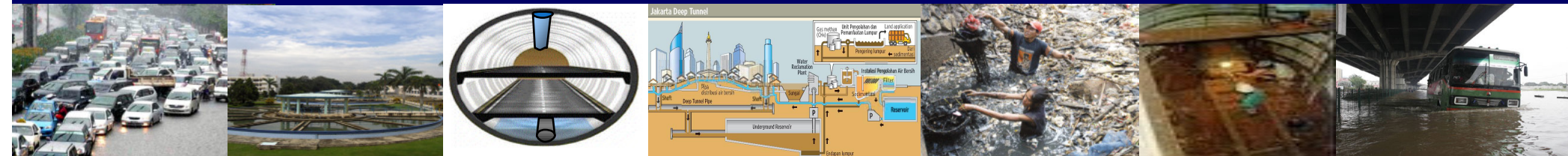
**June 25, 2008**

**Suntec Singapore International Convention & Exhibition Centre -**

**Water Leaders Summit and South East Asia Business Forum**

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**Jakarta Water Supply Regulatory Body  
(JWSRB)**



# **Environmental Serious Problems being faced by Mega City of Jakarta.**

**1) Floods, paralyzing the city (Business, Industrial and Municipal damages);**

a) 2002	→ Flood damages	IDR 9.9 Trillions
b) 2007	→ ditto	IDR 8.8 Trillions
<b>TOTAL</b>		<b>IDR 18.7 Trillions</b> <b>(eq. to USD 2.05 Billions)</b>

**2) Raw water scarcity and also badly polluted;**

**3) Water supply coverage ratio, only around 55 %;**

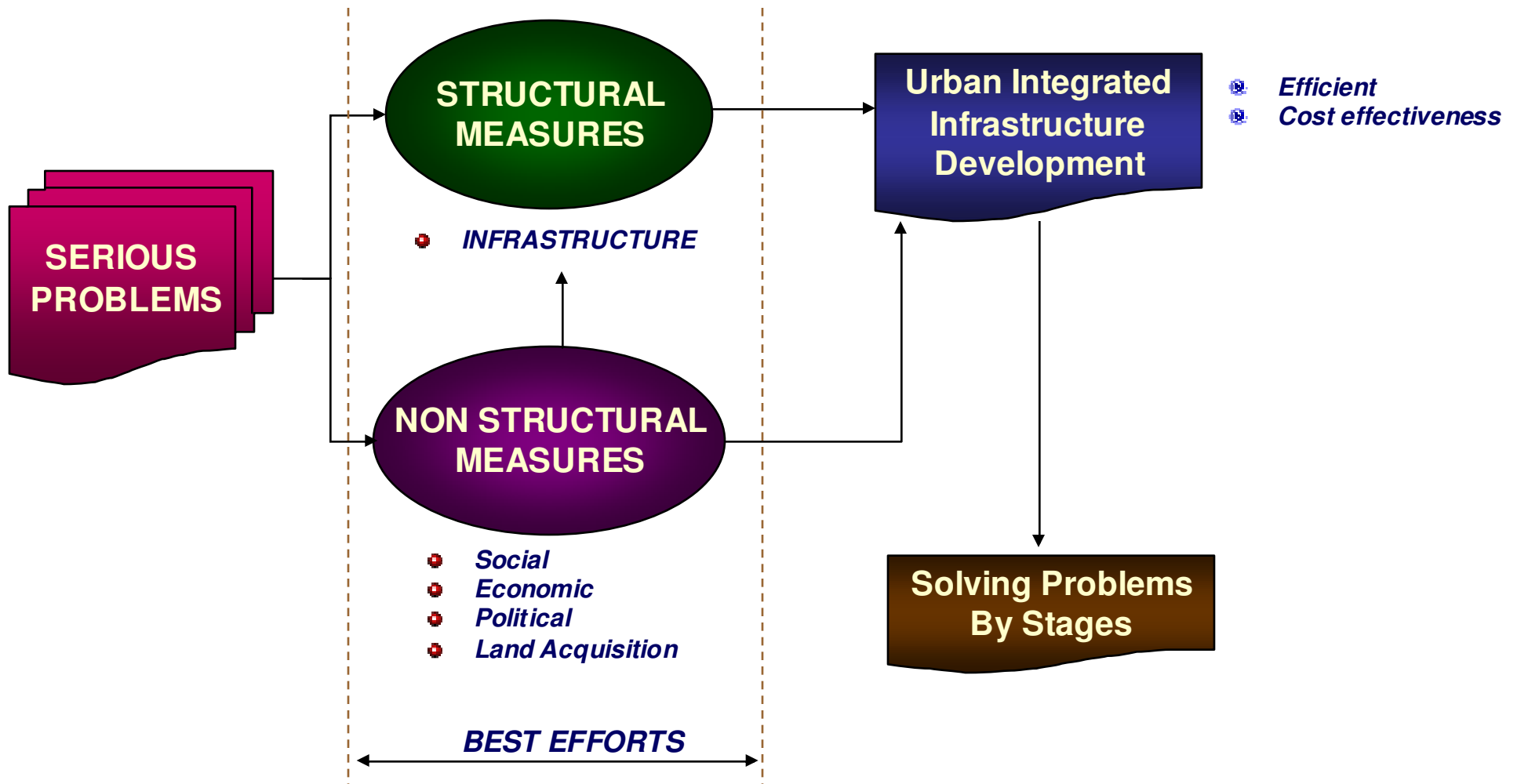
**4) Untreated waste water, causing water borne diseases due to e-colli;**

**5) Excessive abstraction of Ground Water, causing land subsidence and sea water intrusion as well as worsening the flood control management;**

**6) Traffic congestion is severe, causing national loss IDR 43.3 T/annum (eq. to USD 4.76 B/annum);**

**7) Climate change worsen the situation.**

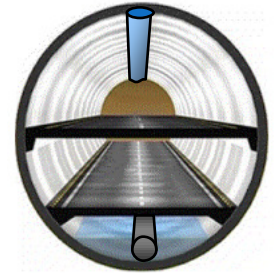
# Strategy to Solve Those Problems :



**Key Words :**

- 1) *Land Acquisition*
- 2) *Commitment on Urban Integrated Infrastructure Development by stages*

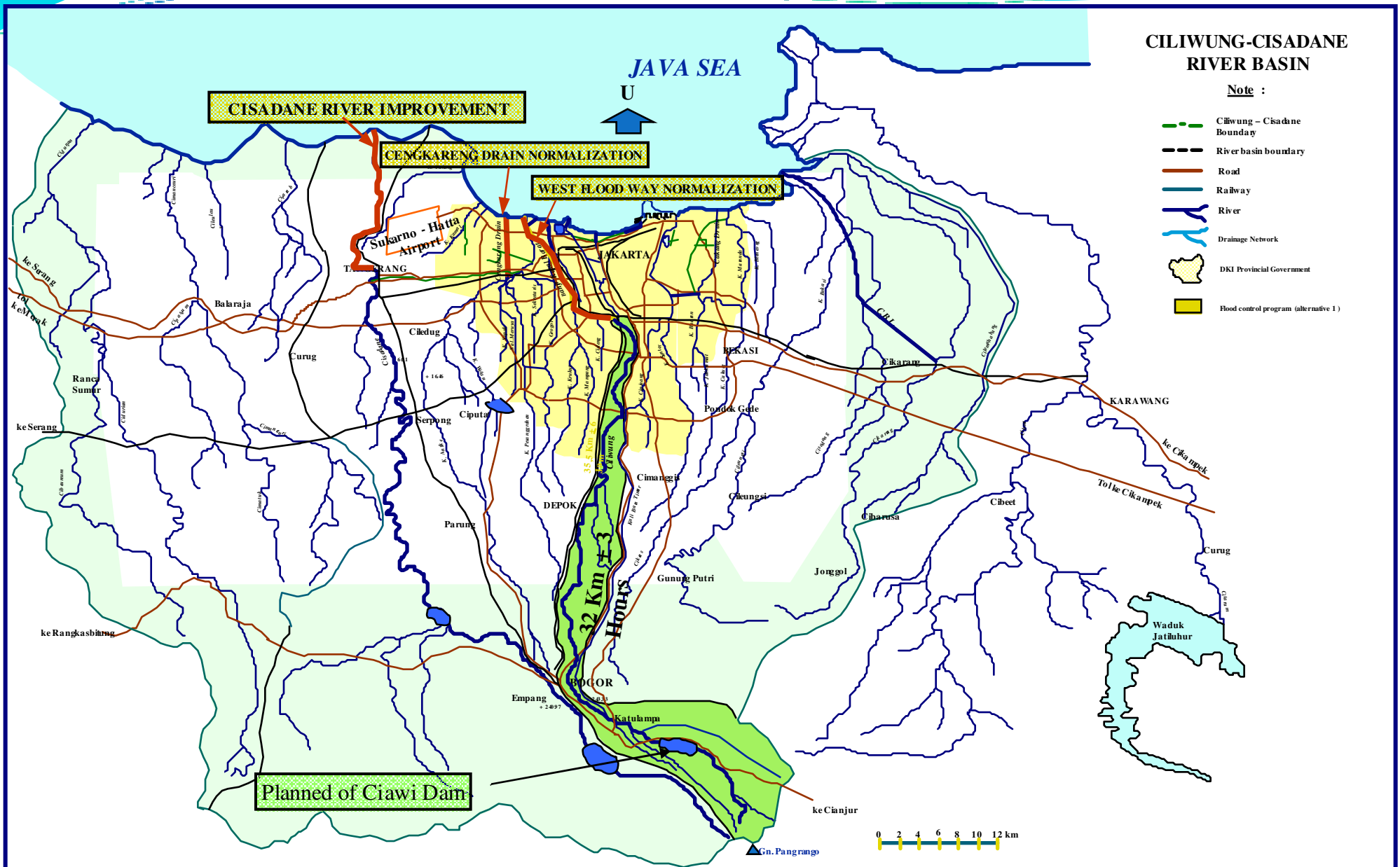
***MULTI PURPOSE DEEP TUNNEL (MPDT)***  
**An Integrated Solution for Flood Control, Water Supply, Waste Water,  
Road Tunnel and Public Utilities in the Jakarta Mega City**



**With the Following Benefits:**

1. Controlling peak flood;
2. Improving urban wastewater management, including Water Reclamation Plants (WRPs) to :
  - Supply clean water for the Northern part of Jakarta;
  - Improve water quality in water bodies;
  - Produce electric power (methane gas) and organic fertilizer.
3. Reducing ground water abstraction due to improved city piped water service due to a more reliable supply of raw water;
4. Constructing of tunnel need no land acquisition except for holding pond and ingresses + egresses of toll road;
5. Utilizing the tunnel as toll roadway as in *SMART project (KL)* and utility shaft, as in *TARP project (Chicago)*.

# Ciliwung River Basin



# Teluk Jaka

To Sea Outfall

Pluit Storage Reservoir

WRP

Egress Airport

Srogol Dam

Egress Roxy

Cideng Pumping Station

Egress Tanah Abang

Karet Sluice Gate

Melati Attenuation Pond

Manggarai Sluice Gate

Pejompongan WTP

Setiabudi Pond

Toll Road  
Balekambang - Manggarai

JAKARTA SELATAN

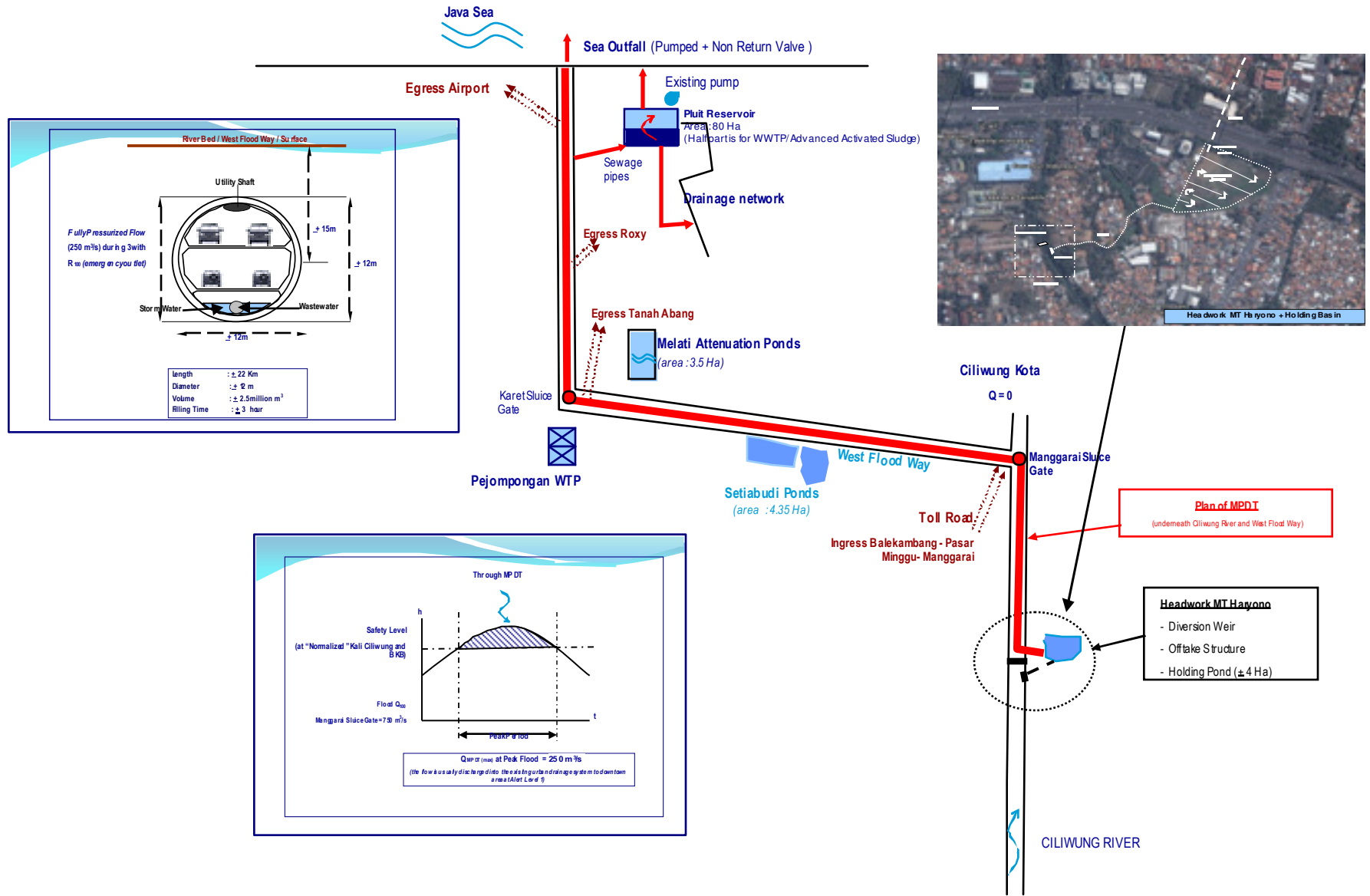
Headworks

Holding Basin

MPDT Central Zone

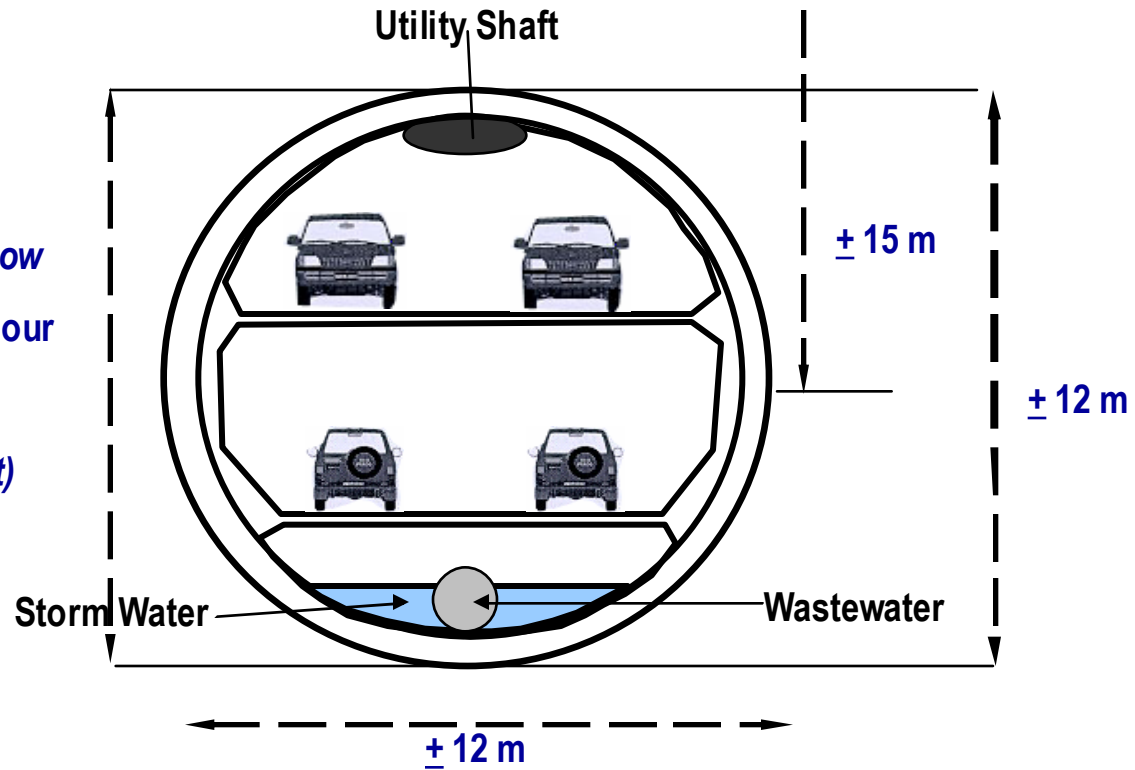


# MPDT FOR CENTRAL ZONE (CILIWUNG, CIDENG, KRUKUT)



River Bed / West Flood Way / Surface

*Fully Pressurized Flow*  
(250 m<sup>3</sup>/s) during 3 hour  
with R<sub>100</sub>  
(emergency outlet)

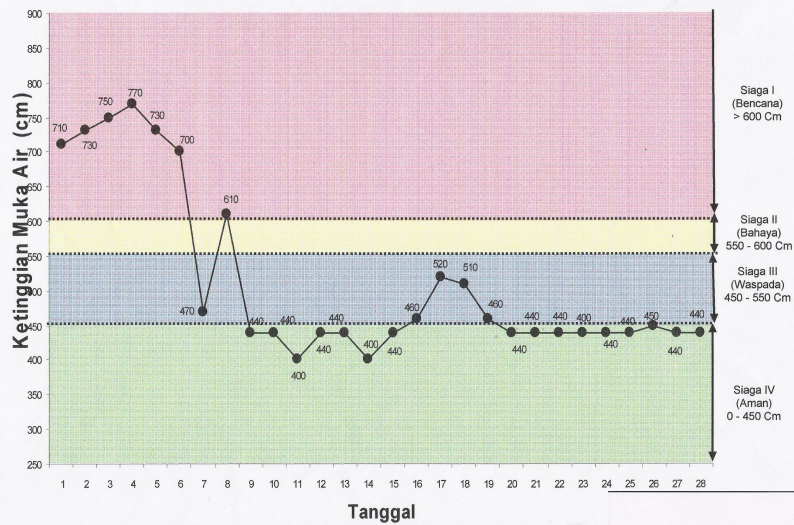


Length	: ± 22 Km
Diameter	: ± 12 m
Volume	: ± 2.5 million m <sup>3</sup>
Filling Time	: ± 3 hour

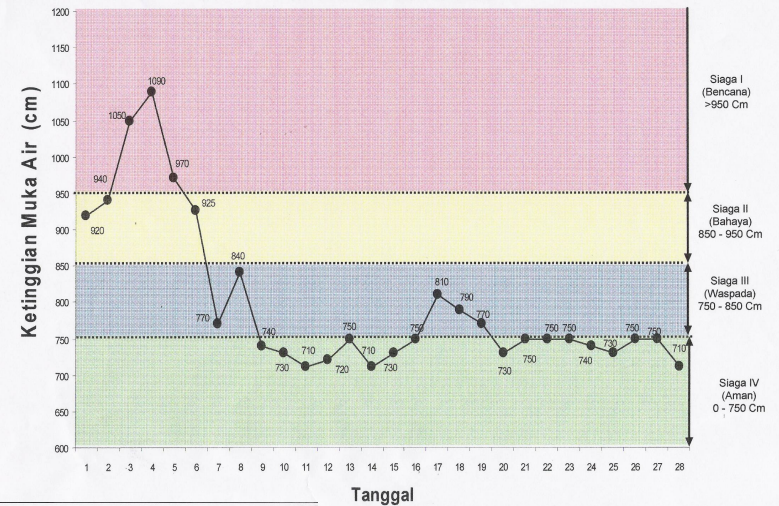


# Flood Data, February 2007

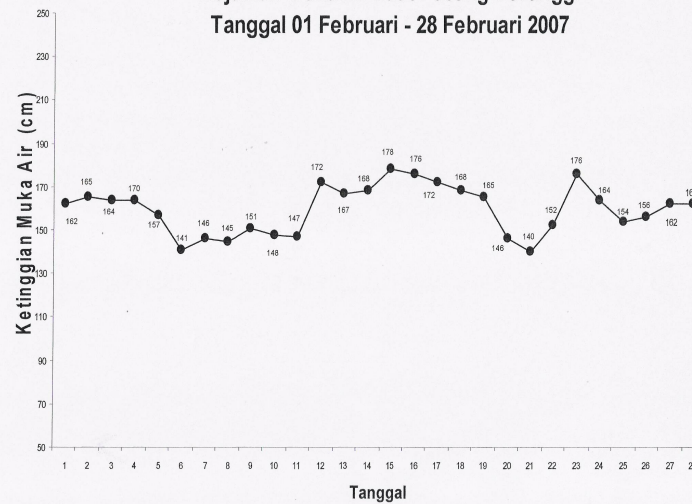
Grafik Ketinggian Muka Air Tanggal 30 Januari - 16 Februari 2007  
PINTU AIR KARET



Grafik Ketinggian Muka Air Tanggal 01 Februari - 28 Februari 2007  
PINTU AIR MANGGARAI



Kejadian Muka Air Laut Pasang Tertinggi  
Tanggal 01 Februari - 28 Februari 2007



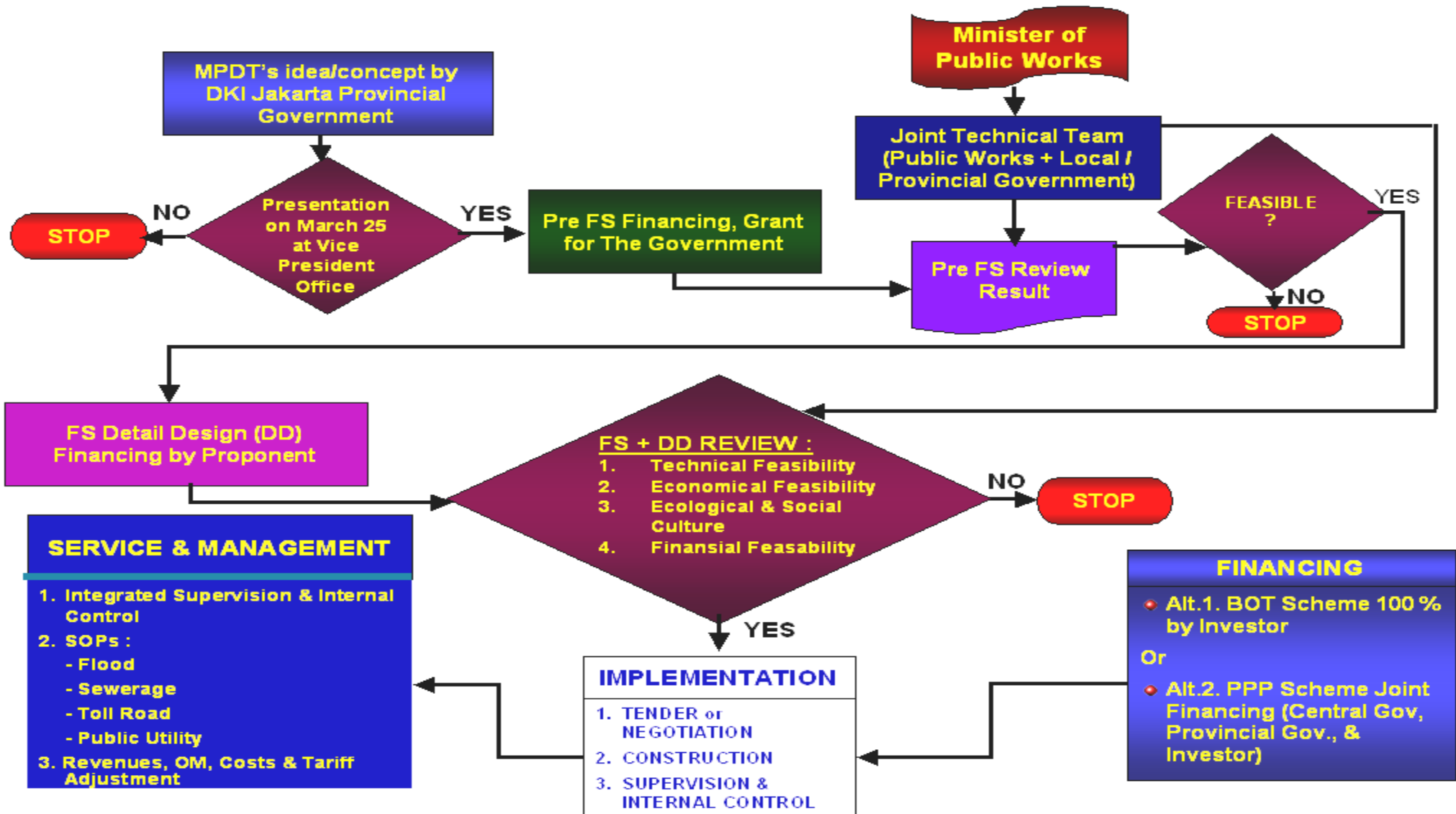
## MPDT & Other Alternative Technology

N o.	Jakarta Water Resources Management (problems & solutions)	MPDT	DAM	Canal	Ancient River	Ground Water Recharge
1.	Flood control	✓	✓	✓	✓	⊖
2.	Scarcity of Raw water resource	✓	✓	✗	✓	✗
3.	Sewage	✓	✗	✗	✗	✗
4.	Ground water conservation	✓	✓	✗	✓ (DG)	✓ (SG)
5.	Improvement of surface water quality	✓	⊖	✗	✗	✗
6.	Land acquisition	✋	✋	✋	✋	✋
7.	Cost	▲▲	▲	▲	?	▼
8.	Technology	▲	☐	☐	?	▼
9.	Integrated Urban Water Resources	✓	✗	✗	✗	✗
10.	Potential Revenue	USD	usd	✗	✗	✗

✓ = appropriate; ? = how?; ✗ = not possible; ⊖ = not effective; ✋ = unnecessary;  
 ✋ = a must; ▲ = relatively expensive; ▼ = inexpensive; USD = potential; usd = slightly potential; ☐ = relatively easy

*Note : in addition to matters mentioned above, MPDT also benefits in improving toll road & utility network*

# FLOW DIAGRAM OF MPDT CONCEPT IMPLEMENTATION





## ***I. Pre-Feasibility Study (FS) to Basic Design***

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This phase comprises of :

- 1) Technical Aspect, for Geological aspect and Hydro Geology, Soil Investigation, Flood Control, Traffic System Engineering and Management, Waste Water Management and its Reclamation Plant, Utility Shaft, Civil/Structural Engineering Mechanical and Electrical Engineering, Health and Safety Engineering.
  
- 2) Economical Aspect, economical aspect is needed to observe to what extent investment is economically feasible to mitigate the impact of flood damages and address economical benefit.

## ***I. Pre-Feasibility Study (FS) to Basic Design***

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- 3) Ecological and social culture aspect, which comprises of :
  - A. Environmental/ecological impact in development phase and operation and maintenance phase.
  - B. Cultural social aspect, especially for those community reside along side Ciliwung river and west flood way including acceptability level.
  
- 4) Financial aspect, is needed in identifying to what extent private sector including BUMN and BUMD both national and foreign investment are financially feasible (FIRR, schematic fund and concession period)



## ***II. Feasibility Study (FS) to Detailed Design***

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- 1) After Pre-Fs is accepted by the government, the stages of FS and detailed design shall be continued by the proponent;
- 2) The result of FS and detailed design shall become a basis for negotiation process based on BOT scheme, or tendering process under PPP scheme between Government and Private sector;
- 3) The negotiation or tender result as mentioned above, shall become a baseline for entering the contract agreement between government and related private sector, based on pre determined of concession period.



### ***III. MPDT Implementation***

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Once FS and Detailed Design are completely done, next phase is to implement MPDT by the investor consortium through EPC system (Engineering, Procurement, & Construction) which consist of work items as follow:

- A. Deep Tunnel 22 km including Holding Pond, Flood Forecasting and Warning Center, Weather Radar and Rain gauge Station, Sea Outfall Turbine Pump plus Surge Chamber;
- B. Toll Road 18 km including Ingress and Egress, Motorway Control Center, Safety Features including Escape Routes and Fire Hydrants ;
- C. Sewerage system consist of Main Trunk, Secondary, Tertiary Pipe Networks and Water Reclamation Plant;
- D. Utility Shaft.



## ***IV. Operational Management***

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- 1) This phase is not only expected by public at large but also by government and investor.
- 2) Considering that MPDT is a multi purpose, integrated and accurate monitoring and controlling are crucially important (for instance : integration among the SOP of flood control, toll road operational management and its safety features, sewerage system, etc)
- 3) Controlling of each component, consist of :
  - a. Revenue Collection
  - b. OM Costs
  - c. Tariff adjustment
  - d. etc.



## Development Cost (based price 2008)

<b>1. MPDT</b>		<b>: IDR 12.7 T ≈ USD 1,396 Millions</b>
▪ Deep Tunnel (including Holding Pond, Flood Forecasting and Warning Center, Weather Radar and Rain gauge Station, Sea Outfall Turbine Pump plus Surge Chamber); double deck toll road (including motorway control center and safety features inside tunnel)	: IDR 11.7 T ≈ USD 1,286 Millions	
<i>(unit price MPDT including double deck toll road is estimated IDR 650 Billions per km length)</i>		
▪ Waste Water Trunk Main	: IDR 0.5 T ≈ USD 550 Millions	
▪ Utility Shaft	: IDR 0.5 T ≈ USD 550 Millions	
<b>2. Waste Water System</b>		<b>: IDR 4.3 T ≈ USD 472 Millions</b>
▪ Secondary & Tertiary		
▪ Water Reclamation Plant /WRP (Recycle)		
<b>Total</b>		<b>: IDR 17 T ≈ USD 1,868 Millions</b>

## Potential Revenue from Toll Road

- **Estimated LHR (Daily Average of Traffic Amounts) : 51,000 vehicles/day**
  - ▶ captive market 25% of Sedyatmo toll road users
  - ▶ based on LHR sedyatmo toll road data until December 2005 is 203,138 vehides/day
- **Captive market :**
  - ▶ short route (manggarai – tanah abang) ± 4 km : 20%
  - ▶ medium route (manggarai – roxy) ± 8.5 km : 20%
  - ▶ far route (manggarai – Soeta airport) ± 18 km : 60%
- **Tariff per km (assumption) : IDR 1,000/km** → (tariff in 2008)
  - ▶ based on SMART-KL, Malaysia data, assumption tariff/km = IDR 1,666/km
- **Effective days used : 350 days**

Toll Road Route	Length (km)	Daily Average of Traffic Amounts		estimated tariff (IDR/vehicles)	Potential Revenue	
		(vehicles/day)	%		(IDR/day)	(IDR/annum)
1 short	4	10,200	20%	4,000	40,800,000	14,280,000,000
2 medium	8.5	10,200	20%	8,500	86,700,000	30,345,000,000
3 far	18	30,600	60%	18,000	550,800,000	192,780,000,000
	10.17	51,000	100%	10,167	678,300,000	237,405,000,000

- **Potential revenue from toll road is IDR 237,405,000,000 per annum, or IDR 237,000,000,000 (rounded down) eq. to USD 26,000, 000 per annum**



## Potential Revenue from Waste Water, Water Reclamation, Electricity, Fertilizer, and Utility Shaft

▶ Area of Central Zone	:	6,932	ha
▶ Population	:	450	People/hectare
▶ Total Population served	:	3,119,400	nos
▶ Waste water production per people	:	100	lt/people/day
▶ Total Waste Water	:	311,940	m <sup>3</sup> /day
	:	113,858,100	m <sup>3</sup> /annum
	:	114,000,000	m <sup>3</sup> /annum ( rounded up)



## Potential Revenue from Waste Water

### ► Waste Water Charges (sources data : JWDP, 2000)

● Average Charges	:	1,900	IDR/m <sup>3</sup>	→(2008)
● Potential Revenue	:	216,600,000,000	IDR/annum	
	:	217,000,000,000	IDR/annum (rounded up)	
eq. to	:	24,000,000	USD/annum	



## Potential Revenue from Water Supply

● Estimated Tariff	:	2,500	IDR/m3	→ 2008
● Volume of water Produced	:	265,149	m3/day	→ 85% of total waste
	:	96,779,385	m3/annum	
● Potential Revenue	:	241,948,462,500	IDR/annum	
	:	242,000,000,000	IDR/annum (rounded up)	
Eq. to	:	26,600,000	USD/annum	

# Potential Revenue from Organic Fertilizer

• Estimated price	:	1,200	IDR/kg	—————>	Based on current urea prices per kg in 2006
	:	1,400	IDR/kg	—————>	Estimated price in 2008
• Specific Gravity	:	1.13	ton/m3		
• Total Waste to be Treated	:	17,078,715	m3/annum	—————>	Assumption of waste to be treated for organic fertilizer is 15% of total waste (113,858,100 m3/annum)
	:	19,298,948	ton/annum		
	:	19,298,947,950	kg/annum		
• Percentage of fertilizer from waste	:	0.20%		—————>	Milwaukee, USA can produce 2 kg organic fertilizer from 1 ton of waste
	:	38,597,896	kg/annum		
• Potential Revenue	:	54,037,054,400	IDR/annum		
	:	54,000,000,000	IDR/annum (rounded down)		
Eq. to	:	6,000,000	USD/annum		

## Potential Revenue from Methane Gas (Electricity)

- **Estimated Price** : **4,500 IDR/kg** → Based on current retail price of LPG :  $\text{IDR } 55,000 / 12\text{kg} = \text{IDR } 4,583/\text{kg}$
- **Total methane gas for electricity** : **8,491,537 kg/annum** → Based on assumption of  $\text{CH}_4$  (gas methan) =  $0.22 \times$  biosolid
- **Potential Revenue** : **38,211,916,941 IDR/annum**  
: **38,000,000,000 IDR/annum (rounded down)**  
: **4,000,000 USD/annum**

Note :

1. *Potential revenue from methane gas could also achieve through Carbon Finance Scheme;*
2. *This scheme is being implemented by Bekasi local government through methane gas conversion sale from TPA Sumur Batu to Dutch Government with 15 year concession period.*

## Potential Revenue from Utility Shaft

● Length of Utility Shaft	:	22	km
● no. of users (assumption)*	:	7	operators
● Potential Revenue	:	23,000,000,000	IDR/annum
	Eq. to:	2,500,000	USD/annum

\*) *assumption no of user*

<i>water</i>	:	<i>1</i>	→	<i>palyja/tpj</i>
<i>electricity</i>	:	<i>1</i>	→	<i>pln</i>
<i>gas</i>	:	<i>1</i>	→	<i>pgn</i>
<i>telecommunication</i>	:	<u><i>4</i></u>	→	<i>telkom, indosat, xl,cdma</i>
<i>total</i>	:	<i>7</i>		





## Estimated Revenue per Year (based price 2008)

1.	<b>Toll Road</b>	= IDR 237 B ≈ USD 26 Millions
2.	<b>Waste Water</b>	= IDR 551 B ≈ USD 60.6 Millions
	- Waste Water Service Charges	: IDR 217 B ≈ USD 24 Millions
	- Water from Reclamation	: IDR 242 B ≈ USD 26.6 Millions
	- Electricity	: IDR 38 B ≈ USD 4 Millions
	- Fertilizer	: IDR 54 B ≈ USD 6 Millions
3.	<b>Utility Shaft</b>	= IDR 23 B ≈ USD 2.5 Millions
		<hr/>
<b>Total Revenue per annum</b>		= IDR 811 B ≈ USD 89.1 Millions



## **Operation and Maintenance Cost per Year (based price 2008)**

- ***Toll Road : 20% x IDR 237 B = IDR 47.4 B ≈ USD 5.2 Millions***
- ***Waste Water : 20% x IDR 551 B = IDR 110.2 B ≈ USD 12.1 Millions***
- ***Utility Shaft : 5% x IDR 23 B = IDR 1.15 B ≈ USD 0.2 Millions***

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**Total Operation & Maintenance cost = IDR 158.75 B**  
**= IDR 159 B (rounded up)**  
**Eq. to = USD 17.5 Millions**



# **Flood Damages Prevention (FDP) Government**

**Flood Damages Prevention (FDP)**

**0.5 x 1/3 x IDR 18.7 T**

**or approximately**

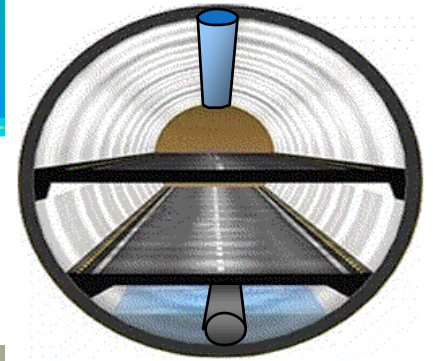
**= IDR 3.11 T (for 5 year)**

**Eq. to = USD 342 Millions**

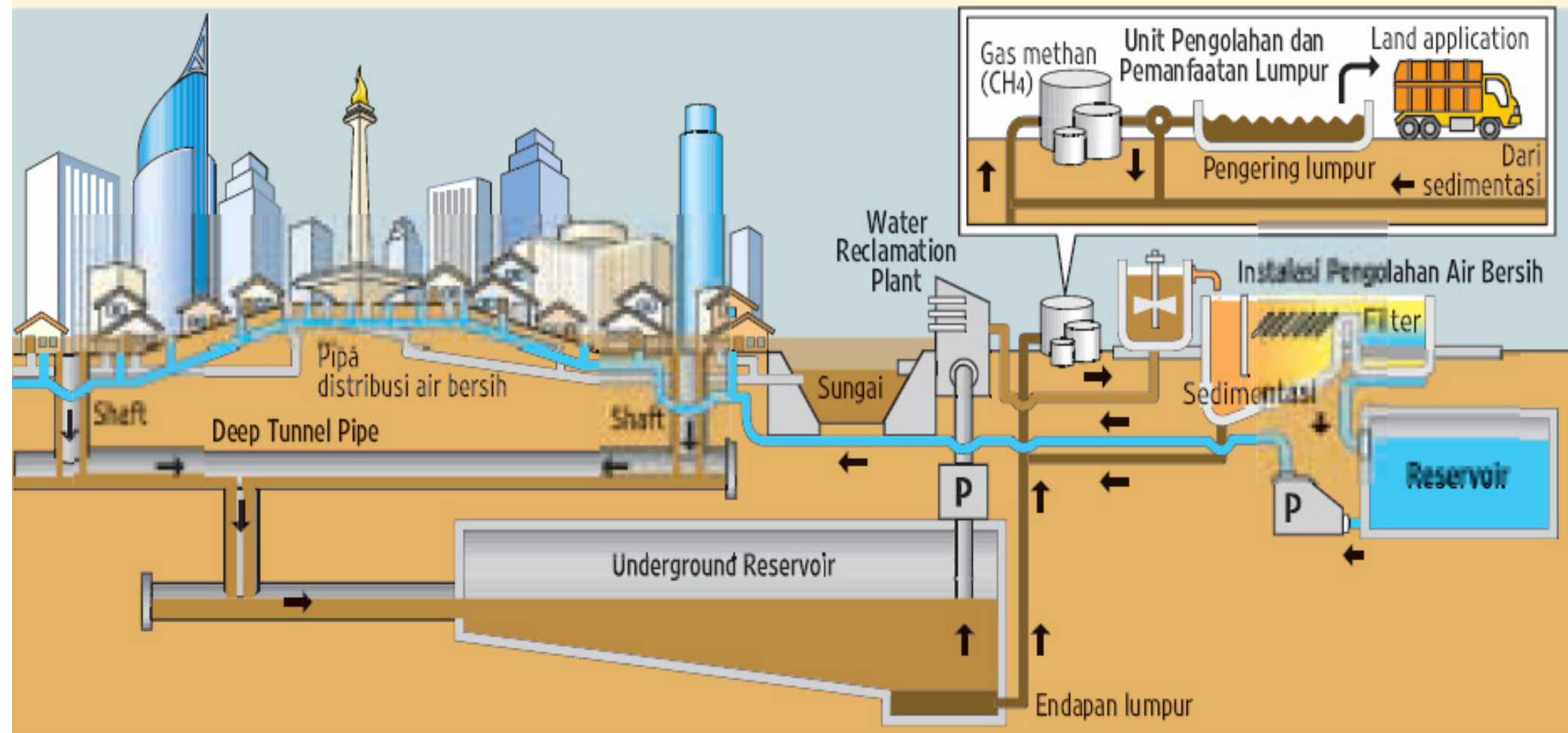
**= IDR 623 B (per annum )**

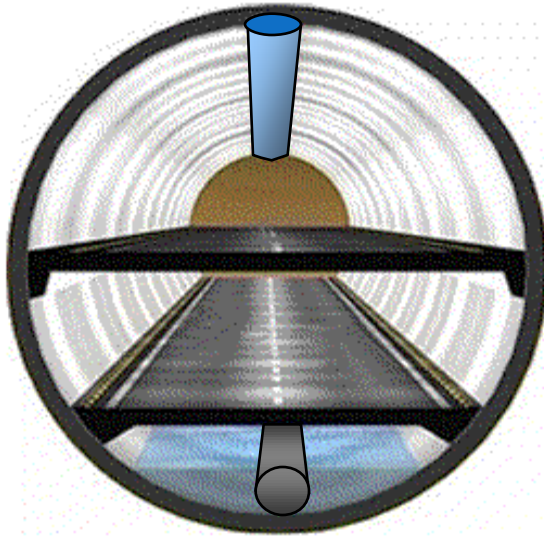
**Eq. to = USD 68 Millions**

# JAKARTA MULTIPURPOSE DEEP TUNNEL (MPDT) SYSTEM



## Jakarta Deep Tunnel





**Thank You**