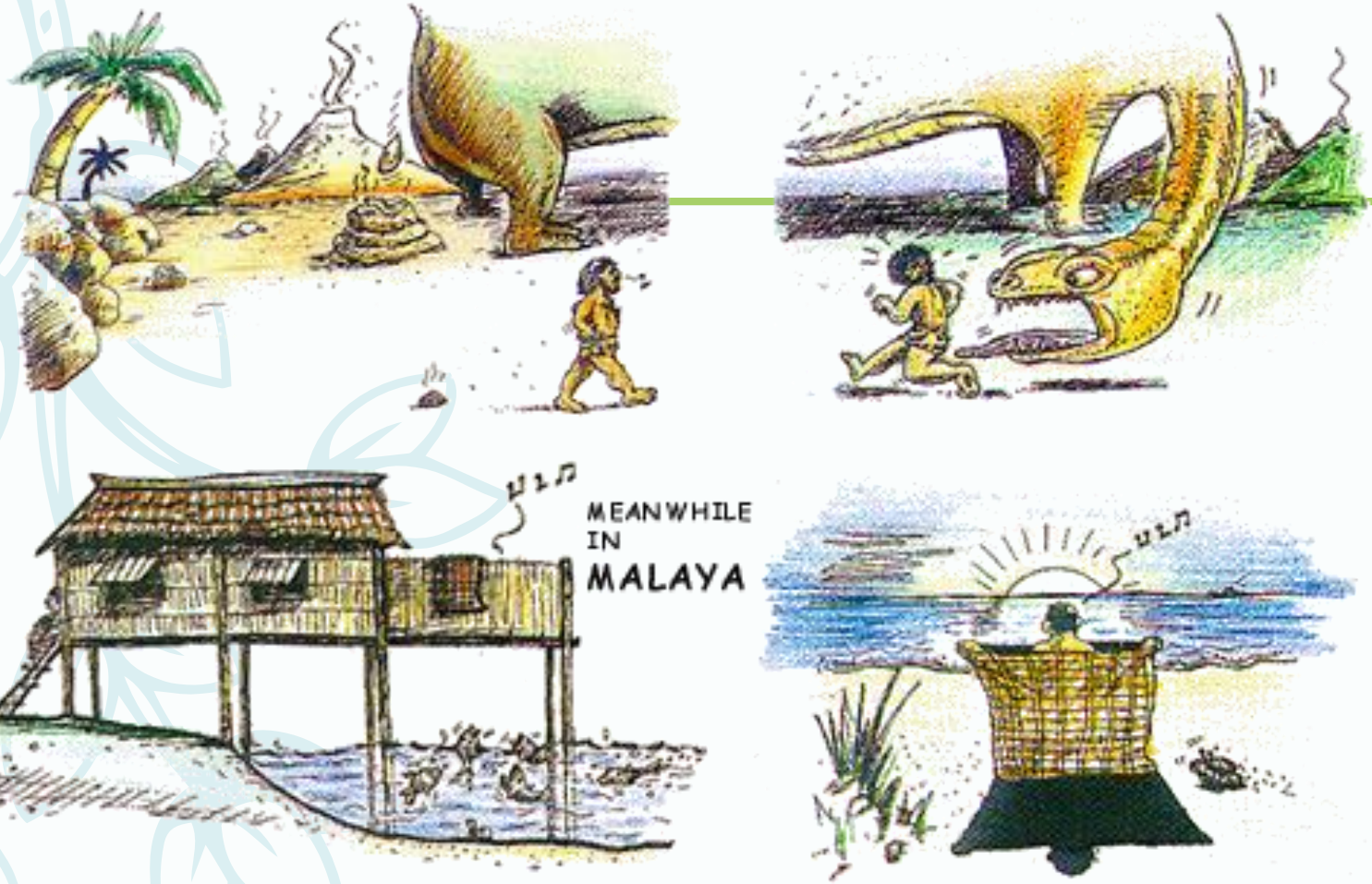
REKABENTUK SISTEM KUMBAHAN UNTUK PROJEK BANGUNAN

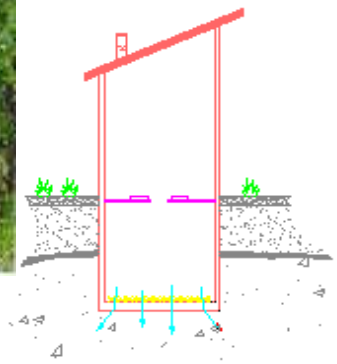
SESI 1:

PENGENALAN DAN KONSEP KERJA PEMBETUNGAN

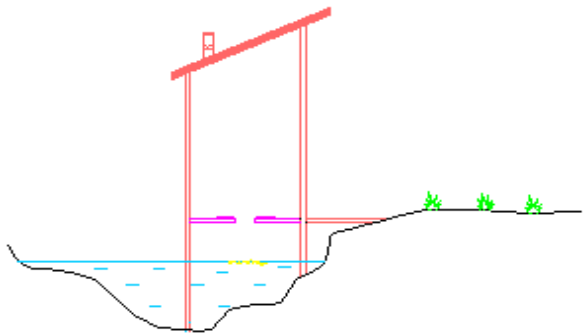
Oleh

Ir. Wan Mohd Nasrul Hadi Bin Wan Ismail


MEANWHILE
IN
MALAYA

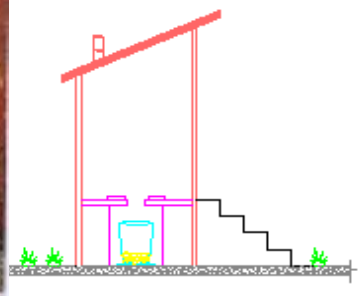


PIT LATRINE

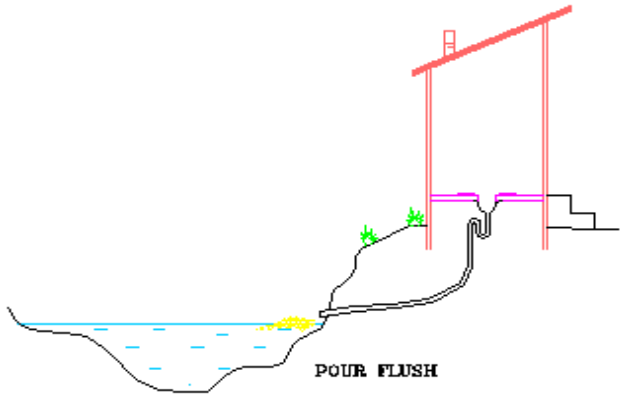


OVERHANGING LATRINE

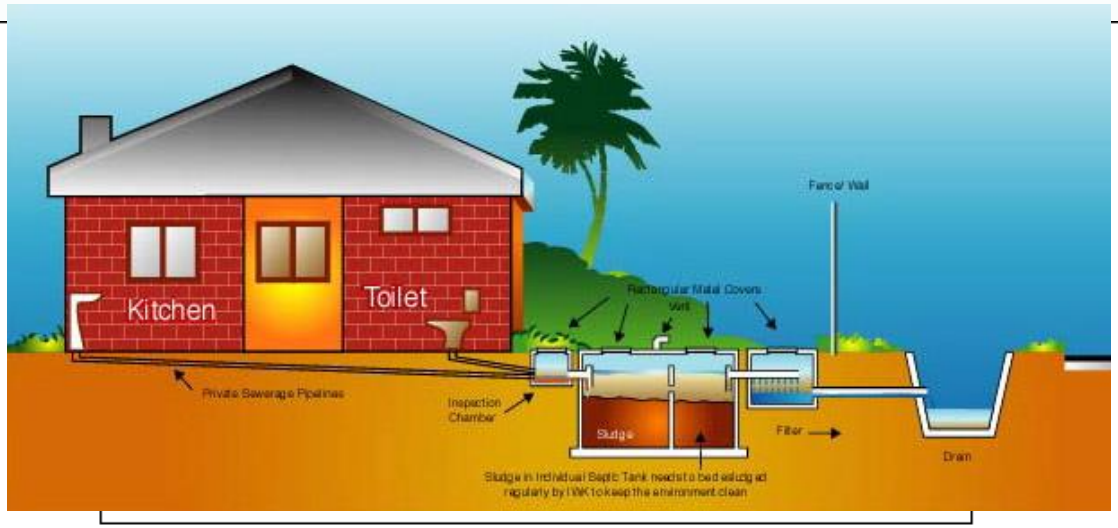
TECHNOLOGY BEFORE MALAYSIA INDEPENDENCE



BUCKET LATRINE



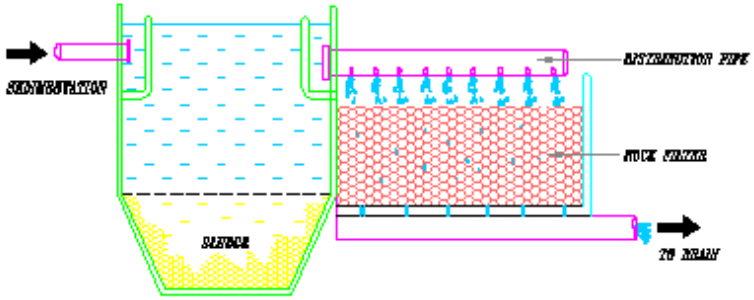
POUR FLUSH



TECHNOLOGY IN 1950s

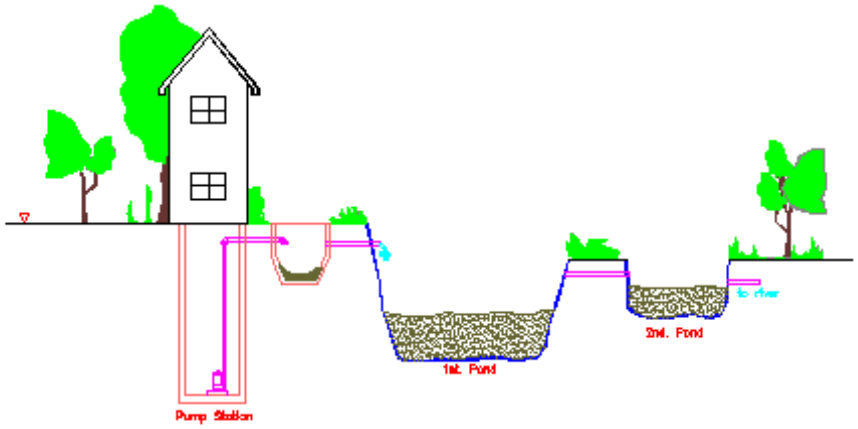
INDIVIDUAL SEPTIC TANK

TECHNOLOGY IN 1960s



IMHOFF TANK

TECHNOLOGY IN 1970s



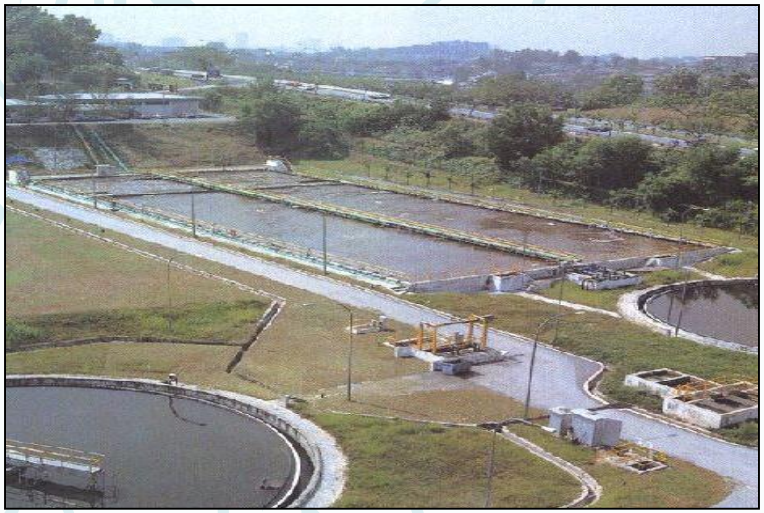
OXIDATION PONDS

Aerated Lagoon (AL)

Technology in 1980s

Technology in 1990s

Rotating Biological Contactor (RBC)



Sequencing Batch Reactors (SBR) (Activated Sludge System)

Extended Aeration System (EA)

INTRODUCTION

- Sewerage system is one of most important infrastructures of residential, industrial and commercial project.
- Consist of a network of underground sewer pipes, inspection chamber, manhole and treatment facilities.

DEFINITION

Sewage

- Sewage is water-carried wastes, in either solution or suspension that is intended to flow away from a community.
- The spent water from residences and institutions, carrying body wastes, washing water, food preparation wastes, laundry wastes, and other waste products of normal living, are classed as domestic or sanitary sewage.
- Under this guideline, noted that *clinical wastes* are not covered.

DEFINITION

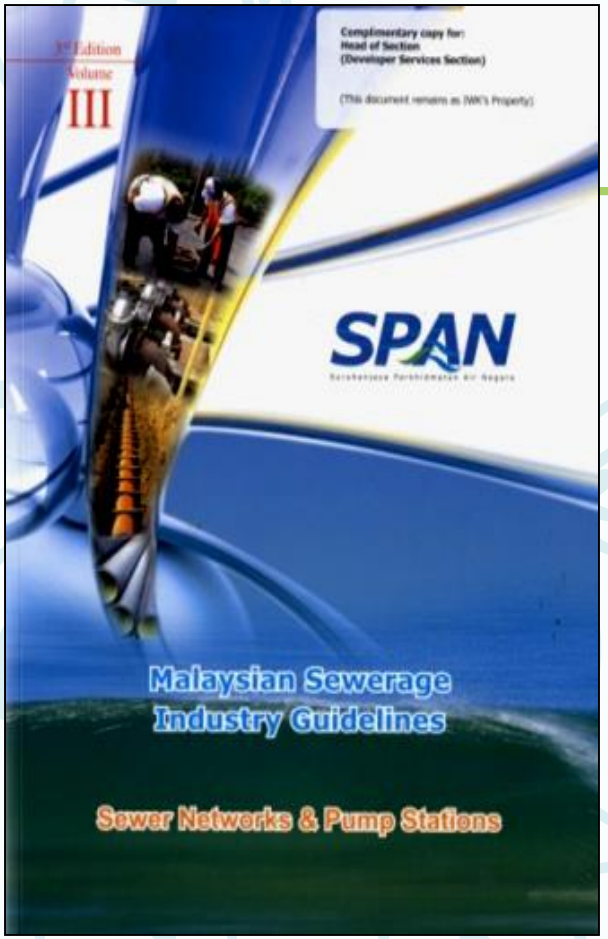
Sewerage

- Sewerage refers to the infrastructure that conveys sewage. It encompasses Inspection chambers, manholes, pumping stations, sewer line etc.
- Sewerage ends at the entry to a sewage treatment plant

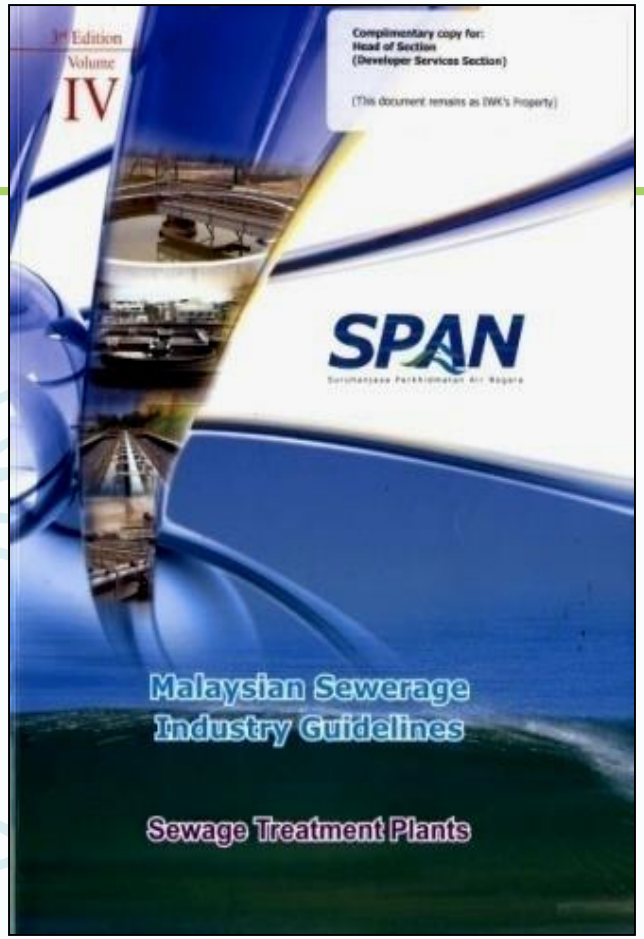
SEWER DESIGN

- Sewerage design generally should be by the principle of Malaysian Sewerage Industry Guideline by SPAN inline of Malaysian Standard MS 1228 : 1991 Code of Practice for Design and Installation of Sewerage System.
- The authorized body for sewage and sewerage management is Indah Water Konsortium or others (in Sabah- DBKK , Sarawak- DBK, Kelantan- MAJAARI) whereby sewerage matter should be approved by them before it can be laid.

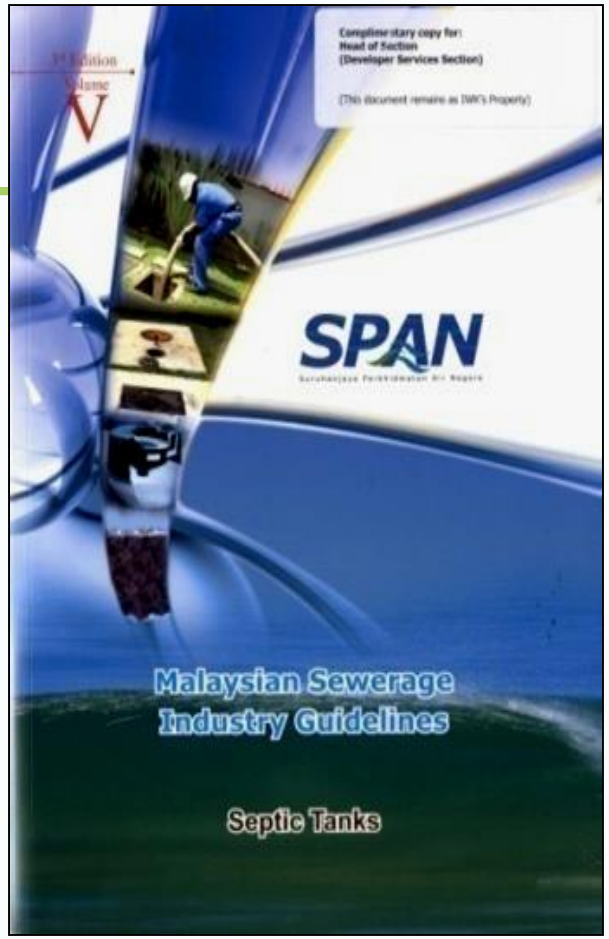
MSIG Volume III , IV & V



Sewer Networks & Pump Station

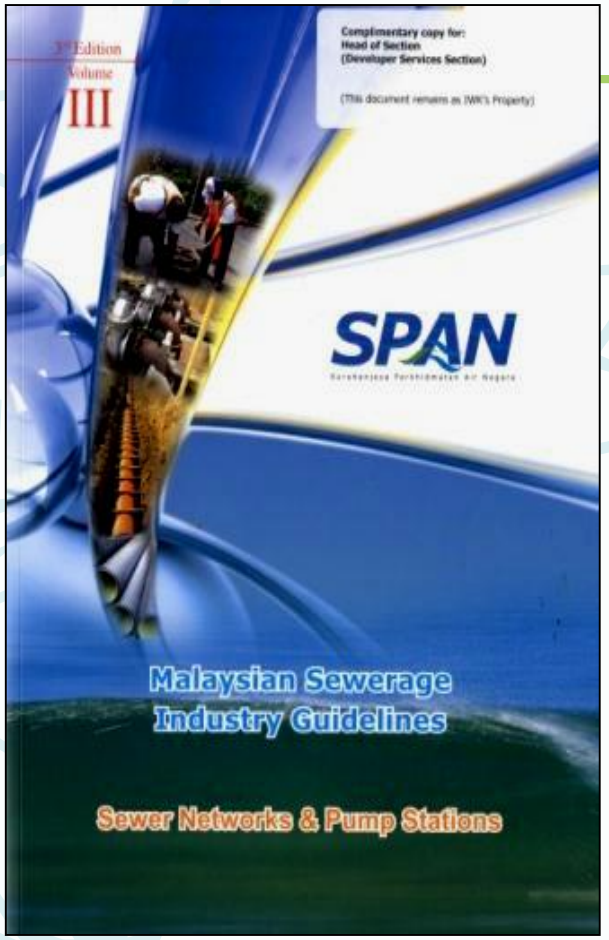


Sewer Treatment Plants



Septic Tank

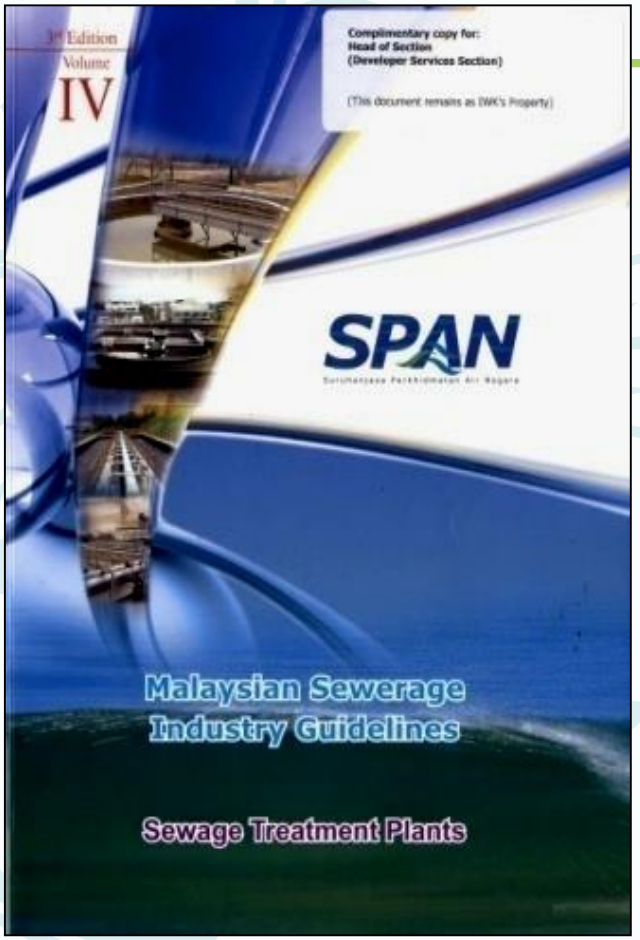
MSIG Volume III



Sewer Networks & Pump Station

- This volume sets out requirements for the design, construction and testing of sewer networks and network pump stations.
- Does not cover internal plumbing system.
- Content
  - **Section 1- Introduction**
  - **Section 2- Planning , material and design**
  - **Section 3- Construction and installation**
  - **Section 4- Sewer testing**

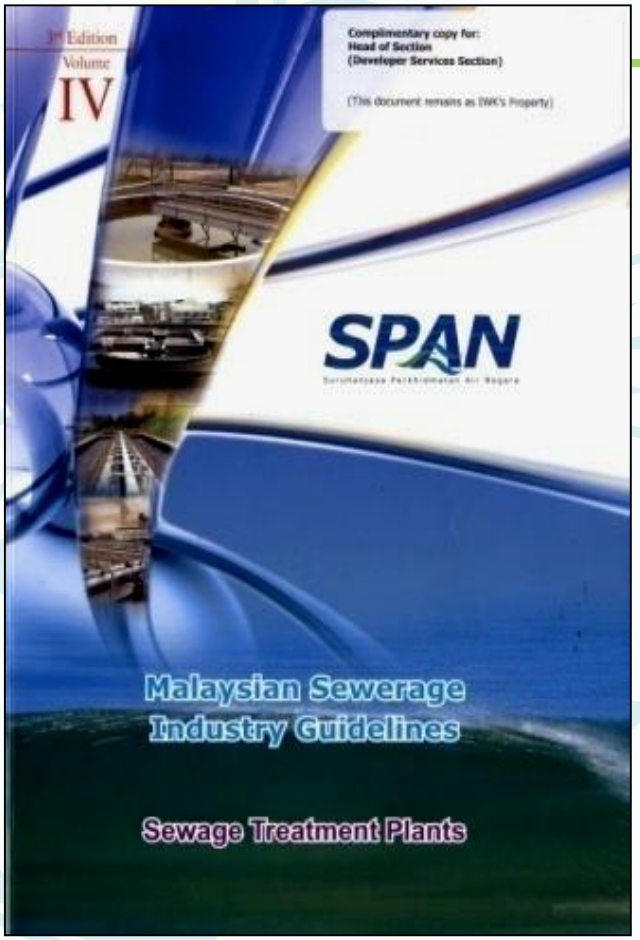
MSIG Volume IV



Sewer Treatment Plants

- This volume sets out requirements for the planning, design and construction of sewage treatment plants..
- Considerations/criteria
- Effluent discharge standards requirements
- Requirement of sizing, treatment stages, sludge treatment process & disposal
- Ancillary facilities.

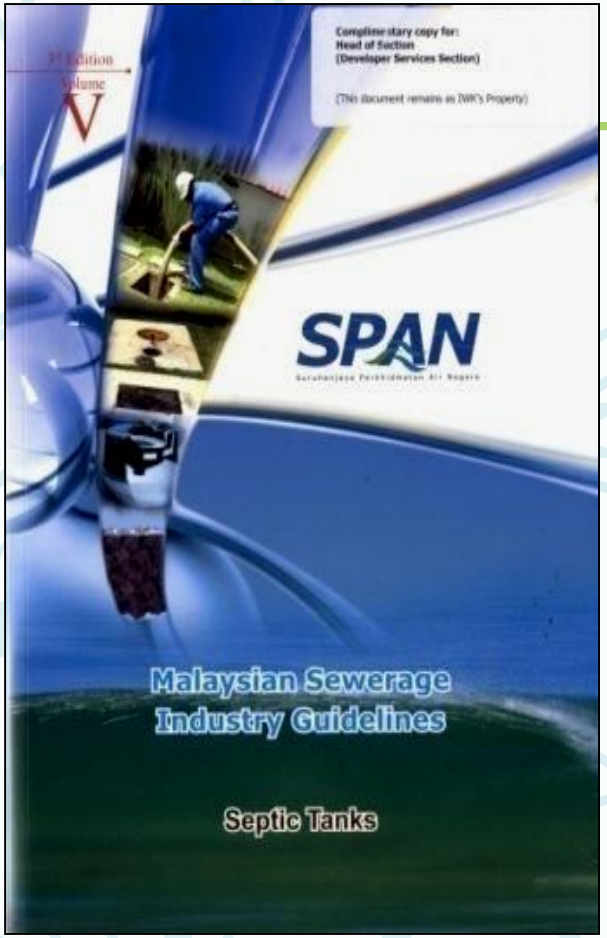
MSIG Volume iV



Sewer Treatment Plants

- **Content**
  - **Section 1- Introduction & general planning**
  - **Section 2- Design Overview**
  - **Section 3- Sewage characteristics & effluent discharge requirements**
  - **Section 4- Requirements for physical design**
  - **Section 5- Requirements for individual treatment processes**
  - **Section 6- Requirements for ancillary facilities**
  - **Section 7- Special requirements**
  - **Section 8- Package sewage treatment plant**

MSIG Volume V



Septic Tank

- This volume sets out requirements for the design and construction of individual septic tanks within development.
- Does not cover internal plumbing system.
- Content
  - **Section 1- Introduction**
  - **Section 2- General guidelines**
  - **Section 3- Design Guide**
  - **Section 4- Septic tanks located in sensitive receiving watercourse**

Initial Planning Prior to Designing of Sewers

– Define the service area

- Service area is define as the total area that will be served by the sewerage system

– Preliminary investigations

- The design engineer must carry out site visit, determine the land use plan, probable future development, topography maps of existing and proposed streets and other utility lines and streams.

Initial Planning Prior to Designing of Sewers

- Proper *sewer layout plan* and profile must be completed before establish design flows.
- Select the site for *wastewater treatment plant*, generally the lowest elevation of the entire drainage area.
- In general, sewers are located on streets or on the available rights-of-way .
- Preliminary layout and routing of sewer flow shall be done by considering total length, depth and minimum number of intermediate pump station.
- Finally street profiles are drawn with the street elevation and manhole location/ depth –to design the detail work.

SEWER PIPE

Type of Pipes

Types of pipes available in Malaysia;

For gravity sewer:

4.2.1 Rigid Pipe

- Vitrified Clay (VCP)
- Reinforced Concrete (RC)

4.2.2 Flexible Pipe

- High Density Polyethylene (HDPE)
- Glass Reinforced Plastic (GRP)

SEWER PIPE

Pipe Selection for gravity flow

- Specific types of sewer pipe selection are best selected as per described below:

Vitrified Clay Pipe (VCP)

- minimum size for public sewer shall be at least 225mm, for service connection shall not be less than 150mm
- pipe has chemical resistance
- Manufactured with spigot socket flexible joints

Reinforced concrete Pipe

- pipe protection linings are required
- only size 600mm or above are allow to be used
- flexible joints are recommended

SEWER PIPE

HDPE Pipe (PROFILED WALL PE PIPE)

- minimum size for public sewer shall be at least 225mm, for service connection shall not be less than 150mm
- Flexible and lighter than VCP pipe
- Standard joint – flexible spigot-socket with rubber seal
- only pipe with double wall and triple wall can be used

SEWER PIPE

Glass reinforce pipe (GRP Pipe)

- Currently imported to Malaysia
- pipe has resistance to chemical attack
- Flexible same as PE pipe
- only size 600mm and above are allow to be use

SEWER PIPE

Location of sewer pipe shall be:

- allowed an adequate access for maintenance
- within streets or alley right-of-way
- at minimum at 3m horizontal and 1 m vertical separation from water pipe.
- never laid above water pipe unless the sewer pipe is adequately protected
- considering the impact of its construction and maintenance to road users
- never laid under buildings

SEWER PIPE

Depth of Sewer Pipe

- The minimum depth of pipe invert level shall be 1.2m

Size of Sewer Pipe

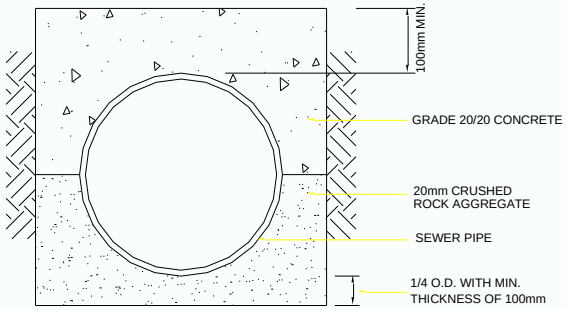
- The minimum size of sewer pipe in conveying raw sewage shall be *225mm* in diameters.

SEWER PIPE BEDDING

Sewer pipe bedding is classified to:

Class A Bedding

- Pipe is embedded in well prepared base compacted with 15mm diameter crusher run.
- The minimum thickness of the crusher run shall be 100mm or ¼ of the pipe diameter (whichever is greater).
- The side fills and top of the pipe shall be of monolithic 1:2:4 concrete mix with minimum cover of 100mm thick

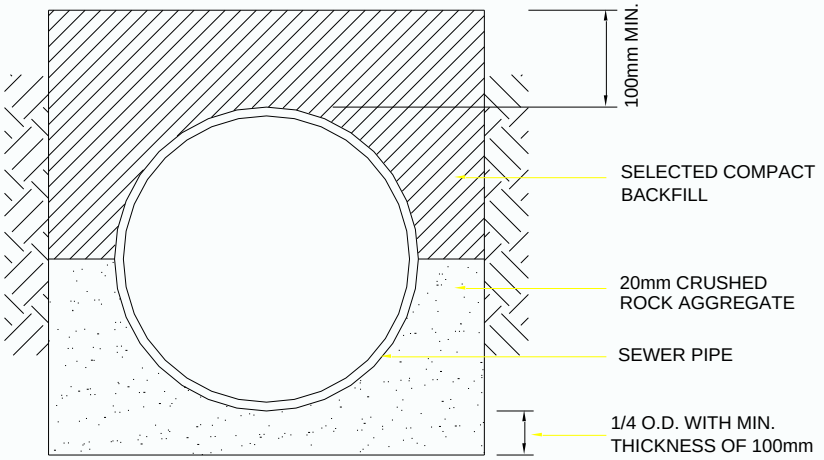


CLASS `A' BEDDING

SEWER PIPE bedding

Class B Bedding

- Pipe is embedded in well prepared base compacted 15mm diameter crusher run.
- The minimum thickness of the crusher run shall be 100mm or ¼ of the pipe diameter (whichever is greater).
- The remainder side fills and top of the pipe shall be well compacted with selected backfill to a minimum of 300mm.



CLASS `B' BEDDING

Population Equivalent (PE)

Definition

- Population equivalent or unit per capita loading, (PE), in waste-water treatment is define as number representing the ratio of the sum of the pollution load produced during 24 hours by industrial facilities and services to the individual pollution load in household sewage produced by one person in the same time.
- Based on assumed contribution per Population Equivalent (PE) of 225 litres from various types of premises.

POPULATION EQUIVALENT (PE)

Type of Establishment	Population Equivalent
Residential	5 per house
Commercial : Includes offices, shopping complex, entertainment / recreational centres, restaurants, cafeteria and theatres	3 per 100m2 gross area
School / Educational Institutions : - Day schools / Institutions - Fully residential - Partial residential	 0.2 per student 1 per student 0.2 per non-residential student 1 per residential student
Hospitals	4 per bed
Hotel with dining and laundry facilities	4 per room
Factories, excluding process water	0.3 per staff
Market (Wet Type)	3 per stall
Market (Dry Type)	1 per stall
Petrol kiosks / Service stations	15 per toilet
Bus Terminal	4 per bus bay
Taxi Terminal	4 per taxi bay
Mosque / Church / Temple	0.2 per person

Population Equivalent (PE)

Building Type	Area / unit / person	Recommended PE	PE
2 Storey Office Building	1800m^2	3per 100 m^{2}grossarea	54
4 Storey Quarters Class F	24 unit	5per house	120
Surau	50 person	0.2per person	10
TOTAL			**184 PE**

Table 2: Example of PE Calculation

Flow Rate Estimation

In selecting pipe diameter and gradient, few basic principal has to be considered:

- to cater the peak flow
- to ensure that there will be a sufficient velocity during each day to sufficiently self cleanse the sewer line
- to limit the velocity to avoid scouring of sewer line

FLOW RATE ESTIMATION

- The volume of sewage that needs to be treated per day is based on assumed contribution per population equivalent of 225 litres from various types of premises.
- The flow that used to determine the diameter and gradient of pipeline.
- The most severe flow that could occur on any day when considering daily flow fluctuation and infiltrations.
- Derived from the average flow by applying a peak factor for daily flow fluctuation
- Average Flow, AF = Cumulative Population x 225 l/day
- Peak Flow Factor = $4.7\ (PE/1000)^{-0.11}$
- Peak Flow, PF = Peak Flow Factor x Average Flow (m3/s)

Design Calculation For Gravity Sewer

Allowable design velocity at peak flow shall be within the range of

0.8 m/s - 4 m/s

– a. Colebrook – White Equation

Velocity, V

$$V = -2\sqrt{(2gDS)} \times \log\left|\frac{ks}{3.7D} + \frac{2.51\,u}{D\sqrt{(2gDS)}}\right|$$

b. Manning Equation

Velocity, V

$$V = \frac{1}{n} R^{2/3} S^{1/2}$$

– c. Hazen-William Equation

Velocity, V

$$V = 0.85 C R^{0.63} S^{0.54}$$

HYDRAULIC DESIGN

- In designing sewerage system, designer shall propose the design at the maximum requirement of the particular site condition (Peak condition)

PROSES PENGIRAAN REKABENTUK

1. Kira PE untuk setiap bangunan yang dicadangkan.
2. Kira 'Average Peak Flow Online' (AF)

   AF = PE x 225 l/day
3. Kira 'Peak Flow' PF= *PFF x AF

*Peak Flow Factor, PFF = $4.7 (PE/1000)^{-0.11}$

5. Kira halaju paip (Colebrook – White Equation)

$$V = -2 \times (2g*D*S)^{1/2} \times \log [(k_s / 3.7\ D) + (2.51\nu/D*(2g*D*S)^{1/2}]$$

di mana V = halaju (m/s)

g = pecutan graviti = 9.81 m/s^2

D = diameter nominal paip (mm)

S = cerun hidraulik

k_s = pekali kekasaran

ν = kelikatan kinematik (m^2/s)

Pengiraan kadar halaju adalah berdasarkan formula *Manning* iaitu:

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

Di mana:

V = Halaju (m/s)

S = Kecerunan hidraulik

R = Hidraulic radius

n = Manning coefficient

Nilai manning, n (VCP) = 0.013; n(HDPE) = 0.015

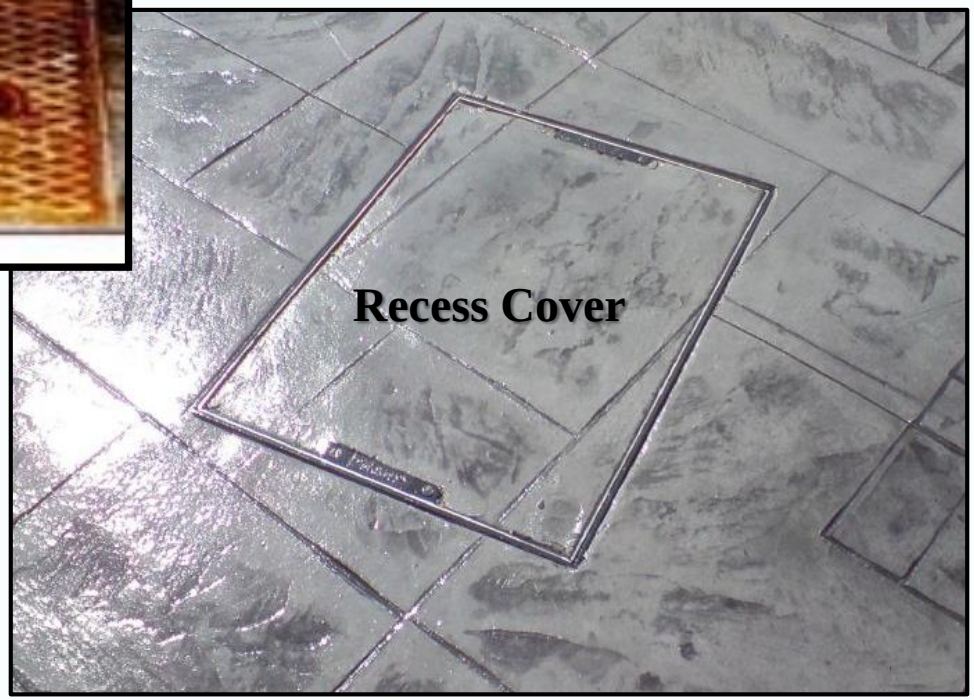
6. Kira $Q_{provided}$; Q =AV

7. Semak $Q_{provided} > Q_{required}$

7. Semak halaju , V ;

- Vmax = 4.0 m/s (maximum full flow velocity)
- Vmin = 0.8 m/s (minimum full flow velocity)

INSPECTION CHAMBER

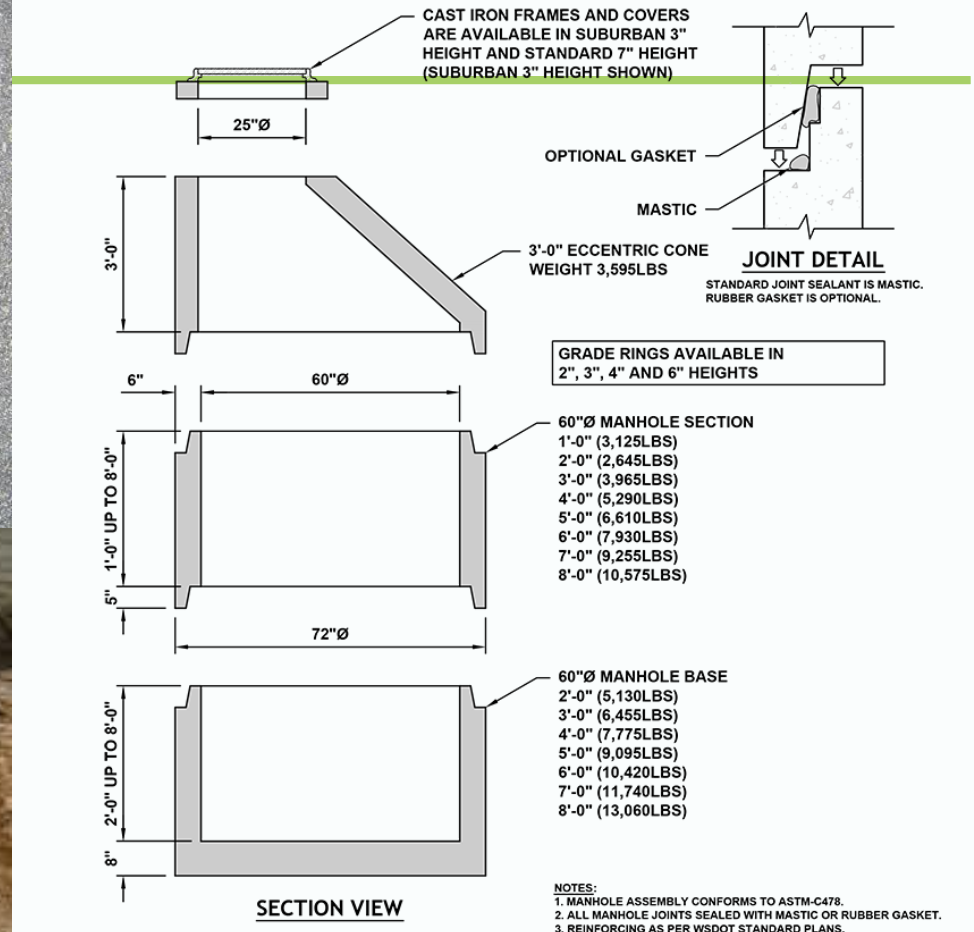


INSPECTION CHAMBER

- Designer should liaise with mechanical's designer (Cawangan Kejuruteraan Mekanikal) to identify location of inspection chamber at site.
- collection of sewage from internal sanitary system
- to be connected with manhole - to convey sewage through sewerage pipe line
- depth of inspection chamber must be at minimum of 100mm *(800mm – recommended)* but not to exceeding 1000mm from the ground level
- cover dimension shall be a minimum of *450mm x 600mm* for rectangular opening or a diameter of 600mm for circular opening.

MANHOLE


BAHAYA
DILARANG MASUK
KUMBAHAN
DANGER
CONFINED SPACE
DO NOT ENTER


CAST IRON FRAMES AND COVERS ARE AVAILABLE IN SUBURBAN 3" HEIGHT AND STANDARD 7" HEIGHT (SUBURBAN 3" HEIGHT SHOWN)
25"Ø
OPTIONAL GASKET
MASTIC
JOINT DETAIL
STANDARD JOINT SEALANT IS MASTIC. RUBBER GASKET IS OPTIONAL.
3'-0"
3'-0" ECCENTRIC CONE WEIGHT 3,595LBS
GRADE RINGS AVAILABLE IN 2", 3", 4" AND 6" HEIGHTS
6"
60"Ø
1'-0" UP TO 8'-0"
5"
60"Ø MANHOLE SECTION
1'-0" (3,125LBS)
2'-0" (2,645LBS)
3'-0" (3,965LBS)
4'-0" (5,290LBS)
5'-0" (6,610LBS)
6'-0" (7,930LBS)
7'-0" (9,255LBS)
8'-0" (10,575LBS)
72"Ø
2'-0" UP TO 8'-0"
8"
60"Ø MANHOLE BASE
2'-0" (5,130LBS)
3'-0" (6,455LBS)
4'-0" (7,775LBS)
5'-0" (9,095LBS)
6'-0" (10,420LBS)
7'-0" (11,740LBS)
8'-0" (13,060LBS)
SECTION VIEW
NOTES:
1. MANHOLE ASSEMBLY CONFORMS TO ASTM-C478.
2. ALL MANHOLE JOINTS SEALED WITH MASTIC OR RUBBER GASKET.
3. REINFORCING AS PER WSDOT STANDARD PLANS.

MANHOLE

- Shall conform to MS1228 and Volume III, MSIG
- Shall be constructed with pre-cast concrete sections surrounded by an in-situ concrete surround
- Lining/coating shall be provided to prevent corrosion of the due to sulphide attack

MANHOLE

Manhole shall be provided at:

- the upstream/starting end of all sewer pipe reticulation
- every change in direction or alignment for sewer pipe size less than 600mm in diameter
- every change in gradient
- every junction or intersection of two or more sewer pipe
- every change in size of sewer pipe
- **not ALLOW to be underneath the road (JKR's Green Mission)**

MANHOLE

- Distance between manholes shall be not greater than 100m for sewer pipe less than 1000mm in diameter and 150m for sewer pipes greater than 1000mm.

  (IWK requirement – based on pipe size)

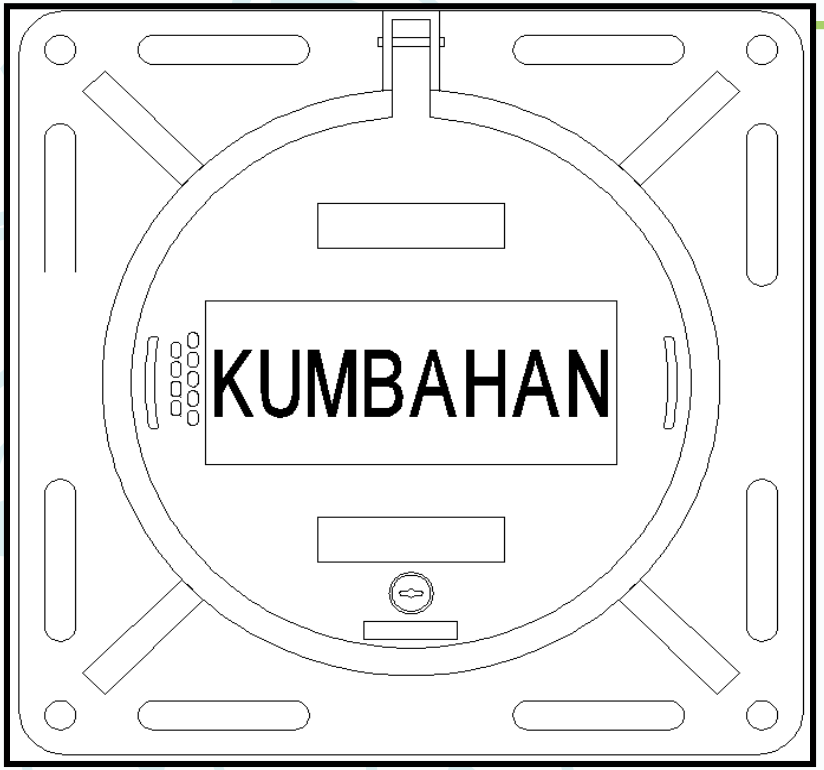
- The minimum manhole depth is 1.2m.

Manhole Cover and Frame

The manhole frame and cover shall be of cast iron and shall have:

- an adequate strength to support superimposed load
- a good fit between each other so that surface runoff or rainfall will not get into it
- provision for hinge and/or locking the cover to prevent vandalism and unauthorized access into manhole

Cover And Frame



MANHOLE COVER

Manhole Invert Level and Depth Calculation

– Invert Level

- The Invert Level of a pipe is the level taken from the bottom of the inside of the pipe as shown below. The definition is also applicable for manhole invert level.

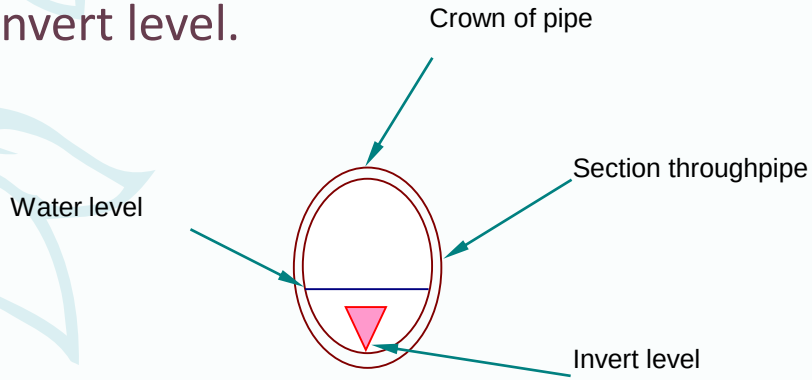


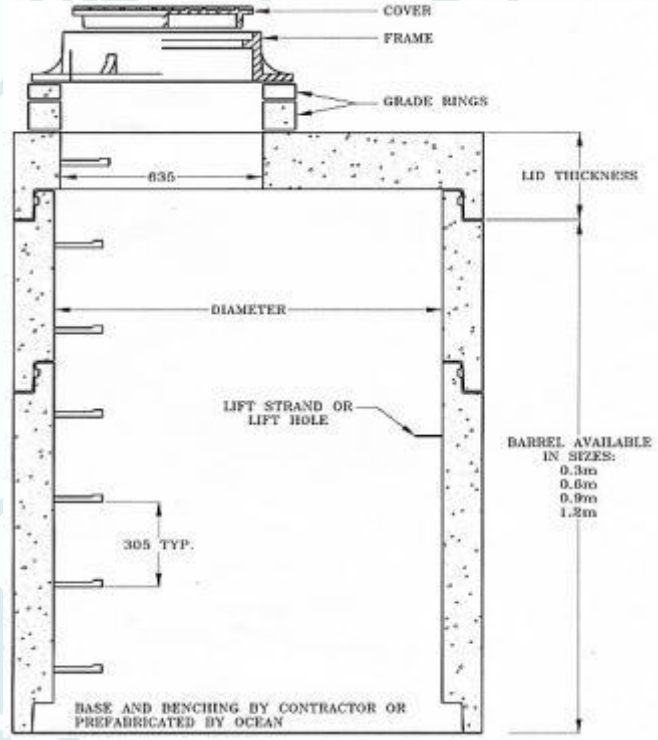
Figure 3: Invert Level of Pipe

Brick manhole

- Brick manhole shall not be used due to the high risk of excessive infiltration.

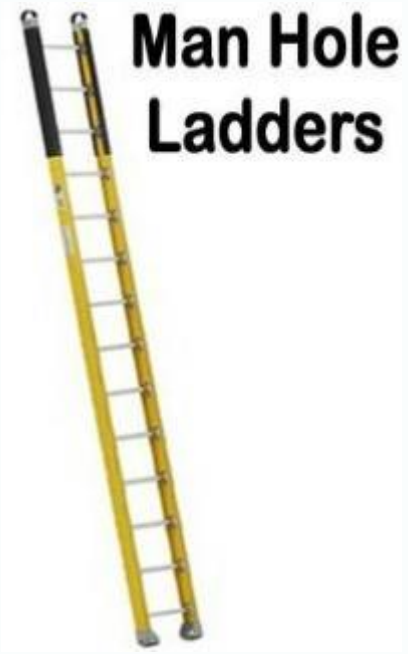
Bolted-in steps

- Bolted-in steps are not permissible in all manholes.

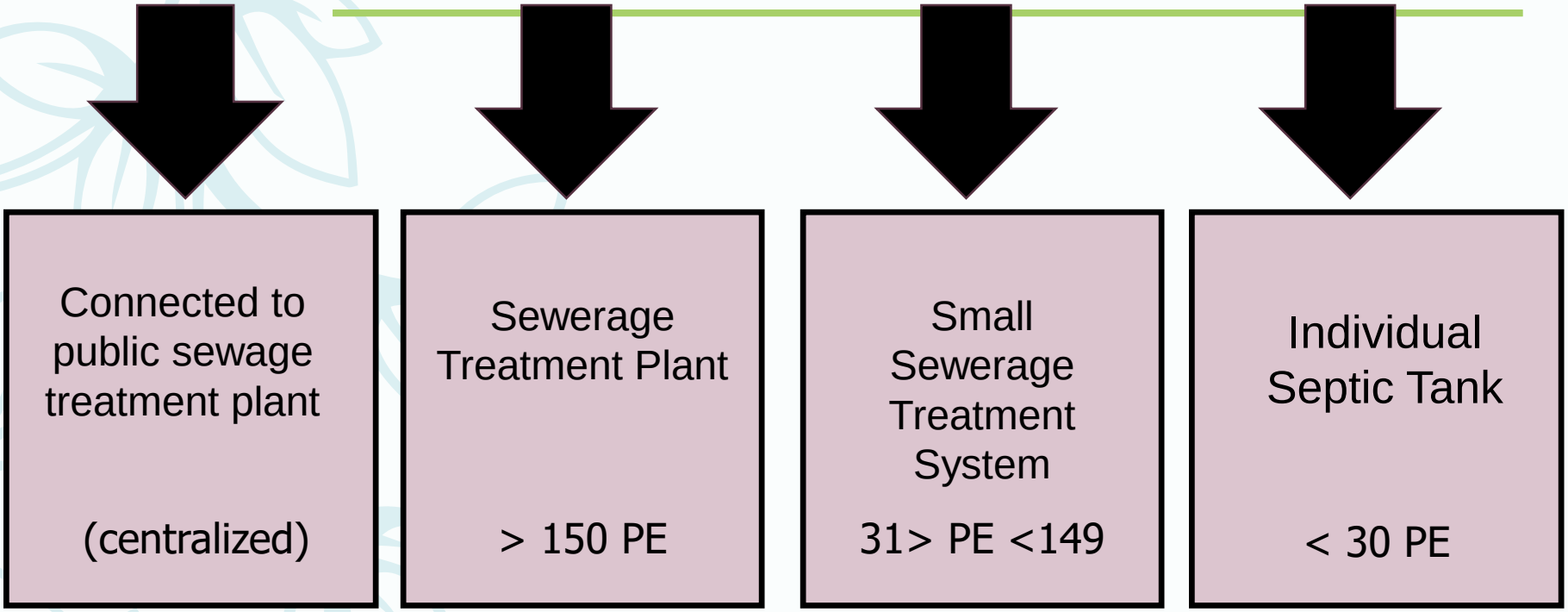


For manhole entrance

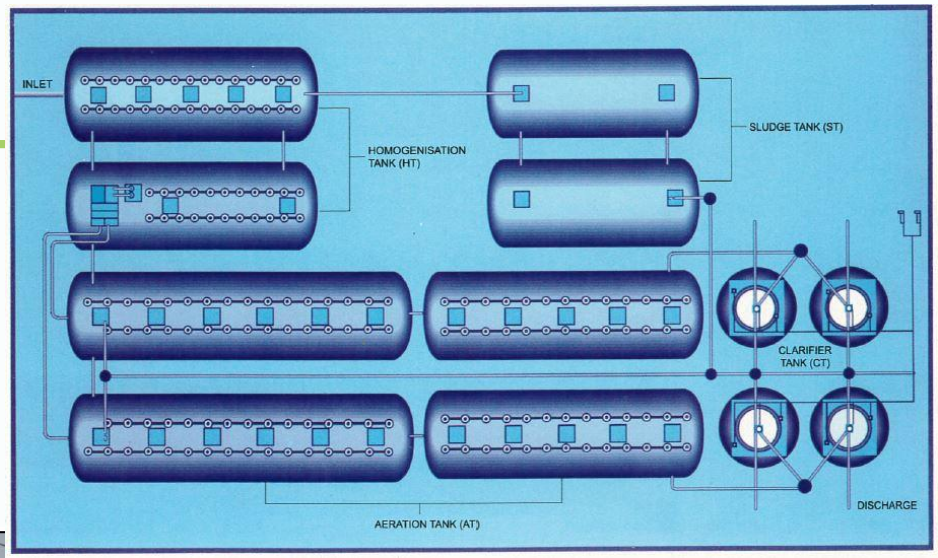
- Harness with tripod and cable for assisted exit.
- Lightweight removable ladders shall be use.



TYPES OF SEWERAGE TREATMENT SYSTEM



SEWERAGE TREATMENT SYSTEM



SEWERAGE TREATMENT SYSTEM

SEWERAGE TREATMENT SYSTEM

- Kapasiti 151 PE dan ke atas
- Melibatkan komponen mekanikal dan elektrikal – pam / blower
- Melibatkan proses biologi iaitu proses penguraian kumbahan oleh bakteria / mikro organisma
- Hasil efluen adalah Standard A
- Jenis bahan FRP dan konkrit
- Proses rawatan melibatkan 3 peringkat pre-treatment, primary dan secondary treatment.

SEWERAGE TREATMENT SYSTEM

Classification

- Correspond to Malaysian Sewage Industry Guideline Volume IV: Sewage Treatment Plants there are 4 classes of STP Classifications. Those are Class 1, Class 2, Class 3 and Class 4.
- Commonly uses in JKR projects are Class 1 and Class 2.
  - Class 1 - < 1000 PE
  - Class 2 – 1000 PE - 5000 PE
  - Class 3 – 5001 PE – 20000 PE
  - Class 4 - >20000 PE

Land Area Requirement

Population Equivalent	Land Area Requirement	
	m^2	acre
100	*210*	*0.052*
150	*285*	*0.070*
200	*360*	*0.089*
250	*430*	*0.106*
300	*485*	*0.120*
350	*545*	*0.135*
400	*600*	*0.148*
450	*655*	*0.162*
500	*700*	*0.173*
550	*745*	*0.184*
600	*790*	*0.195*
650	*835*	*0.206*
700	*870*	*0.215*
750	*905*	*0.224*
800	*940*	*0.232*
850	*980*	*0.242*
900	*1010*	*0.250*
950	*1040*	*0.257*
1000	*1070*	*0.264*

- Keperluan luas stp berdasarkan jumlah PE

**Source: Malaysian Sewage Industry Guideline Volume IV: Sewage Treatment Plants*
Table 3: Class 1

Land Area Requirement

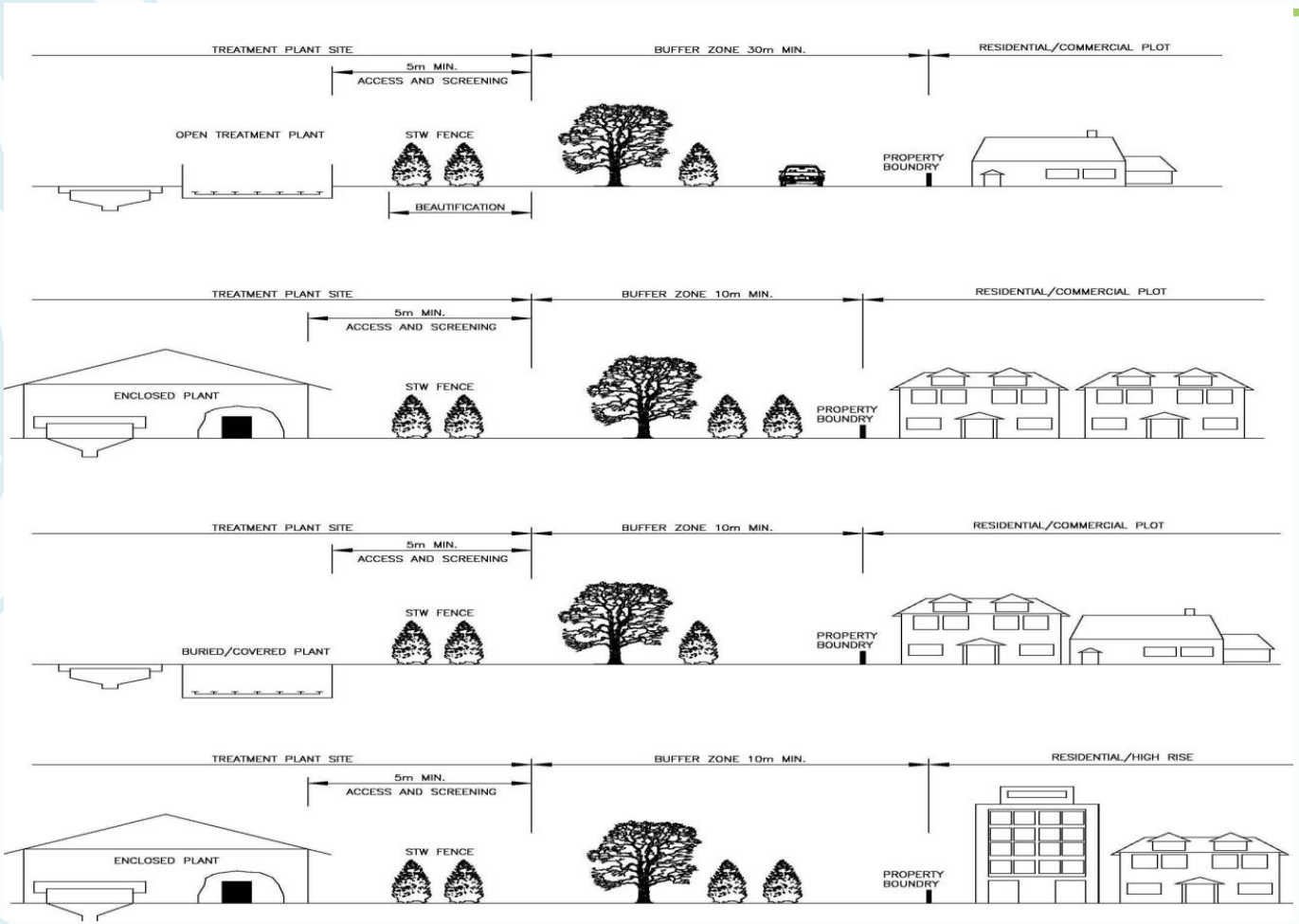
Population Equivalent	Land Area Requirement	
	m^2	acre
1100	*1115*	*0.276*
1200	*1160*	*0.287*
1300	*1200*	*0.297*
1400	*1240*	*0.306*
1500	*1275*	*0.315*
1600	*1310*	*0.324*
1700	*1340*	*0.331*
1800	*1370*	*0.339*
1900	*1395*	*0.345*
2000	*1420*	*0.351*
3000	*2226*	*0.55*
4000	*2671*	*0.66*
5000	*3076*	*0.76*

**Source: Malaysian Sewage Industry Guideline Volume IV: Sewage Treatment Plants*

Table 4: Class 2

Buffer Zone

- Keperluan buffer zone



Design Requirements to Achieve Environment Quality Act Effluent Standards

The Environmental Quality Act (EQA) 1974 specifies two standards for effluent discharge, which are:

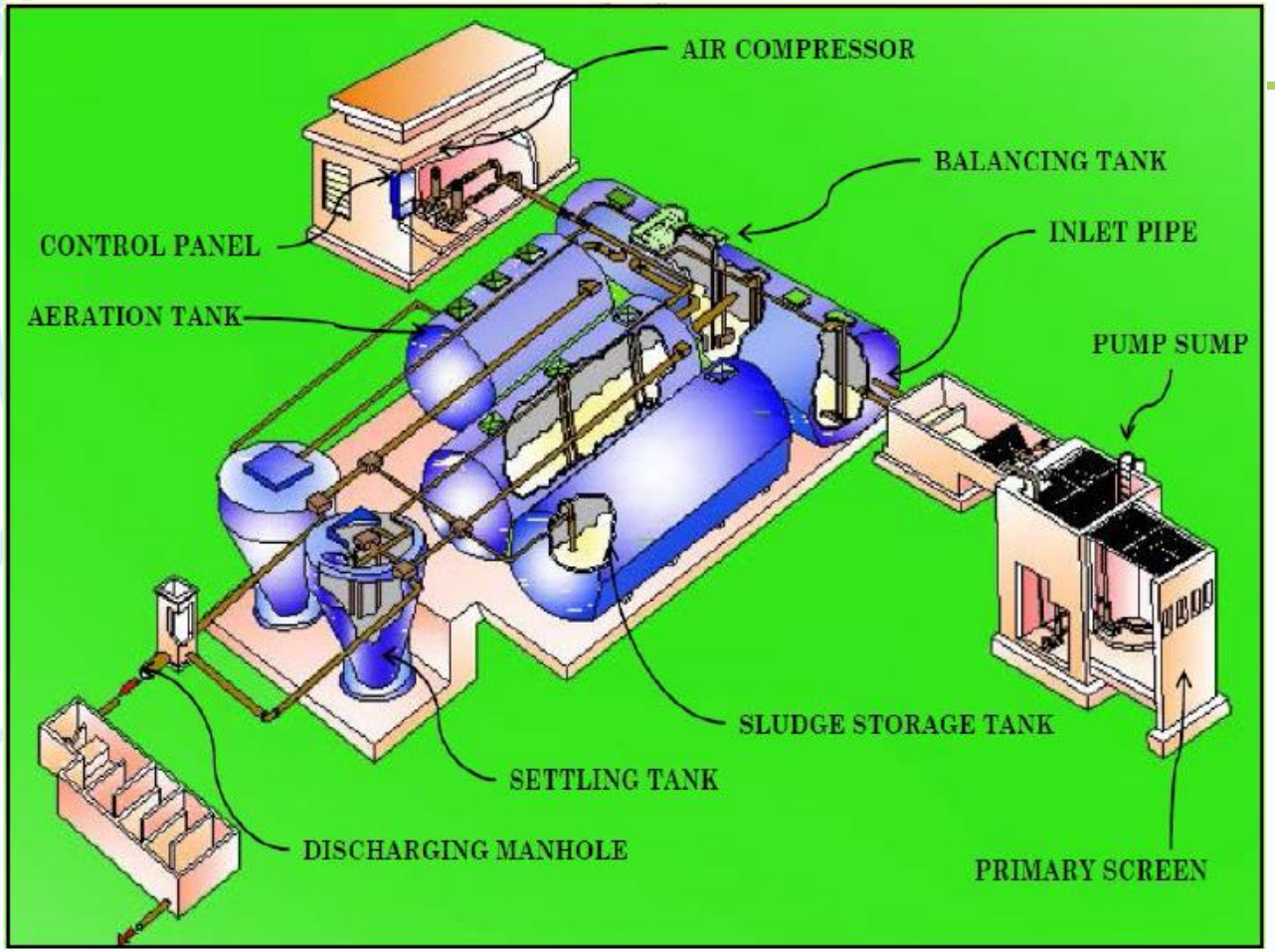
- Standard A for discharge upstream of any raw intake
- Standard B for discharge downstream of any raw intake

- In JKR project, usually the standards must meet the Standard A. Table below indicates the design effluent values based on parameter needed.

Parameter	Effluent discharge to rivers/stream				Effluent discharge to stagnant water bodies*			
	Standard A		Standard B		Standard A		Standard B	
	Absolute	Design	Absolute	Design	Absolute	Design	Absolute	Design
BOD5	20	10	50	20	20	10	50	20
SS	50	20	100	40	50	20	100	40
COD	120	60	200	100	120	60	200	100
AMN	10	5	20	10	5	2	5	2
Nitrate Nitrogen	20	10	50	20	10	5	10	5
Total Phosphorus	N/A	N/A	N/A	N/A	5	5	10	5
O&G	5	2	10	5	5	2	10	5

Notes :
N/A =not applicable
All values in mg/l unless otherwise stated
*stagnant water bodies refer to enclosed water bodies such as lakes, ponds and slow moving watercourses where dead zone occur.
A : Discharge upstream of water supply sources
B : Discharge downstream of water supply sources

Proses rawatan



Proses rawatan

Screen Chamber (Pre-treatment)

- Memerangkap dan menapis bendasing besar seperti batu dan sampah sarap.

Pump Sump (Pre-treatment)

Pump sump berfungsi sebagai;

- Mengangkat kumbahan ke tempat tinggi (secondary screen)
- Menyediakan aliran masuk yang konsisten
- Mengelakkan limpahan sisa kumbahan

Proses rawatan

Primary sedimentation

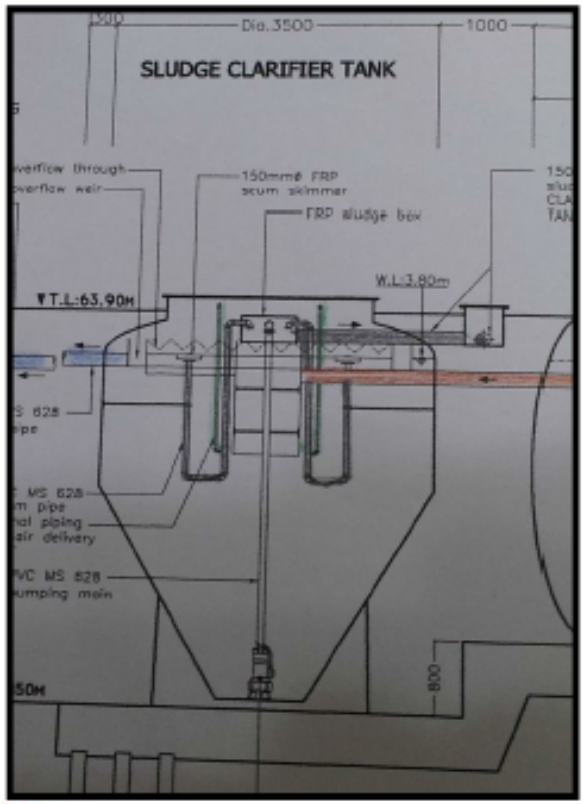
- Proses rawatan utama loji kumbahan adalah proeses enapan (sediment) yang berlaku pada kotoran halus dan kecil melalui tangki enapan
- Berfungsi ;
- Membenarkan kotoran dalam air mendap ke dasar tangki
- Partikel halus ini akan berkumpul di dasar membentuk pepejal kotoran (sludge). Air yang lebih bersih akan dialirkan ke tangki yang seterusnya

PROSES RAWATAN

Aeration Tank

- Beroperasi dibawah pengudaraan yang panjang untuk menggalakkan pertumbuhan bakteria / mikro organisma yang akan menguraikan kumbahan

PROSES RAWATAN



a) Secondary Clarifier Tank

Fungsi :

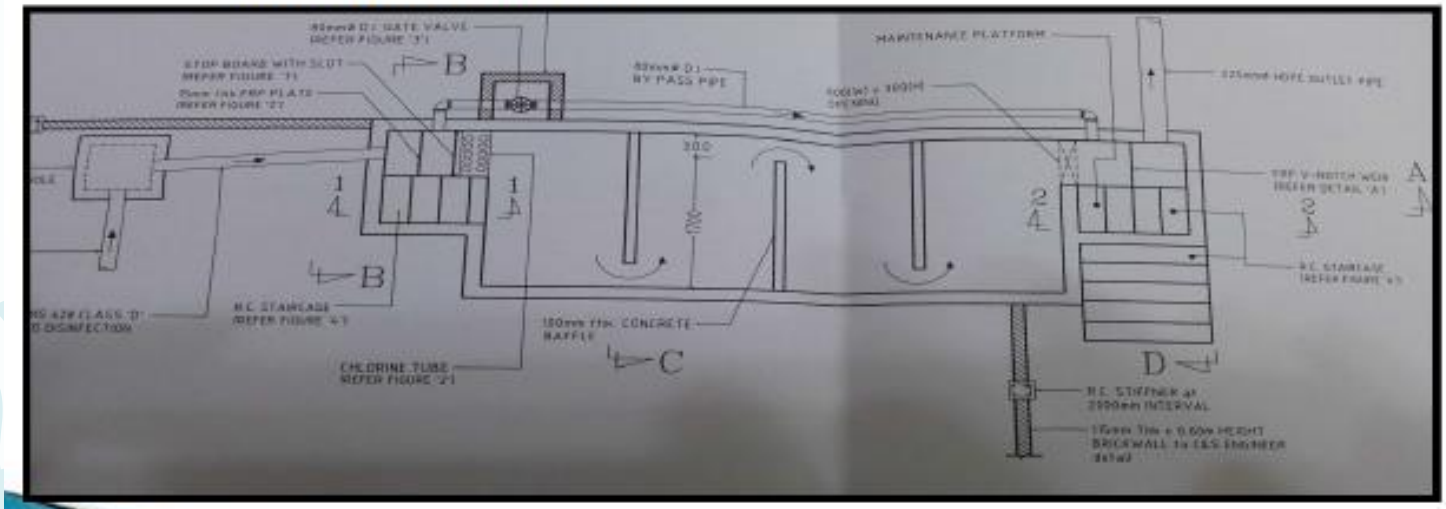
- Tempat berlakunya proses biomas
- Sebahagian besar daripada biomas dikitar semula ke dalam tangki anoxic.
- Bahagian yang dalam keadaan bentuk cecair akan hantar ke *Chlorination Chamber* sebelum keluar sebagai *Efluent Standard*
- *Sludge* yang berlebihan disimpan di dalam *Sludge Holding Tank*

PROSES RAWATAN

- *Disinfection Chamber*

Fungsi :

- Olahan kumbahan dari mikroorganisma yang boleh menyebabkan penyakit memudaratkan. Maka, proses nyahkuman dijalankan

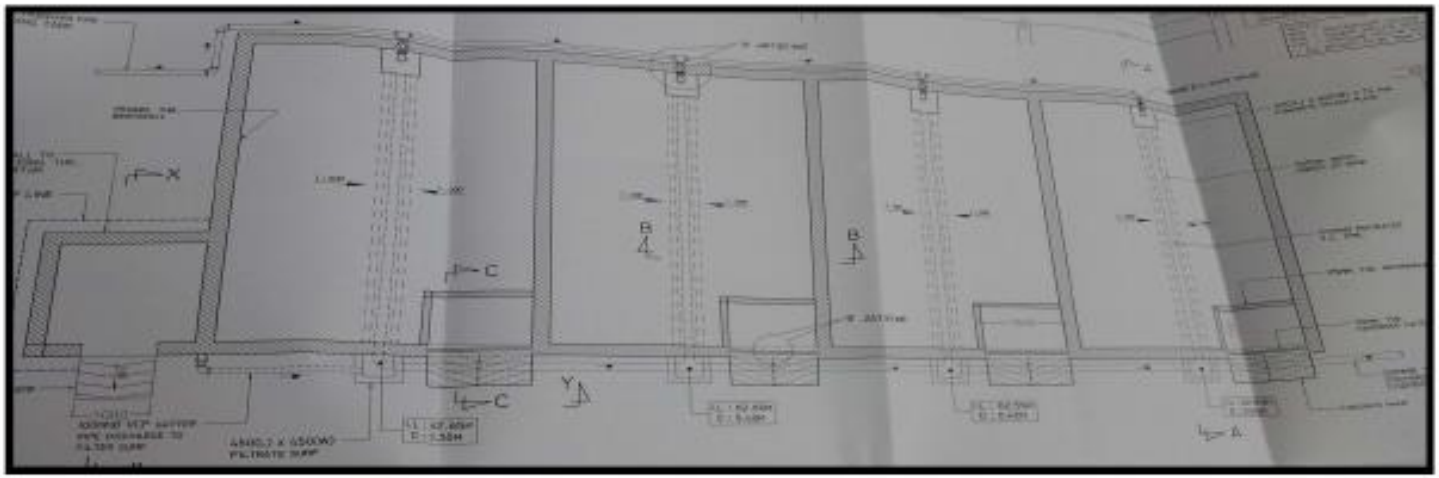


PROSES RAWATAN

- *Sludge Drying Bed*

Fungsi :

- Mengurangkan potensi kesan buruk terhadap alam sekitar dan menukarkan enapcemar kepada yang sesuai dari untuk pelupusan muktamad.



SEWERAGE TREATMENT SYSTEM

Small sewage treatment system (SSTS)

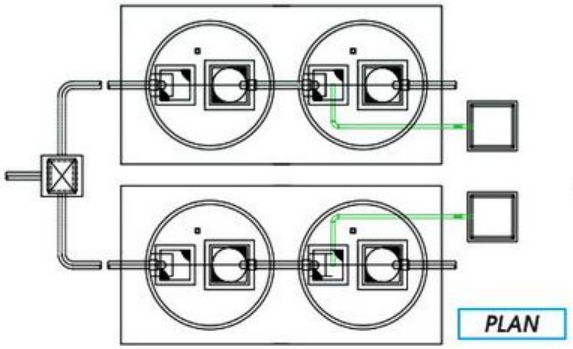
- Kapasiti – 31PE sehingga 149 PE
- Melibatkan komponen mekanikal dan elektrikal – pam blower/ electrical control panel
- Terdiri daripada 2 tangki iaitu separation tank dan aeration tank
- Melibatkan proses penguraian oleh bakteria untuk merawat kumbahan
- Kumbahan daripada premis akan masuk ke pump sump dan dipam ke tangki rawatan
- Hasil efluen adalah Standard A
- Bahan : HDPE / FRP

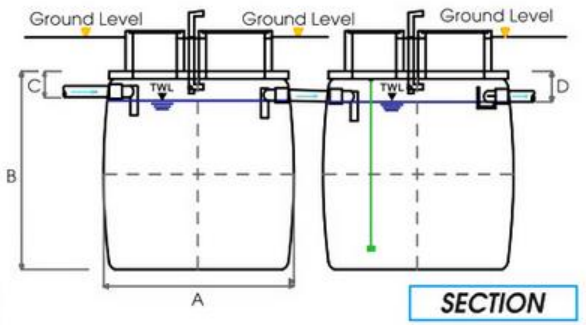
Small sewage treatment system (SSTS)

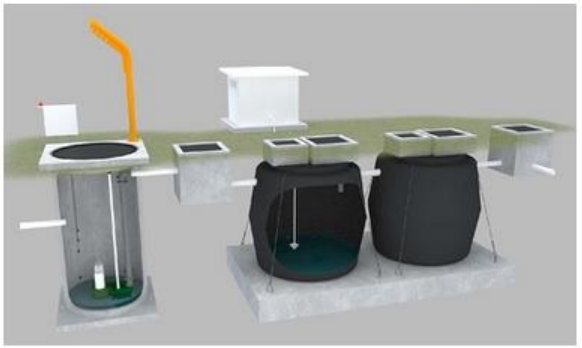
Proses

- 2 tangki bersambung – tangki pemendapan dan tangki pengudaraan
- Selepas proses pemedapan - efluen mengalir masuk ke tangki pengudaraan
- Udara dipam ke dalam tangki pengudaraan
- Proses pengudaraan – meningkatkan pertumbuhan mikro organisma. Mengalakkan proses penguraian sisa kumbahan dengan cepat (Actvated sludge)
- Effluen seterusnya di alirkan keluar ke longkang.
- Muatan simpanan - perlu dikosongkan setiap 2 tahun

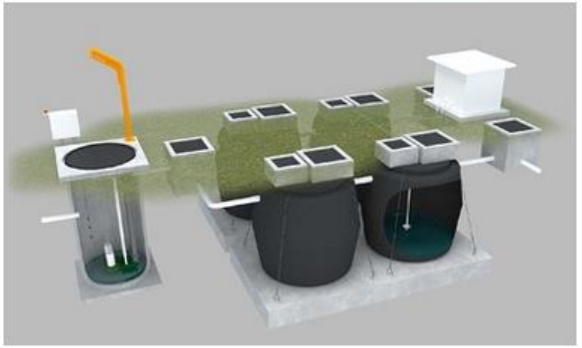
Small sewage treatment system (SSTS)





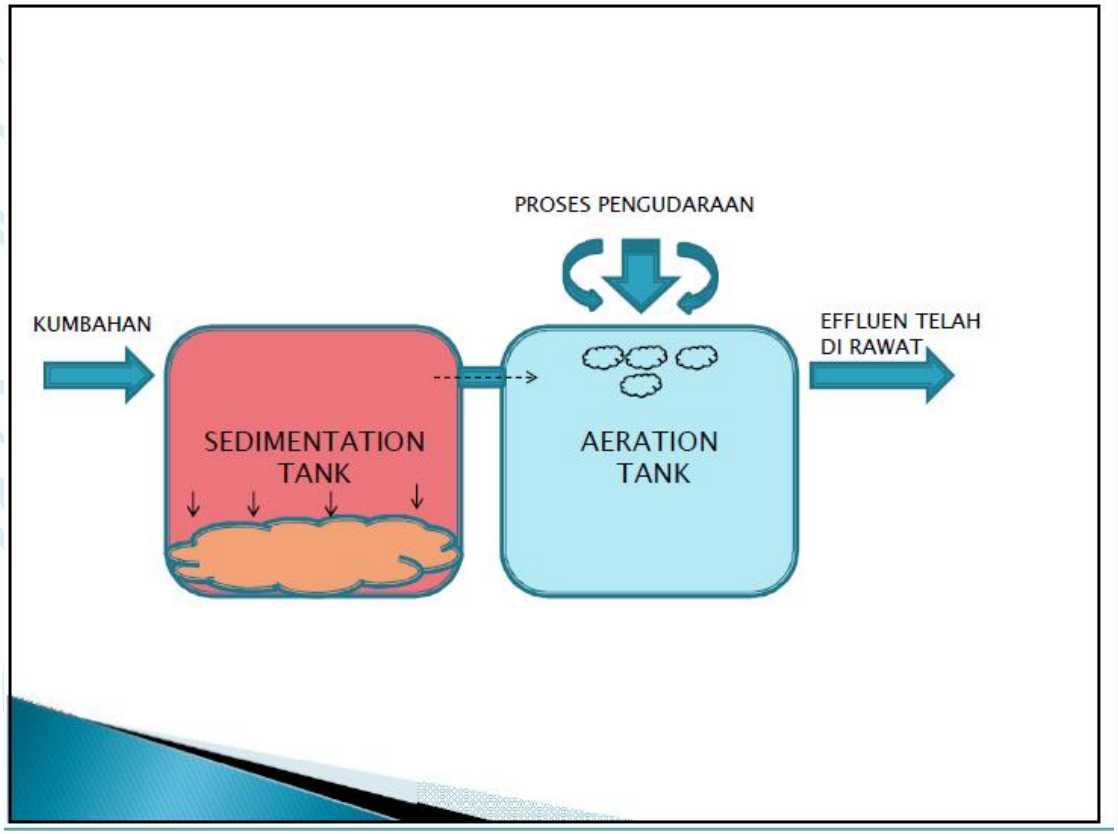


3D VEIW FOR CAT-90PE

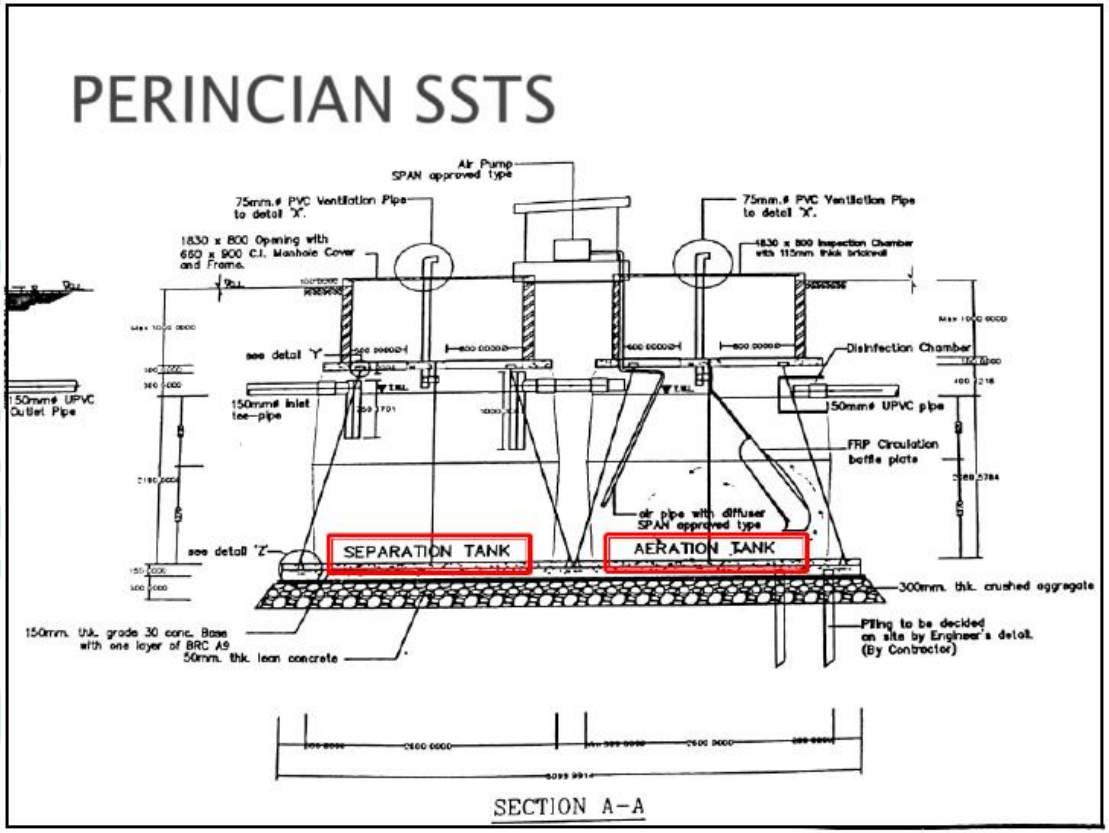


3D VIEW FOR CAT-149PE

Small sewage treatment system (SSTS)



Small sewage treatment system (SSTS)



Small sewage treatment system (SSTS)

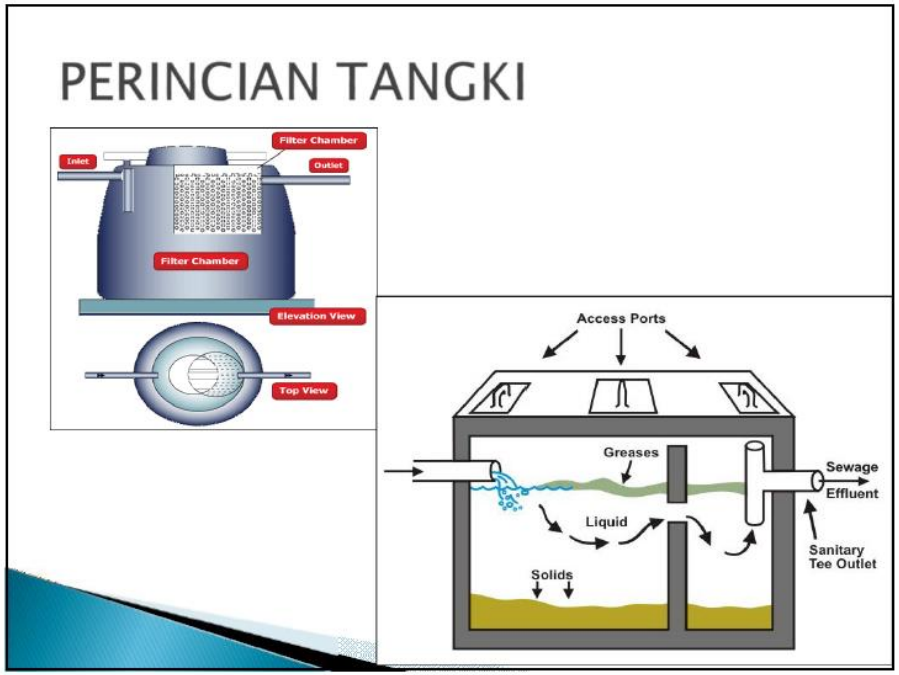
INDIVIDUAL SEPTIC TANK

- Melibatkan proses bakteria untuk merawat kumbahan
- Kumbahan dari premis akan memasuki tangki septik secara graviti
- Hasil effluent adalah Standard B
- Bahan jenis HDPE/ konkrit /FRP
- Kapasiti sehingga 30 PE

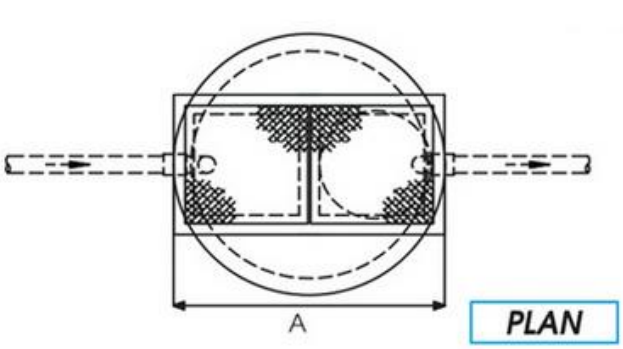
INDIVIDUAL SEPTIC TANK

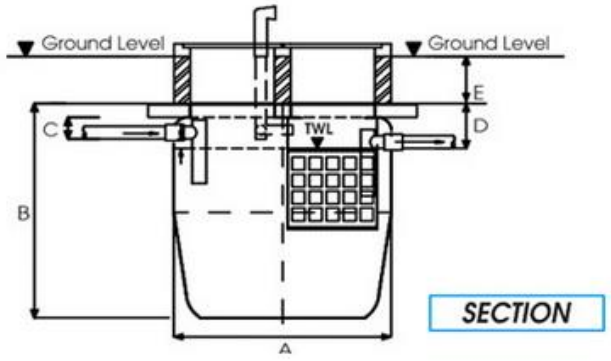
- Ist mempunyai 2 ruang yang bersambung secara bersiri
- Ruang pertama – pepejal daripada kumbahan akan mendap dan membentuk enapcemar manakala gris dan minyak akan terapung dipermukaan dan membentuk lapisan skum
- Ruang kedua – efluent di antara lapisan skum dan enapcemar akan mengalir masuk ke ruang kedua. Proses pemendapan seterusnya akan berlaku
- Proses akhir – efluen meninggalkan ruang kedua dan memasuki longkang
- Ist direkabentuk untuk masa pengekalan (Hydraulic retention time) selama 24jam
- Muatan simpanan – perlu dikosongkan setiap 2 tahun

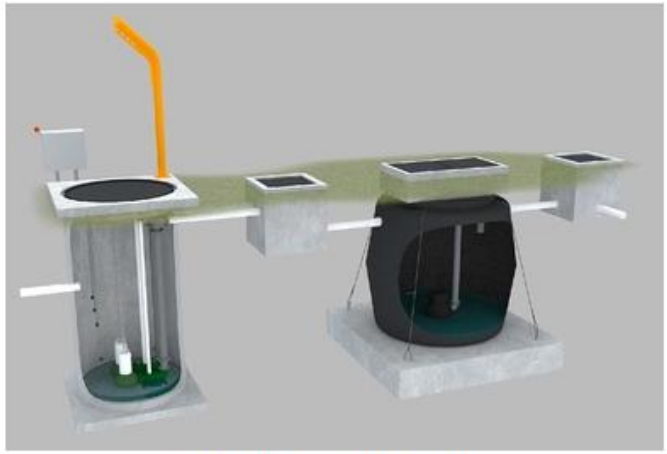
INDIVIDUAL SEPTIC TANK



INDIVIDUAL SEPTIC TANK







3D VIEW FOR CAT-30PE

INDIVIDUAL SEPTIC TANK

Application for Approval of Sewerage Work

- Submissions for approval to Indah Water Konsortium (IWK) using the followings forms:
- By civil designers:

- PDC 1 - Application for Sewerage Planning Approval
- PDC 2 - Application for Approval of Sewerage Work

APPLICATION FOR APPROVAL OF SEWERAGE WORK

By others (SO/CONTRACTOR/SYSTEM SUPPLIER) :

- ***PDC 2* - Application for Approval of Sewerage treatment system**
- ***PDC 3 - Certification of Structural Plan and Design Calculation***
- ***PDC 4 - Certification of mechanical Process and Design Calculation***
- ***PDC 5 - Certification of Electrical Drawing, Design Calculation, Equipment Data and Material Sheet (EDMS)***
- PDC 6 - Notice of Commencement or Resumption of Sewerage Works
- PDC 7 - Notice of Inspection and Testing
- PDC 8 - Notice of Final Inspection

Application for Approval of Sewerage Work

- Pihak berkuasa SPAN , dibawah WSIA 2006, adalah pihak berkuasa yang mengawalselia sistem pembetungan.

- Agensi Perakuan dilantik oleh SPAN untuk menyemak sistem yang dicadangkan, membuat pengesyoran terhadapnya untuk mematuhi kehendak - kehendak yang digariskan, menjalankan pemeriksaan dan membuat pengesyoran untuk pengeluaran CF/CCC.

PERLANTIKAN IWK SEBAGAI AGENSI PERAKUAN PEMBETUNGAN

- *IWK telah didaftarkan sebagai Agensi Perakuan Pembetungan oleh Jabatan Perkhidmatan Pembetungan (JPP) sejak 1995 bagi meluluskan pelan dan pembinaan sistem pembetungan dan tangki septik.*

PERLANTIKAN IWK SEBAGAI AGENSI PERAKUAN PEMBETUNGAN

- *IWK telah didaftarkan sebagai Agensi Perakuan Pembetungan oleh SPAN sejak 1/1/2008 bagi meluluskan pelan dan pembinaan sistem pembetungan dan tangki septik.*

Application for Approval of Sewerage Work

SKOP PERKHIDMATAN AGENSI PERAKUAN :

1. Mengkaji cadangan perancangan sistem pembetungan.

2. Mengkaji cadangan rekabentuk sistem pembetungan.

3. Mengadakan pemeriksaan perantara sistem pembetungan.

4. Mengadakan pemeriksaan terakhir dan memberi surat pengesahan bagi tujuan pengeluaran syor sijil kelayakan atau perakuan siap dan pematuhan.

5. Mewakili SPAN di pelbagai mesyuarat agensi.

6. Menjalankan tugas-tugas lain yang diwakilkan.

PERINGKAT-PERINGKAT PROSES KELULUSAN

Pengujian & Pemeriksaan Paip Pembetung

Ujian bagi Paip pembetungan:

- Ujian kebocoran, kelurusan, halangan dan Ujian Gred pemeriksaan CCTV.
- Ujian aliran (flow test)
- mana-mana ujian dan kaedah lain yang diluluskan.
- Ujian boleh dijalankan secara rawak di mana-mana seksyen pembetung
- QP hendaklah menjalankan ujian kebocoran dan mengemukakan laporan yang
- disahkan kepada CA
- CA hendaklah menentukan pemilihan pembetung untuk diperiksa

Pengujian & Pemeriksaan Paip Pembetung

Ujian cctv:

- Stage 1 – 10% daripada panjang keseluruhan paip pembetungan. Di pilih secara rawak oleh Ca. sekiranya didapati terdapat keadaan grade 3,4 dan 5. ujian cctv diteruskan ke stage 2
- Stage 2 – 40% daripada baki panjang keseluruhan paip pembetungan. sekiranya didapati terdapat keadaan grade 3,4 dan 5. ujian cctv diteruskan ke stage 3.
- Stage 3 – 50% daripada baki panjang keseluruhan paip pembetungan.
- Ujian cctv DITERIMA sekiranya hanya terdapat keadaan grade 1 dan grade 2.
- Ujian cctv dikira gagal sekiranya hanya terdapat keadaan grade 3,4 dan 5. paip pembetungan yang terlibat perlu dibuat pembaikan SEMULA SEBELUM DIBUAT PEMERIKSAAN SEMULA.

Pengujian & Pemeriksaan Paip Pembetung

Ujian cctv:

Table 4.2 Defect Grades Descriptions

Grade 1 Occurances without damage and no cracks of pipe but only acceptable displacement on joint where no visual infiltration can be observe
Grade 2 Constructional and sewer product deficiencies or occurances with insignificant influence to tightness, hydraulic or static pressure of pipe, etc. Examples: Joint displaced large; badly torched intakes; minor deformation of plastic pipes (<5%); minor erosions; infiltration seeping; Cracks – joint, circumference, longitudinal; Debris, silt – 15%; Encrustation light.
Grade 3 Constructional, operational and maintenance deficiencies diminishing static, hydraulic, safety and tightness. Examples: Infiltration dripping. (OMD); Open joint; untorched intakes; cracks; minor drainage obstructions such as calcide build ups; protruding laterals; minor damages to pipe wall; individual root penetrations; corroded pipe wall; flexible pipe deformation (>5%); Lining defect.
Grade 4 Constructional and structural damages with no sufficient static safety, hydraulic or tightness. Examples: axial/radial pipebursts; visually noticeable infiltration/exfiltration; cavities in pipe-wall; severe protruding; laterals severe root penetrations; severe corrosion of pipe wall; Infiltration running; encrustation medium; minor deformation; flexible pipe deformation >15%.
Grade 5 Major structural damaged where pipe is already or will shortly be impermeable. Examples: collapsed or collapsed eminent; major deformation; deeply rooted pipe; any drainage obstructions; pipe loses water or danger of backwater in basements etc.

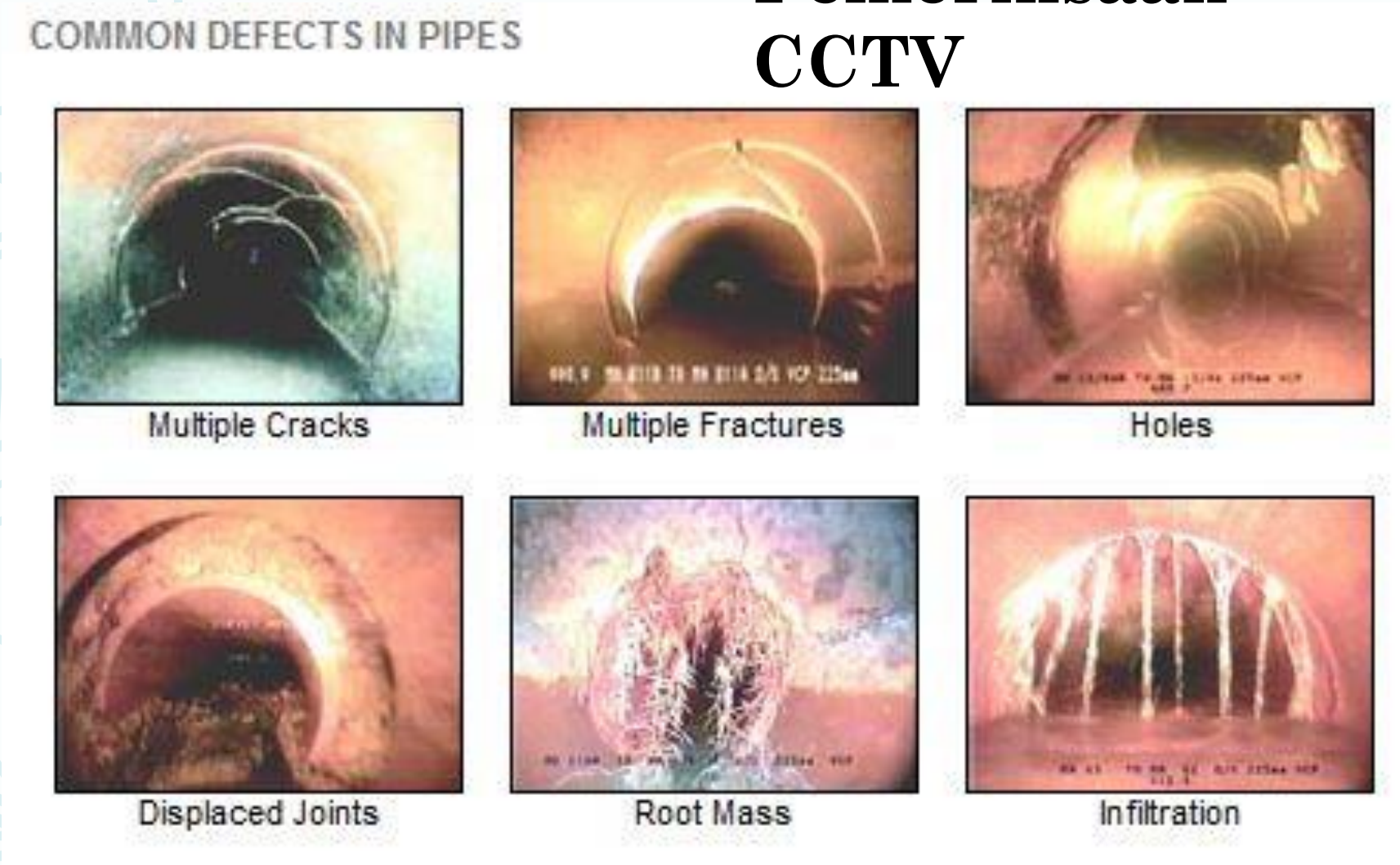
Pengujian & Pemeriksaan Paip Pembetung

Pemeriksaan CCTV

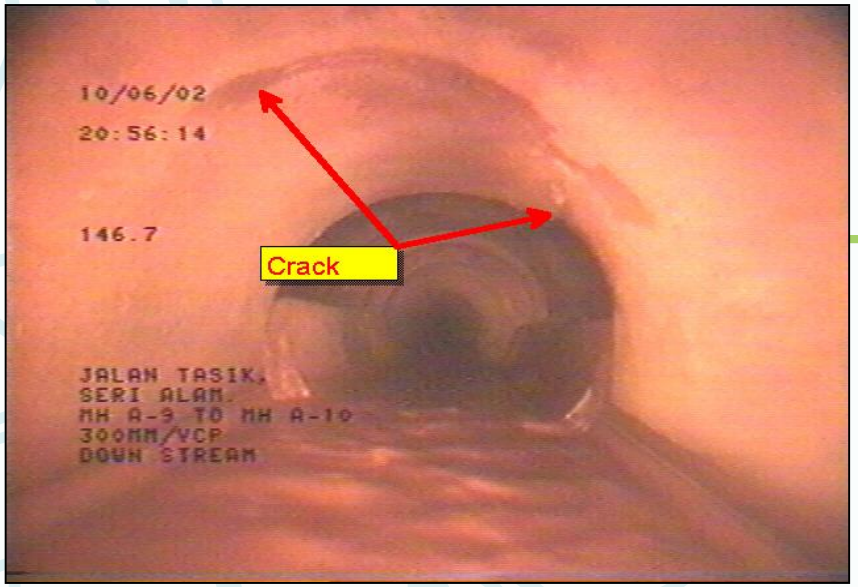
- to ensure sewers are properly constructed and laid so that deformation, gap, sag or other defects which could not be detected by means of normal inspection.

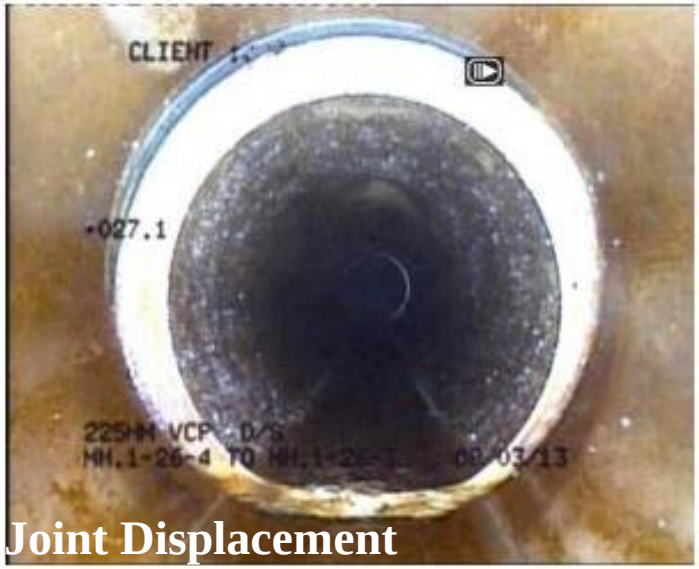
Pengujian & Pemeriksaan Paip Pembetung

Pemeriksaan CCTV



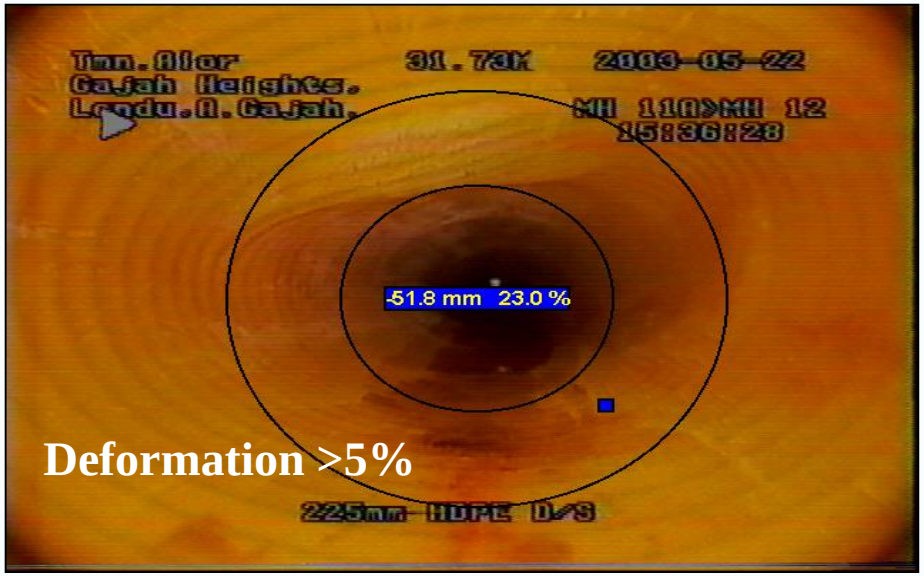
Pemeriksaan CCTV





Joint Displacement

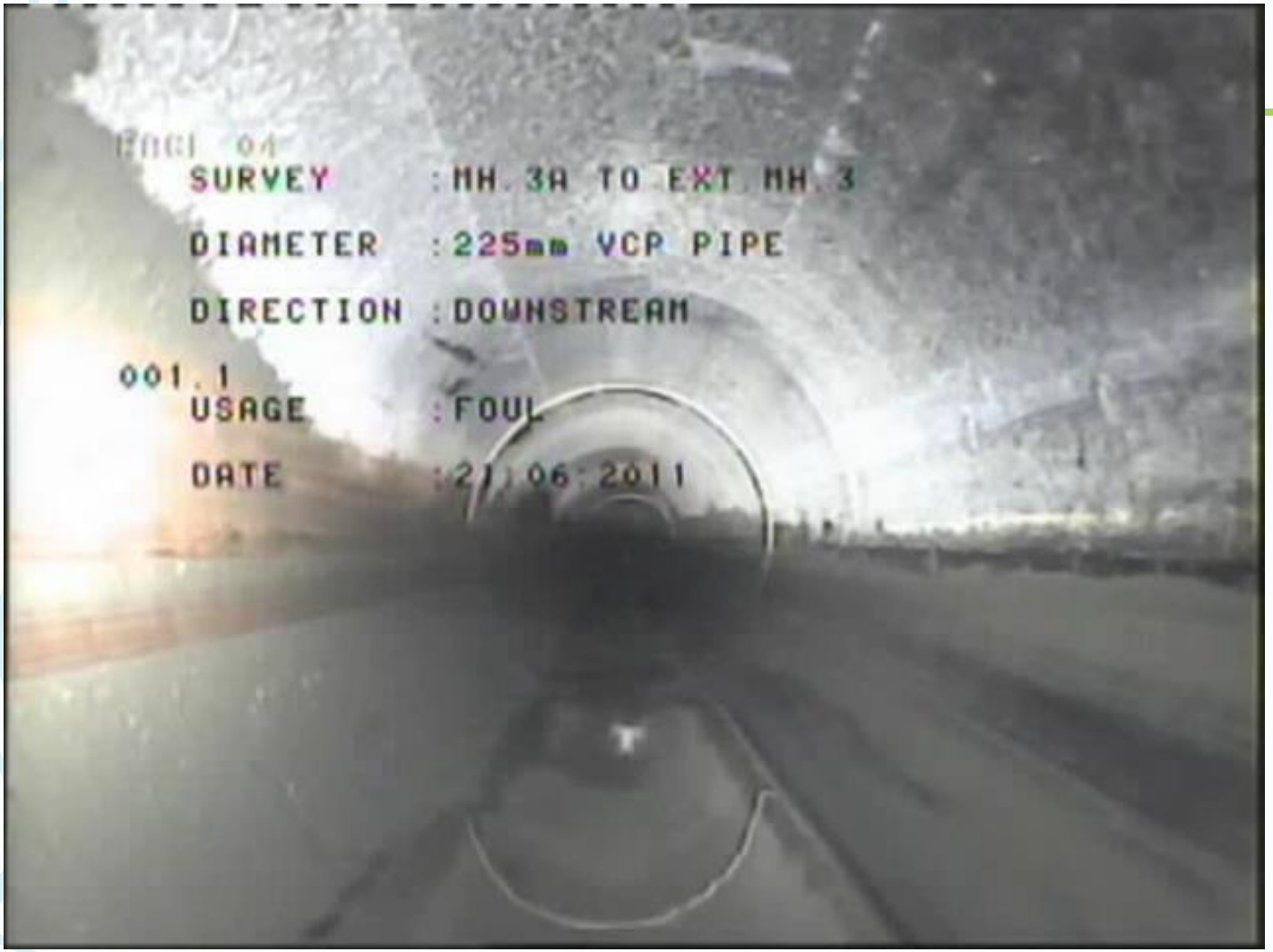
Seepage



Deformation >5%

Pengujian & Pemeriksaan Paip Pembetung

Pemeriksaan CCTV



Pengujian & Pemeriksaan Paip Pembetung

Pemeriksaan CCTV

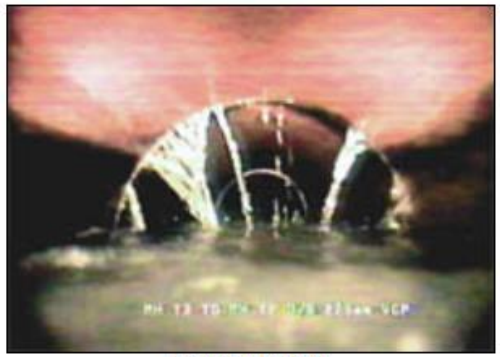
PEMBAIKAN Paip Pembetung

PEMBAIKAN PAIP PEMBETUNGAN MENGGUNAKAN CCTV

SECTIONAL PIPELINE REPAIR

For localised problems within a sewer length the patch system will renovate the damaged area and prolong the life of the sewer where full-length pipe lining would be unnecessary. Localised patch repairs are an effective way of carrying out in –situ structure repairs within a live sewer without the need for over-pumping. It is quick to install and offers no disruption to property, service and surface activities. Patch repairs have tapered ends allowing a smooth virtually unnoticeable transition from pipe to repair and providing little resistance to flow. Patch repairs are installed to Water Industry Standard.

Renovated Clay Pipe

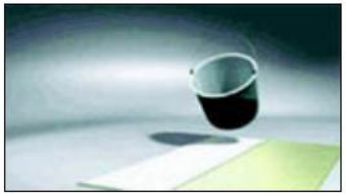


Before Patch

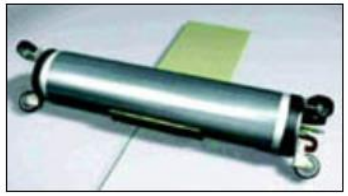
INSTALLATION PROCESS

Procedure for No-Dig Sectional Pipeline Repair

STEP 1: Preparing and Mixing the Resins



STEP 2: Impregnate the Fibre Glass withthe Resin

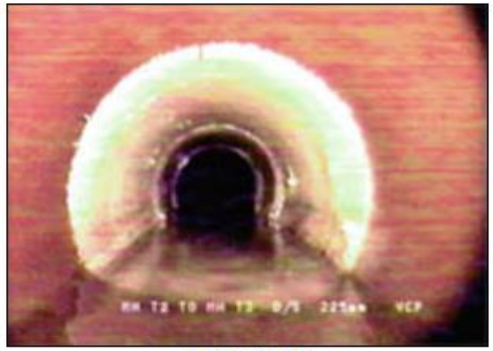


STEP 3: The impregnated Fibre Glass is attached to the packer

STEP 4: Air pressure is used to inflate the packer. The pipe adjacent to the defect

STEP 5: Air pressure is used to nflate the packer. The resin impregnated fibre glass is pressed over the defect and held in place until the resin cures

STEP 6: The packer is deflated and removed from the pipe. The section repair has now fully sealed the defect



After Patch

PEMBAIKAN Paip Pembetung

PEMBAIKAN PAIP PEMBETUNGAN MENGGUNAKAN CURED IN PLACE (CIPP) SECTIONAL PIPELINE REPAIR

PEMBAIKAN Paip Pembetung

PEMBAIKAN PAIP PEMBETUNGAN MENGGUNAKAN KAEDAH CURED IN PLACE (CIPP)

PEMBAIKAN Paip Pembetung

PEMBAIKAN PAIP PEMBETUNGAN MENGGUNAKAN KAEDAH CURED IN PLACE (CIPP PART 2)

PEMBAIKAN Paip Pembetung

PEMBAIKAN PAIP PEMBETUNGAN MENGGUNAKAN KAEDAH CURED IN PLACE (CIPP)

SEKIAN, TERIMA KASIH