Fecal Sludge Management

A Case Study of Malaysia

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No.Syarikat 211763-P

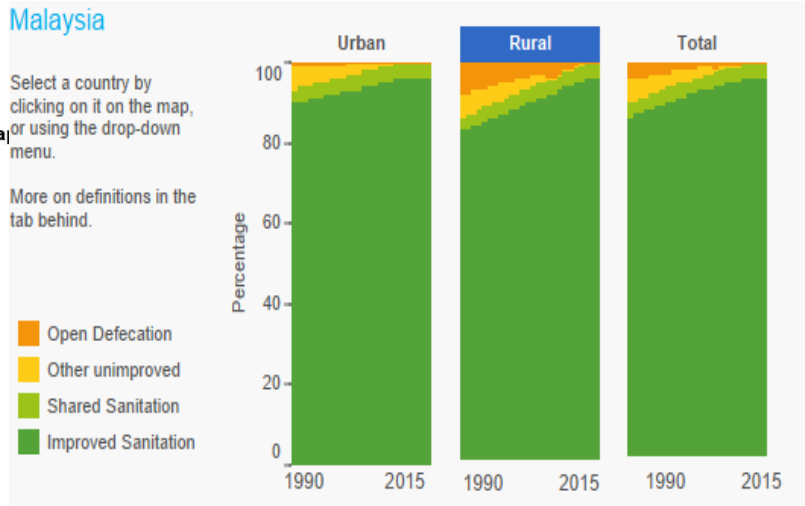
Status of Sanitation & Environmental Health in Malaysia

14 States | 144 Local Authorities | Population: 32 Million |189 River Basin

96%
Population with access to improved sanitation

70%
Population Connected to Wastewater Treatment Systems

90%
Increase in ratio of Clean Rivers in 2015 vs 1993



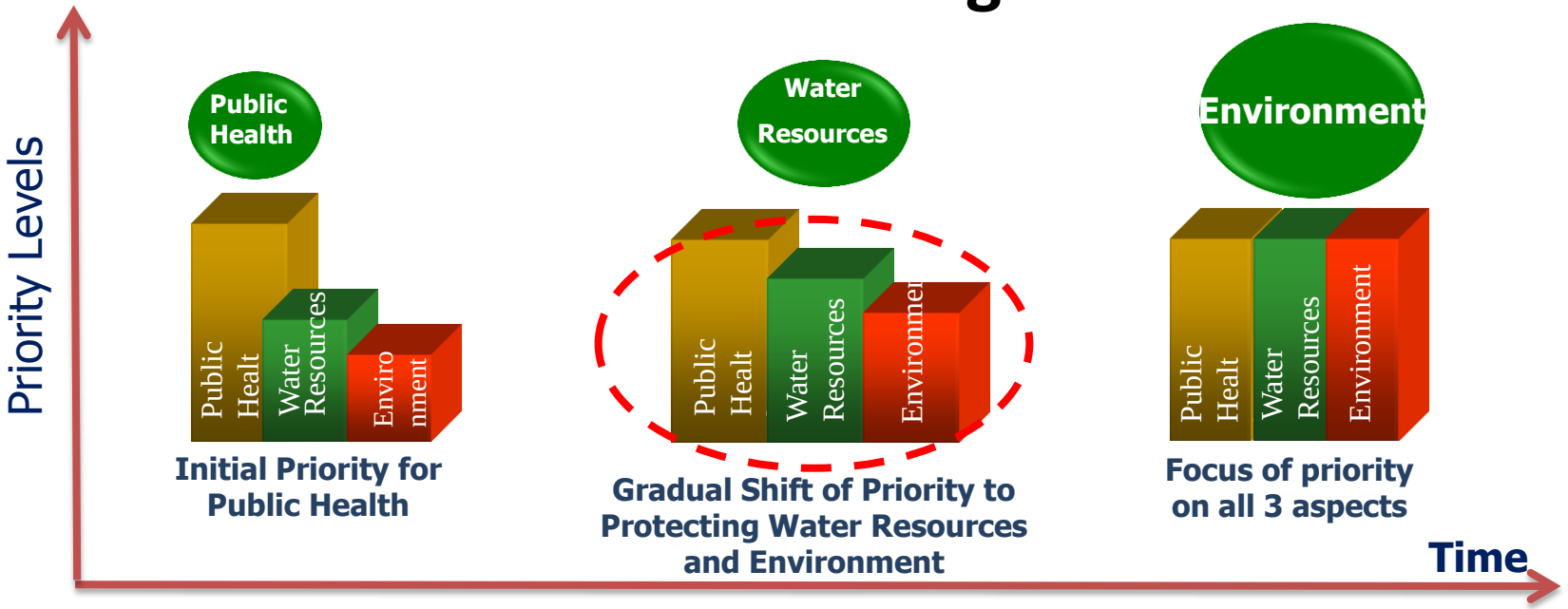
26%
Population Connected to Septic Tanks

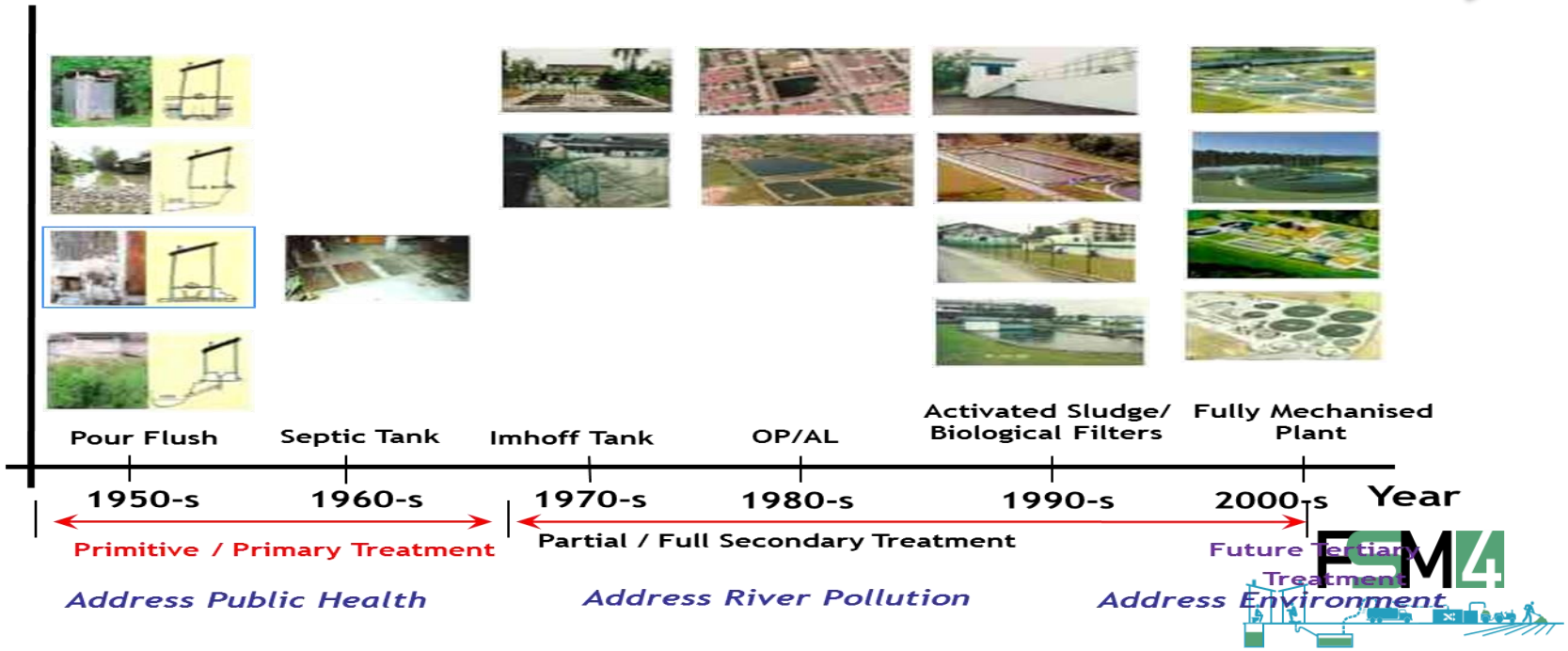
95.5%
Population served with Piped Water Services

Water Borne Disease Related to Sewage Pollution => **Negligible**

FSM4

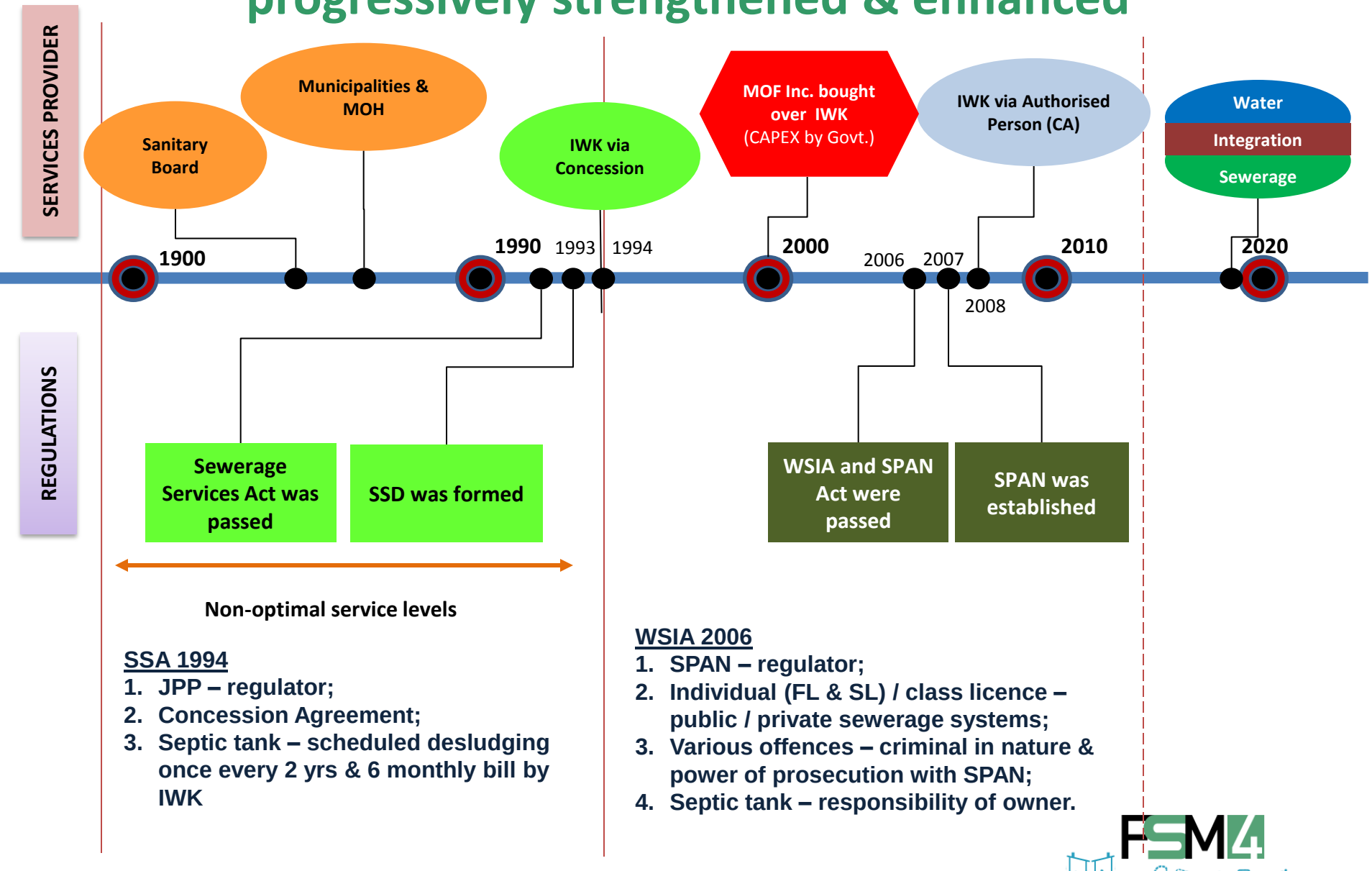
The Needs of Sewerage Services





Sewerage Management in Malaysia

progressively strengthened & enhanced



SSA 1994

1. JPP – regulator;
2. Concession Agreement;
3. Septic tank – scheduled desludging once every 2 yrs & 6 monthly bill by IWK

WSIA 2006

1. SPAN – regulator;
2. Individual (FL & SL) / class licence – public / private sewerage systems;
3. Various offences – criminal in nature & power of prosecution with SPAN;
4. Septic tank – responsibility of owner.

IWK's Key Obligations

a) Manage, operate, maintain the existing and new public sewerage systems;
b) Upgrade and refurbish the existing public sewerage systems;
c) Plan, design, construct and commission new public sewerage systems;
d) Receive, collect, treat and dispose of sewage and sewage sludge
e) Empty, transport, treat and dispose of sewage sludge from septic tanks
f) To collect and retain sewerage charges from customers

Note :

Item (b) and (c) are not carried out since Water Services Industry Act (WSIA) 2006 was enforced.

The role is being undertaken by the Government.

Spirit of the WSIA 2006 :

- **OPERATOR TO BE ASSET LIGHT**
- **OPERATOR FOCUS ON DELIVERY OF SERVICE TO CUSTOMERS**

Governance Structure of Sewerage Services in Malaysia

Ministry of Energy, Green Technology and Water

Undertakes Refurbishment or Upgrading Projects Funded by Government

Ministry of Finance

Owns Indah Water through the Minister of Finance Incorporated

Ministry of Natural Resources & Environment

National Water Services Commission

Policy & Control of National Sewerage Agenda by Government

Regulates Sewerage Services

Regulates Effluent Discharge

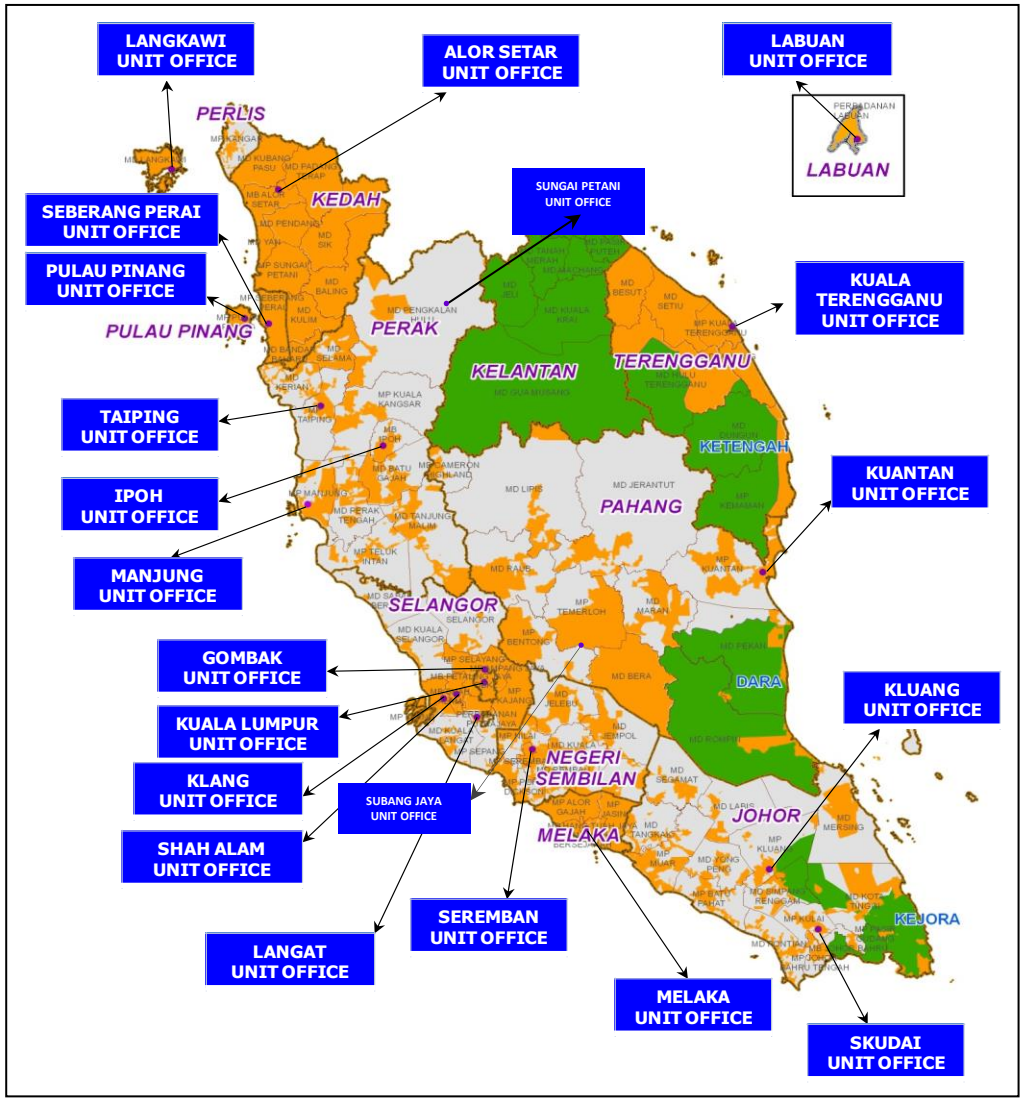
Department of Environment

Ensures a well balanced and sustainable management of natural resources and environment

1. Provision of Sewerage Services in 87 Local Authority Areas
2. Sewerage Services Billing & Collection

IWK Operates in Peninsular Malaysia

excludes Kelantan, Part of Johor, Sabah & Sarawak

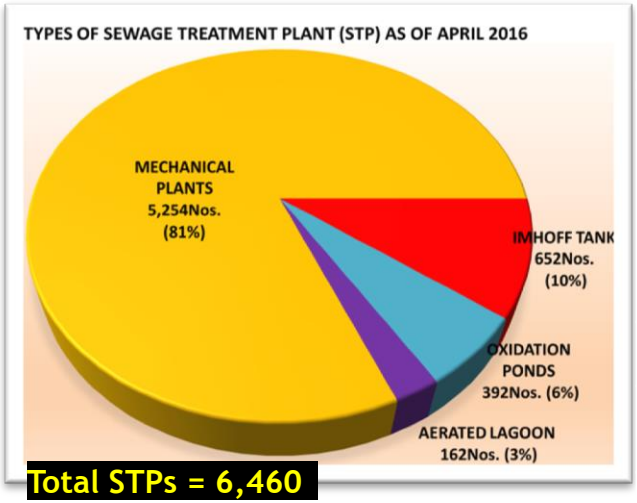


Business Dimension	2000	2016
Total Unit Offices	17	**21**
No. of Local Authorities	86	**87**
No. of STP	3,003	**6,460**
No. of CST	3,454	**3,637**
No. of IST	890,870	**1,278,904**
No. of NPS	277	**1,063**
Sewer length (km)	9,236	**18,153**
Total PE	9.0Mil	**23.1Mil**
No. of billed customers	1.4 Mil	**3.7 Mil**

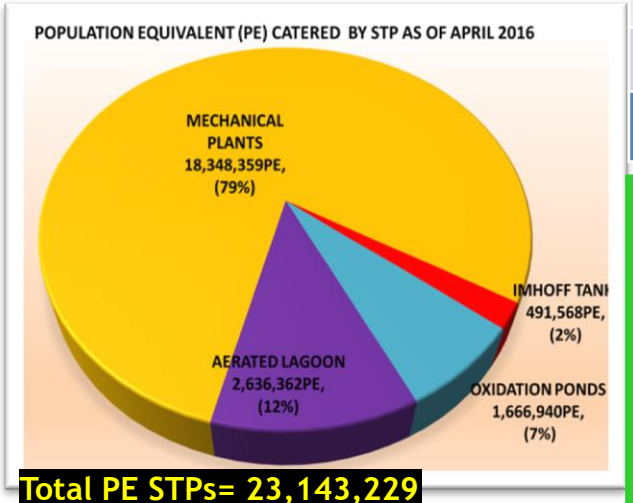
Data as of 2016

- IWK Operational Area
- Non IWK Operational Area
- Outside Local Authority Areas

Profile of Public Sewage Treatment Plants



Total STPs = 6,460



Total PE STPs= 23,143,229

TYPE OF SERVICE AND POPULATION SERVED

Type of Service	IWK Service Areas				Total PE	%
	Public (IWK)		Private / Individual (Non-IWK)			
	No	PE	No	PE		
Connected	6,460	23,143,229	4,682	2,958,572	26,101,801	70.5
CST	-	-	3,637	412,673	412,673	1.1
Septic Tank	-	-	1,278,904	6,394,520	6,394,520	17.3
Pour Flush	-	-	826,388	4,131,940	4,131,940	11.2
Total	6,460	23,143,229	2,113,611	13,897,705	37,040,934	100

Aspects	% of PE			
	Urban		Rural	
	Connected	Septic Tank	Connected	Septic Tank
Concession Target	84.3%	15.7%	29.5%	70.5%
Current Status	73.2%	17.8%	38.7%	31.1%

	PE<5,000	5,000<PE≤20,000	PE>20,000	TOTAL
STP No	5,646	654	160	6,460
Total PE	6,503,012	6,109,100	10,531,117	23,143,229

13% STP>5,000PE; serving 72% of PE

FSM4

Various Sewerage System Types Co-exist in a City

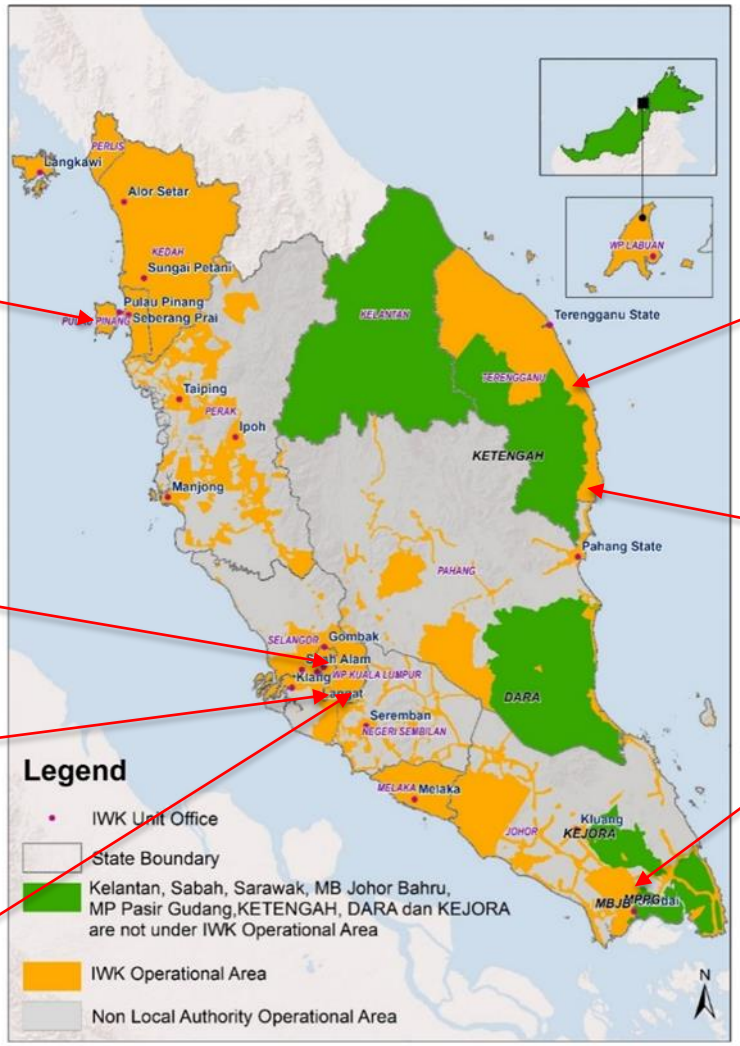
in varying proportion, based on the need of the City

Penang
STP = 1.3 Mil PE
(3 Regional STP, 144 Local STP)
Septic Tanks = 0.04 Mil PE
Pour flush = 0.03 Mil PE

Kuala Lumpur
STP = 3.5 Mil PE
(10 Regional STP, 181 Local STP)
Septic Tanks = 0.27 Mil PE
Pour flush = 0.025 Mil PE

Subang Jaya
STP = 1.7 Mil PE (6 Regional STP, 119 Local STP)
Septic Tanks = 0.04Mil PE
Pour flush = 0.01 Mil PE

Putrajaya
STP = 0.3 Mil PE (2 Regional STP)
Septic Tanks = Nil
Pour flush = Nil

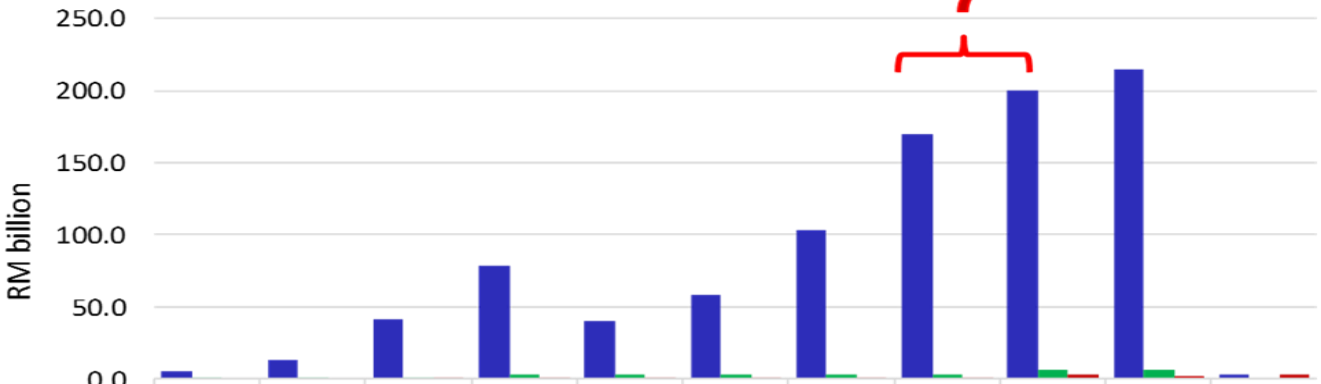


Kuala Terengganu
STP = 0.08 Mil PE
(0 Regional STP, 118 Local STP)
Septic Tanks = 0.15 Mil PE
Pour flush = 0.17 Mil PE

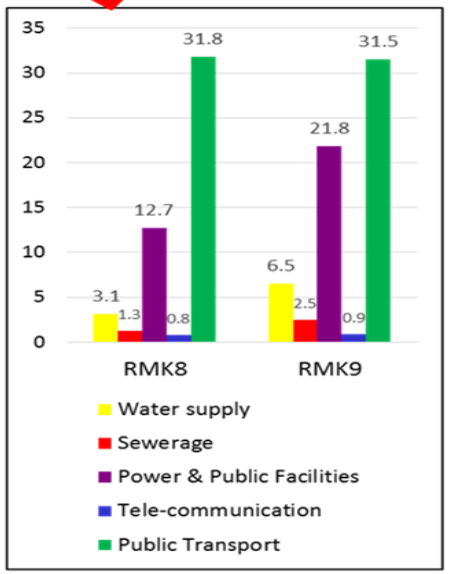
Kemaman
STP = 0.04 Mil PE (0 Regional STP, 25 Local STP)
Septic Tanks = 0.1Mil PE
Pour flush = 0.2 Mil PE

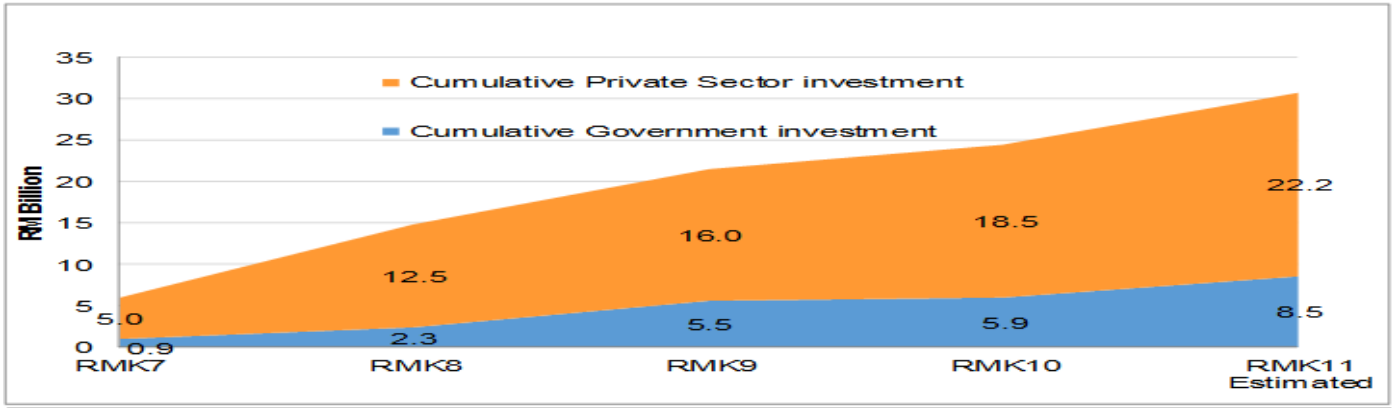
JB Tengah
STP = 1.3 Mil PE
(12 Regional STP, 120 Local STP)
Septic Tanks = 0.2 Mil PE
Pour flush = 0.002 Mil PE

Investment In Sewerage Infrastructure



	RMK1	RMK2	RMK3	RMK4	RMK5	RMK6	RMK7	RMK8	RMK9	RMK10	**RMK 11-RP1
Total Allocation	5.3	13.1	41.1	78.5	40.0	58.5	103.6	170.0	200.0	215.0	2.6
Water Supply	0.2	0.3	0.9	2.8	3.2	3.5	3.1	3.1	6.5	6.5	*NA
Sewerage	0.0	0.0	0.2	0.3	0.1	0.5	0.6	1.3	2.5	2.3	2.6





- Government investment in sewerage infrastructure to-date (up to RMK11) is estimated at RM9 billion.
- Private sector is estimated to have invested nearly RM22.2 billion to-date in sewerage infrastructure.
- The sewerage development, which is predominantly driven by developers, has resulted in many problems.

Impact Due To Shortfall In CAPEX Investment:

- The imbalance in investment by the Government and private sector has resulted in the sewerage industry being not on par with other utilities.
- Ad-hoc development by private sector has caused IWK to increase its operational costs in addition to higher risks to the environment.

Sewerage Services Tariff in Malaysia

since 1994

Regulated under the Sewerage Services (Charges) Regulations 1994

DOMESTIC & GOVERNMENT QUARTERS		
Category / Description	***Connected (RM)***	***Septic Tank(RM)***
Domestic premises & Government Quarters class A, B, C, D and E	**8.00**	**6.00**
New Village	**3.00**	**3.00**
Low Cost premises & Government Quarters class F, G, H and I	**2.00**	**2.00**

1 USD = RM 4.45 | RM 1 = INR 15.04

GOVERNMENT PREMISE	
Connected (RM)	***Septic Tank (RM)***
40.00	**25.00**
Excess Charge of RM0.45 per m3 (>100m^3)	
Excess Charge of RM0.95 per m3 (>200m^3)	

INDUSTRIAL PREMISE	
Connected (RM)	***Septic Tank (RM)***
RM2.50 per person	**RM2.00 per person**
Min charge of RM25.00 per month	***Min charge of RM20.00 per month***

COMMERCIAL PREMISES				
Band	**Min Annual Value (RM)**	**Max Annual Value (RM)**	***Connected (RM)***	***Septic Tanks (RM)***
1	0	2,000	8.00	7.00
2	2,001	5,000	14.00	8.00
3	5,001	10,000	20.00	14.00
4	10,001	20,000	26.00	19.00
5	20,001	30,000	29.00	21.00
20	5,000,001	7,000,000	9,200.00	6,000.00
21	7,000,001	above	9,600.00	6,600.00

Avg Water Consumption per month (m^3)	Excess Charge per m^3 (RM)
100 or less	Exempted
Above 100 to 200	0.30
Above 200	0.45

Improvement in Sewerage Services


IWK terbaik Asia

KUALA LUMPUR 2 April - Ketiasama Alam Sekitar-Asia (ECO-Asia) telah memilih penyedia perkhidmatan pembetungan Malaysia, Indah Water Konsortium Sdn Bhd (IWK), sebagai pengendali contoh bagi amalan terbaik dalam rawatan pembetungan untuk diikuti pengendali lain di Asia.

Eco-Asia, sebuah program senatau yang menggalakkan peningkatan kemudahan mendapatkan air bersih dan perkhidmatan sanitasi, kini membantu beberapa pengurus air dan buangan di rantau ini daripada segi pengurusan sanitasi.

Pengarah IWK, Suhaimi Kamaruzaman berkata, IWK akan berkongsi kepakaran dan pengalamannya dalam rawatan pembetungan dengan pengendali yang 'memerlukan', yang dikenal pasti oleh ECO-Asia.

Suhaimi berkata demikian kepada pembentita selepas upacara menandatangani memorandum persefahaman antara IWK dan ECO-Asia di sini hari ini.

ECO-Asia ditaiyai oleh Agensi Pembangunan Antarabangsa Amerika Syarikat.

Suhaimi berkata, usaha yang dijalankan bersama oleh IWK dan ECO-Asia itu akan membantu memantah baik perkhidmatan rawatan air dan pembetungan di bandar-bandar di Asia.

Kata beliau, IWK akan mengerjakan penyelesian dan analisi inovatifnya melalui latihan dan bengkel.

"Mereka ECO-Asia) akan menemui pengendali-pengendali di negara-negara lain yang memerlukan bantuan, kita akan bantu dengan latihan... kita akan sediakan sokongan," jelas Suhaimi.

"Sama ada mereka (pengendali berkenaan) datang ke Malaysia untuk melihat sendiri (operasi IWK) atau kita ke sana untuk berkongsi pengalaman kita," katanya.

— Bernama

- Operations & Maintenance
- Risk Management
- Desludging Services
- Compliances
- Enhanced Security
- Monitoring System

Operational

Infrastructures

- Asset Management System
- Nationwide Catchment Strategy
- Guidelines Standardisation
- Product Standardisation
- STP Standardisation
- Green Technology
- Management IT Support System

Capacity Development

- Training & Certification
- R&D & Innovation

KEY IMPROVEMENT

Public Awareness

- Communications
- Public Campaigns
- Education

Collection Trends

- Billing & Collection Mechanism

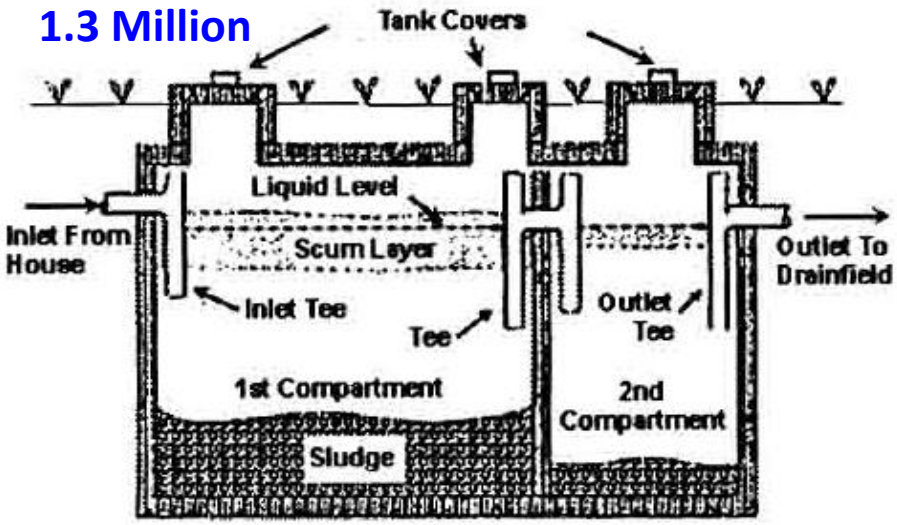
Customer Services

- Operational Complaints
- Level of Services

SEPTIC TANKS IN MALAYSIA

INDIVIDUAL SEPTIC TANKS

1.3 Million

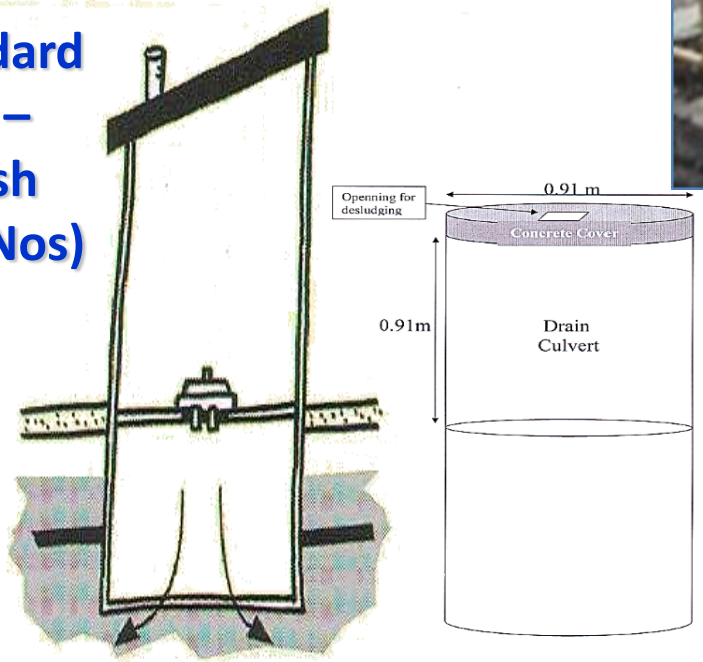


CAST IN-SITU

PREFABRICATED

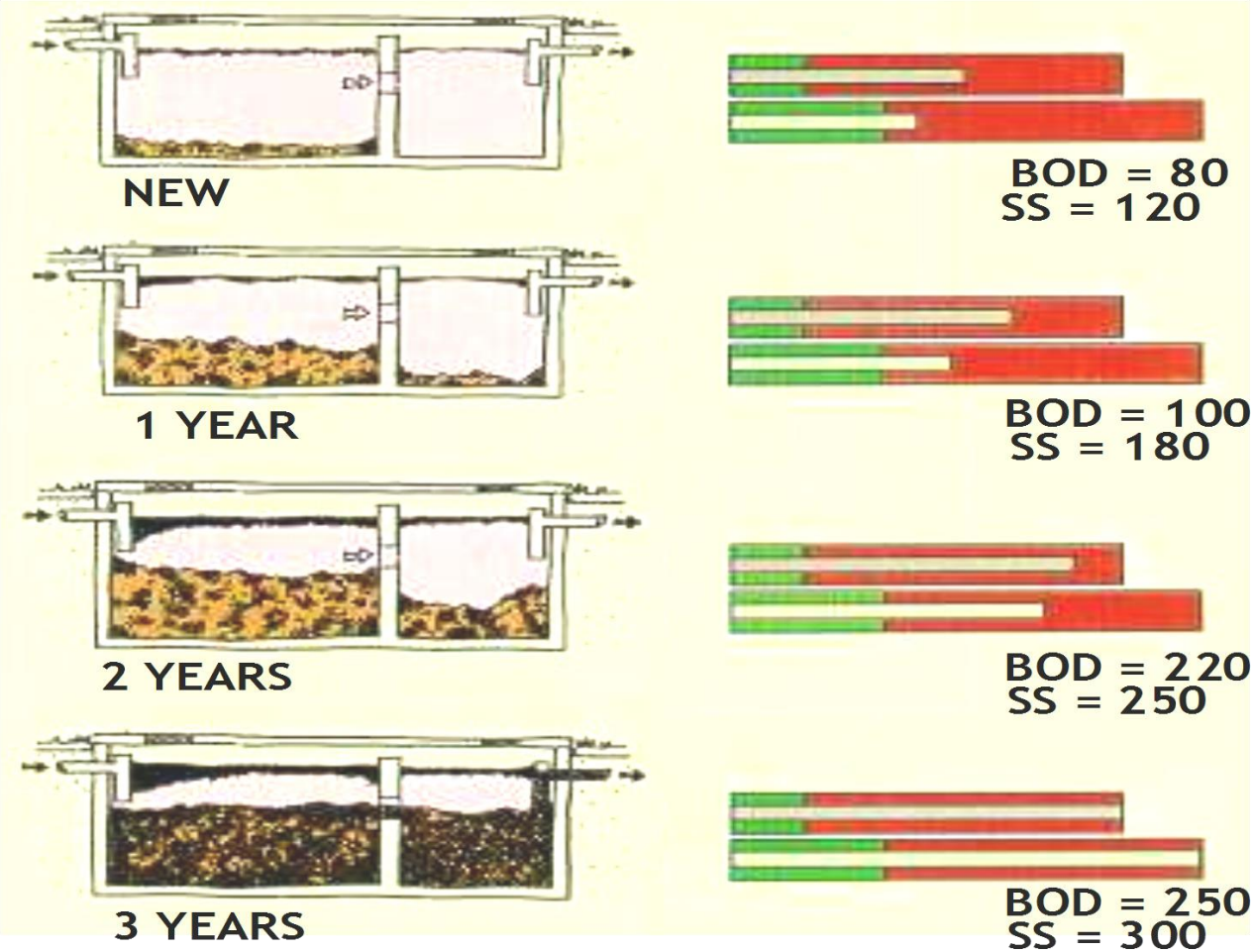
COMMUNAL SEPTIC TANK **(3600 Nos)**

Non Standard System – Pourflush (800,000 Nos)



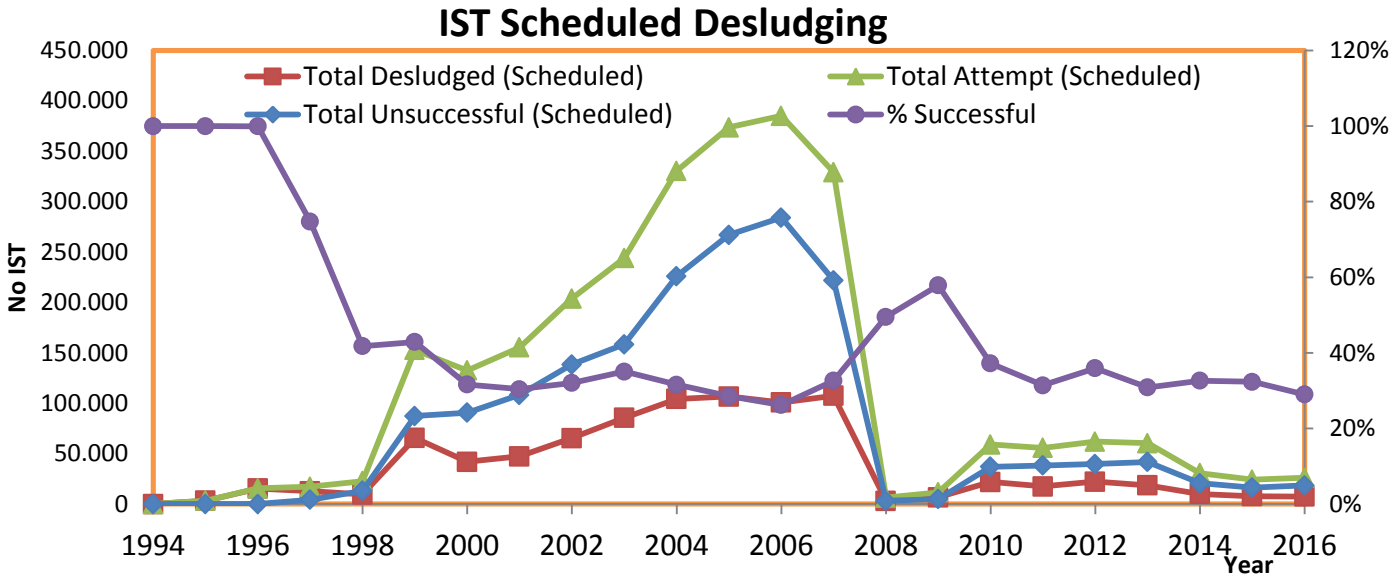
Septic Tanks Need to be Desludged or Emptied

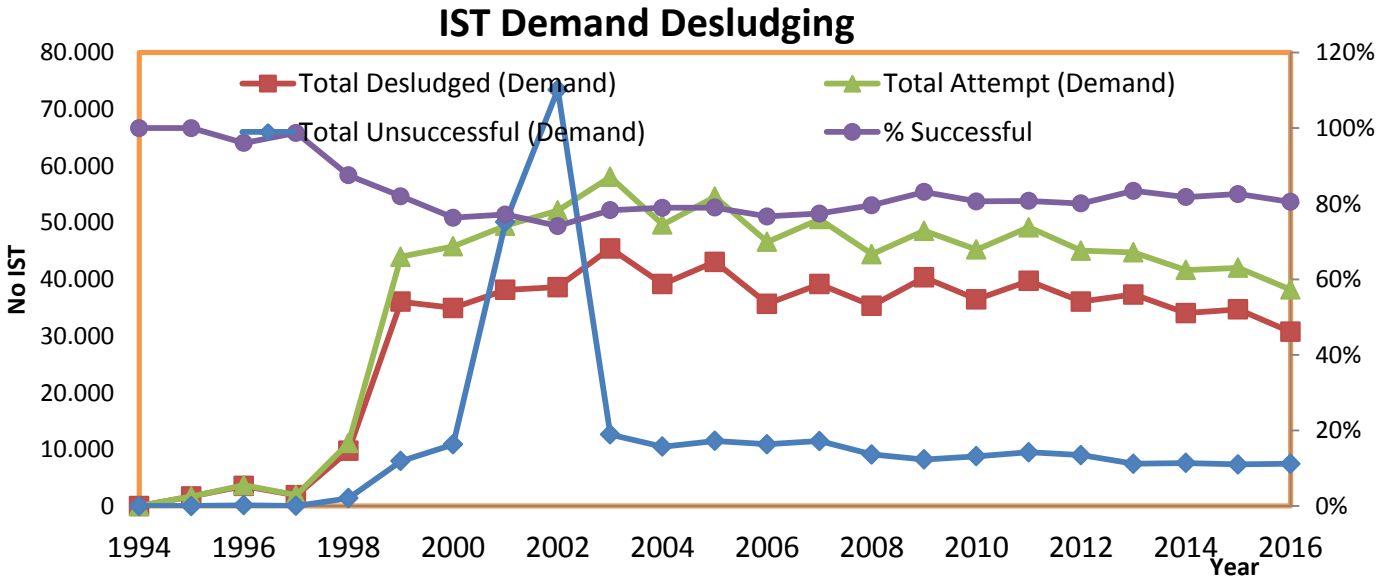
2 to 3 years cycle depending on household occupancy



Septic Tank Desludging Status in Malaysia

Two Types of Services – Scheduled and Demand

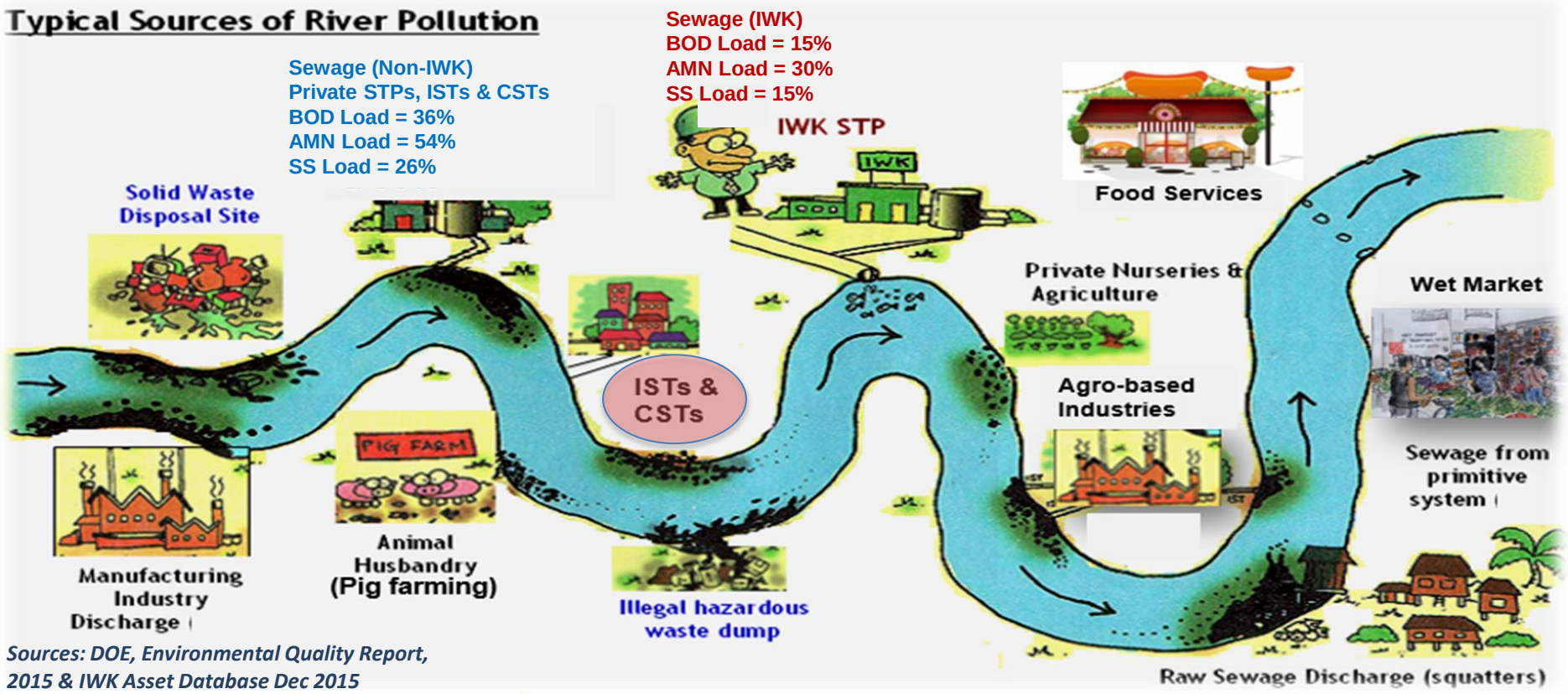




- Achieve 30% success rate
- Unsuccessful reasons:
  - Refused access
  - Nobody home
  - Obstruction
  - Inaccessible
  - Lack of enforcement
- Liberalization of desludging services
- Onus on the house owners/occupier to ensure septic tank is desludged – scheduling stopped

Sources of River Pollution in Malaysia

- Sewage Tops the List



Sources: DOE, Environmental Quality Report, 2015 & IWK Asset Database Dec 2015

SOURCES	BOD LOAD (%)	SS LOAD (%)	AMN LOAD (%)
Animal farm (Pig farming)	41	49	11.3
Sewage	51	41	83.7
Manufacturing Industries	5	6	1.5
Agro-based Industries	2	3	3.4
Wet Market	1	1	0.1
TOTAL	100	100	100

Investing in sewerage infrastructure is important but actions are also needed to address other polluters, if river pollution is to be effectively addressed

Sources of River Pollution in Malaysia

Septic Tanks are the Major Source

ESTIMATION OF LOADINGS (BOD, SS & AMN) FROM VARIOUS SEWAGE SOURCES (as at December 2015)

Types	Sources	PE	Regulatory Standard	Total Loading (kg/day)		
				BOD	SS	AMN
Public Plants (IWK) [1,2,3]	6,397	22.65 mil	EQ(S)R, 2009	80,833	138,183	69,147
Private Plants [4]	4,626	3.03 mil	EQ(S)R, 2009	34,081	68,163	34,081
CST [4]	3,637	0.41 mil	EQ(S)R, 2009	7,428	6,685	3,714
IST (Desludged) [5, 7]	215,463	1.08 mil	No regulatory standard	19,392	17,453	9,696
ISTs (Non Desludged) [6]	1,058,515	5.29 mil	No regulatory standard	119,083	142,899	47,633
Pour Flush / Primitive System [6]	826,388	4.13 mil	No regulatory standard	92,969	111,562	37,187
TOTAL		**36.58 mil**		**353,786**	**484,945**	**201,459**

Note: Data provided is within IWK services area only

1. **BOD Actual Load from Public Plants (IWK) is 23% of total sewage load**
2. **SS Actual Load for Public Plants (IWK) is 29% of total sewage load**
3. **AMN Actual Load for Public Plants (IWK) is 34% of total sewage load**
4. Allowable total load if all plants were to comply to EQ(S)R,2009 Standards
5. Total loading from ISTs (desludged) based on effluent discharged of BOD=200 mg/l, SS=180 mg/l, AMN = 100mg/l
6. Total loading were taken based on raw sewage discharged (BOD=250 mg/l, SS=300 mg/l, AMN = 100mg/l)
7. Total number of ISTs desludged in year 2013, 2014 and 2015 (3 years cycle)

Fecal Sludge Treatment

Type of Methods, Systems and Technologies

Trenching

Drying Bed

Geobags

Mechanized Sludge Dewatering Facility

Centralized Sludge Treatment Facility

Sludge Lagoon

- There is no one type that fits all purpose
- Built with environmental mindedness

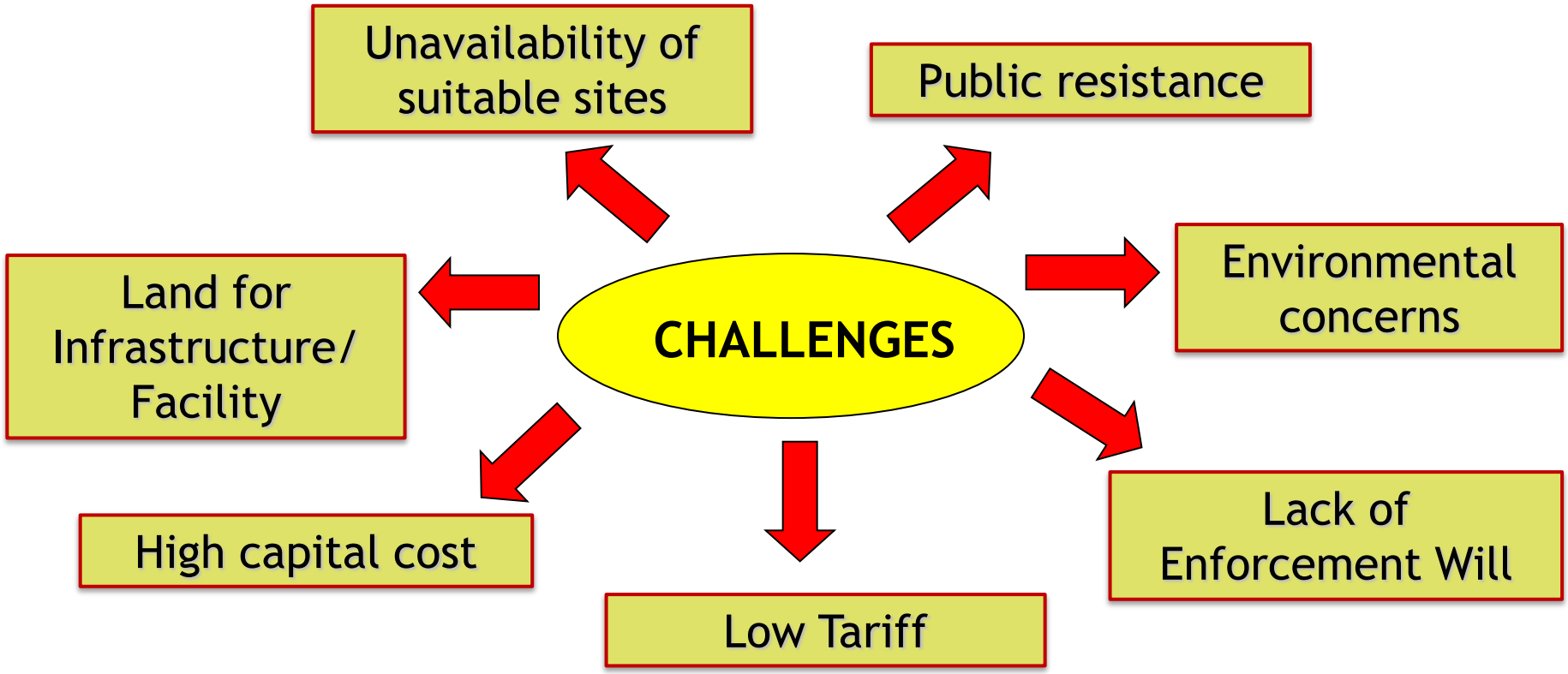
Disposal / Reuse of Sludge

Treated Sludge is not Fecal Matter

- In Malaysia, dewatered sludge is disposed – landfill
- R&D on reuse extensively done
  - Potential for resource recovery
  - Nutrient, energy value
- Reuse – very marginal but gaining interest.
  - Use for landscaping plants by Municipalities.
- Land application, composting – for non food crop
- Leverage on National Green Technology Policy
- Guidelines being developed by the Regulator

Challenges in Fecal Sludge Management

The Malaysian Scenario



Management of Fecal Sludge

Summary & Takeaways

- Engage with stakeholders – from regulators to customers/public
- Enforcement
  - Empower the main providers of sewerage and desludging services
- Communications Programme – Public Awareness and Education for ALL stakeholders
  - Use various media forms, from newspapers to Facebook
  - Involve Schools
  - Include Policy and Decision Makers
- Be transparent
  - Institute Customer Charter, Level of Services and Targets
  - Measure, monitor and improve
- Know your customers
  - Collect and capture customer data,
  - Septic tank details – e.g. size, location

Management of Fecal Sludge

Summary & Takeaways

- Exploit on IT system
  - Customer care system
  - Mapping of septic tank areas and customers
- Adapt and adopt Technology to facilitate FSM efficiently and effectively
  - Vehicle Monitoring System (VMS)
  - Instant dewatering of sludge – mobile units
- Operations management – desludging works/logistics, outsourcing/term contractors, sludge treatment and disposal facilities at strategic locations, record keeping
- Develop local vendors, service providers and enterprises
  - Partnership programme
- Capacity Building & Training
- Incentive scheme helps

Management of Fecal Sludge

Summary & Takeaways

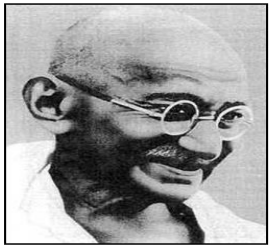
- Selection of Technology for sludge treatment
  - Proven, modular basis, innovative low-medium technology, less demand on operator skill, low energy and O&M cost, efficient land use
  - affordable to the community.
- Be responsible for the fecal sludge
  - Know its quality, quantity and fate (cradle to grave)
- Rebrand “Fecal Sludge” to encourage Recycling and Resource Recovery
- Short Term and Long Term Sludge Management Strategies
- Sustainable tariff and strategies for full cost recovery

Quotes on Sanitation

Indira Gandhi

"Sanitation in India is not only cleanliness; it is also an end of the humiliation and miseries of scavengers who carry human excreta on the head."

" I may not be born again, but if it happens I will like to be born in a family of scavengers, so that I may relieve them of the inhumane, unhealthy and hateful practice of carrying nightsoil."



Mahatma Gandhi

Jawaharlal Nehru

"The day everyone of us gets a toilet to use, I shall know that our country has reached the pinnacle of progress."

THANK YOU

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Lessons Learned from Malaysian Sewerage Management

Water & sewerage to be managed as a full water cycle

- Integration of water & sewerage services

Reduce proliferation of small plants

- Rationalization of plants

Mixed Sewerage Systems in a Catchment/Local Areas

- Institute effective management

Many plant types & sizes affecting efficiency & effectiveness

- Standardization of plants

Escalating cost of operations vs Tariff is not sustainable

- Optimize cost
- Risk management
- Engagement with stakeholders