(6) Presentation Materials for Seminar/Workshop Held on 25th January, 2011

List of Materials

①: Briefing of the Project (AGM (NRW))

②: Briefing of the Seminar (JICA Expert Team)

③: Findings in Technical Exchange Program in Jordan (Engineer (O&M))

④: Findings in Technical Exchange Program in Jordan (Engineer (O&M))

⑤: Results of the Pilot Activities in Kotahena (AE Colombo North -Kotahena)

⑥: Results of the Pilot Activities in Borella (AE, Colombo East - Borella)

⑦: Results of similar activities in Other areas (AE Colombo South)

WORKSHOP / SEMINAR

FOR
THE CAPACITY DEVELOPMENT PROJECT
FOR NON REVENUE WATER (NRW) REDUCTION
IN COLOMBO CITY

Time and Date: At 9:00HR on Tuesday 25 January 2011
Place: Conference Room at Berjaya Mount Royal Hotel

Agenda

9:30-9:40 Opening Address (Addl. GM)
9:40-9:50 Briefing of the Project (AGM (NRW))
9:50-10:00 Briefing of the Seminar (JICA Expert Team)
10:00-10:20 Findings in Training Program in Japan (AGM (O&M))
10:20-10:40 Findings in Technical Exchange Program in Jordan (Engineer (O&M))

10:40-11:00 Break

11:00-11:20 Results of the Pilot Activities in Kotahena (AE Colombo North -Kotahena)
11:20-11:30 Q&A
11:30-11:50 Results of the Pilot Activities in Borella (AE, Colombo East - Borella)
11:50-12:00 Q&A
12:00-12:15 Results of similar activities in Other areas (AE Colombo South)
12:15-12:30 Results of similar activities in Other areas (OIC Maligawatte)

12:30- 12:50 Questionnaire

12:50-13:00 Closing Address (DGM)

THE CAPACITY DEVELOPMENT PROJECT FOR NRW REDUCTION IN COLOMBO CITY

NRW Components

- Leaks
- Unauthorized consumption
- Administrative losses
- Free water





Who is Responsible?

- NRW Section Staff
- O&M Section Staff
  - Commercial Staff

Strategic Approach for NRW reduction in CMR

- Action path
  - Replacement of pipes which are beyond economical repairs in a planned manner
  - Reorganize Colombo City Management
  - Implementation of planned preventive approach
  - Implement pilot projects to enhance Capacity Building and Create awareness among staff
  - NRW section to play a role of NRW Management
  - Review specification of materials to maintain Quality
  - Strength Legal Section for NRW control and speed up court cases
  - Review Present Incentive Scheme

Projected Target

- Reduce NRW in Colombo City to 32% by year 5

Capacity Development Purpose of the Project

- NWSDB Capacity to implement NRW reduction activity in Colombo City is Strengthened

Outcome of the Project

- Management Capacity of Senior Officers of RSC (W-C) to Plan and Supervise NRW Reduction Activities is Enhanced
- Technical and Operational Capacity to Conduct NRW reduction activities by officer / Staff of RSC (W-C) is Developed

JICA Experts

- Chief Advisor
- Leaks Detection Advisor
- Arrangement of pipeline drawing and Customer Data Advisor
- Service pipe connection Advisor

Equipment

Name	Quantity
Valves for isolating pilot areas (φ100-200mm)	60
Portable ultrasonic flow meters	10
Data loggers with pressure inducers	8
Pipe detectors (metal)	4
Pipe detectors (non-metal)	3
Acoustic rods (Listening bars) - digital type	5
Electronic leak detectors	5
Correlation leak detectors	2
Plastic customer meter assembly	200
Lap top computers	2
Crew CABs (Double cabin trucks)	2
Pickup trucks	2
Micro excavators	2

Contd.

Name	Quantity
Metal locator (Valve locator)	5
Listening stick	6
Boring bar	2
Drill bit	30
Hammer drill	2
Pressure gauge for house connection	6
Generator	2
Projector	1

Pilot Zones

Planning & Monitoring

- Weekly Meeting

On going Pilot Zones

- Under the guideline of Experts 5 zones having 2,330 connections
- Voluntarily selected 3 nos Zones 963 connections

Monitoring Form

Daily & Weekly Work Done - Mr/Mrs.

Date		Weather - Good / Fair / Raining		
Nature of Work - Randiya / Illegal / Survey / Leak Detection / Flow Measurement / Permission /Office/.....				
Team	Fitter / Labour	Vehicle	Board / Hired	hrs .....
Working hrs	Morning	Afternoon		Night .....
Work Done / Locations				

Thanks

② Briefing of the Seminar (JICA Expert Team)

Briefing of the Workshop / Seminar

1

Findings in Overseas Training

- In JAPAN （Management Level)
- In a Third Country (NRW Reduction Team)

A chance to Share the findings and ideas among NWSDB

2

Pilot Project Activities

Aim to

- Share the ideas and findings of the activities
- Understand the importance and difficulties of NRW reduction activities
- Exchange the ideas or opinions on the Pilot Project Activities

3

Questionnaire

- Welcome any comments on and suggestions to the Project Activities !!

4

Outcome of the Training Course in Tokyo, Japan on NRW Reduction

8th to 16th September, 2010
NWSDB, Sri Lanka

1

0. Schedule

- 10/Sep (Fri)
  - AM: JWWA
    - Lecture on history of water supply system development and on strategy of future development in Tokyo
  - PM: Tokyo Metropolitan W'Works
    - Lecture on NRW Reduction Measures at Training Center
- 13/Sep (Mon)
  - AM: NSC
    - Lecture on Commercial Activities for NRW reduction in Japan
  - PM: Tokyo Metropolitan W'Works
    - Importance of integrated controlling / monitoring water conveyance system
    - Water History Museum
- 14/Sep (Tue)
  - AM: Tokyo Metropolitan W'Works
    - PR activities by waterworks bureau
  - PM: NSC
    - Summarizing work

2

1. Impression/Findings (difference between CMB & Tokyo) (1/2)

- Organization
  - NWSDB: National organization (semi-govt.)
  - JPN: Municipal operated (public enterprise)
- NRW Rate
  - 50% in CMB (leakage, illegal use, estimated bill, administrative loss, free water)
  - 3% in Tokyo (leakage)
- Free Water
  - Very high in CMB due to 1,600 Tenement Gardens
- Distribution Pressure
  - Tokyo: minimum 15m
  - CMB: very low due to aged CI pipes (scale, leakage, etc), high number of public stand post (4,000)
- Operation & Maintenance
  - Tokyo: Highly computerized, centralized and automated

3

1. Impression/Findings (difference between CMB & Tokyo) (2/2)

- Quality of Material
  - Tokyo: very high (eg. stainless connection pipe, DI Pipe in distribution pipes)
  - SLK: poor quality
- Office Environment
  - Good for working
- Tariff
  - SLK: covers only O&M
  - JPN: covers O&M + investment
- Mapping for water transmission / distribution
  - Tokyo: highly-established
  - CMB: lacks due to unavailability of resources

4

2. What we would like to tell/disseminate to our colleagues / What we would like to do after going back

- Training Center
- PR Activities
- Planned Activities
- Improvement of Meter-reading Activities
- Establishment of New Water Supply Operation Center

5

2-(1) Training Center

- Highly organized
- Importance of equipped/centralized training center (OJT)

6

2-(2) PR Activities

- Response method (highly attended, customer focused)
- Improvement of call center with the facilities and personnel
- Museum

10

2-(3) Planned Activities

- Continuation of on-going activities on reduction of administrative losses (defective meters, unreadable meters, estimated bills etc), illegal use, number of stand posts, free water in Tenement Gardens
- Pipe replacement program (delay due to lack of funds)
- Improvement of transmission pipes (capacity, etc)

11

2-(4) Improvement of Meter-reading Activities

- Promotion of awareness of their role / discipline
- Bi-monthly: to save cost
- Make use of private sector (outsource)

12

2-(5) Establishment of New Water Supply Operation Center

- To maintain pressure/ residual chlorine/ adequate quality

13

Thank you

14

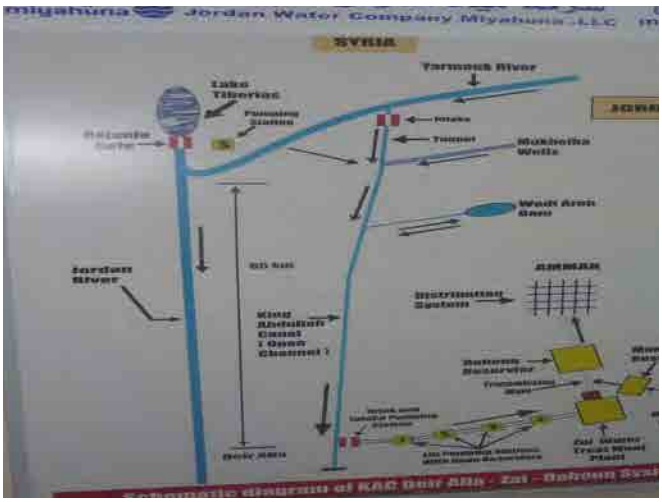

What we have gained through the Jordan Tour


Where is JORDAN ?
WORLD
LOCATION MAP: JORDAN
JORDAN

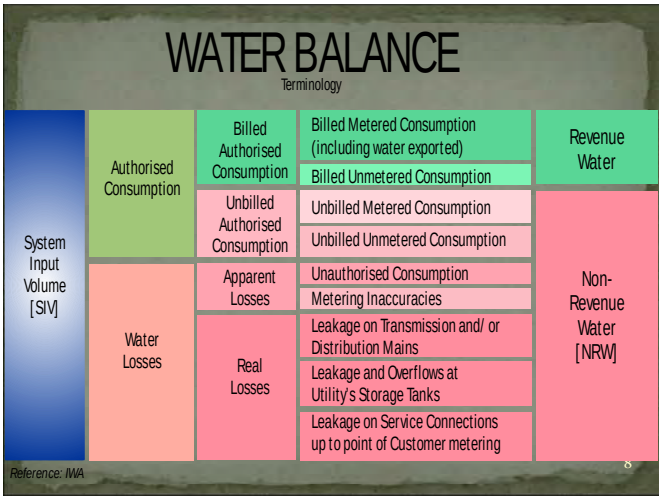

Neighboring Countries
Palestine
Syria
Jordan
Iraq
Yemen
3


OUR TEAM
4


Introduction
JICA


Jordan Water Company Miyahuna
SYRIA
Yarmouk River
Lake Tiberias
Wadi Arab Dam
Jordan River
Mukheiba Wells
AMMAN
King Abdullah Canal (Open Channel)
Dead Sea

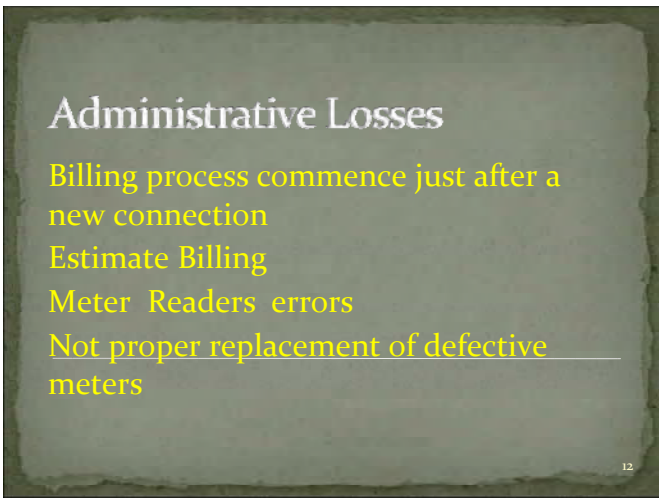

شركة مياه الاردن - مياهنا
Jordan Water Company Miyahuna .LLC
miyahuna
Storage Tanks
Pumps Mate
Force Main
7


WATER BALANCE
Terminology
System Input Volume [SIV]
Authorised Consumption
Billed Authorised Consumption
Billed Metered Consumption (including water exported)
Billed Unmetered Consumption
Unbilled Authorised Consumption
Unbilled Metered Consumption
Unbilled Unmetered Consumption
Water Losses
Apparent Losses
Unauthorised Consumption
Metering Inaccuracies
Real Losses
Leakage on Transmission and/ or Distribution Mains
Leakage and Overflows at Utility's Storage Tanks
Leakage on Service Connections up to point of Customer metering
Revenue Water
Non-Revenue Water [NRW]
Reference: IWA
8

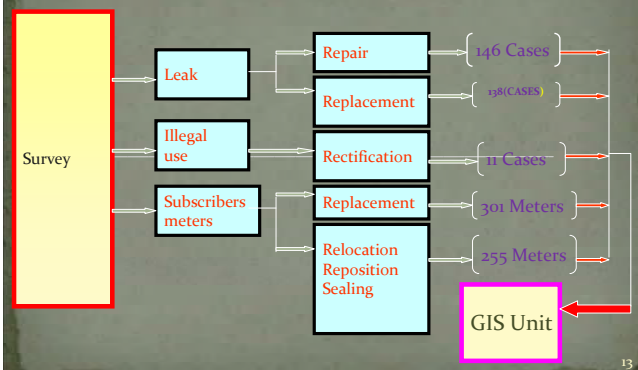

Major Problems in Jordan Water Supply System
9


Un-Authorized Consumption


Metering Inaccuracies


Administrative Losses
Billing process commence just after a new connection
Estimate Billing
Meter Readers errors
Not proper replacement of defective meters
12

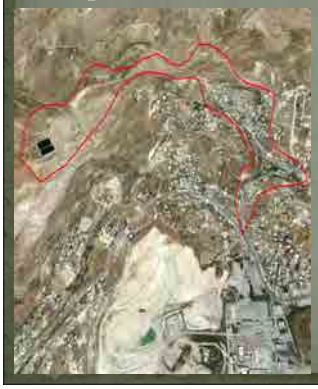
How They Reduce the NRW



13

Selected Pilot Areas

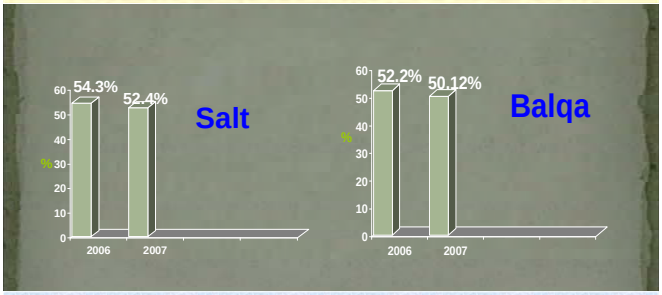
Thafilah



Balqa

14

The Benefit of NRW Reduction



One Of The Main Reasons For This Reduction Is
(Our Activities In The Pilot Area During The Year 2007)

Glance at Similarities and Differences in Jordan & Sri Lanka

Description	Sri Lanka	Jordan
Rainfall per year	5000-6000 mm	<300 mm
Water service	Uninterrupted	Once a week
NRW	52.1 % in 2010	52% in 2002
Pilot Area	Kotahena and Borella	Balqa and Thafilah
No of consumers per zone officer	> 6000	< 2500
Population	20 million	6.0 million
Water Source	Many	Only one
Pressure	Low 0.1 m-10m	High 250m – 350m
Charging System	Only water	Water, Waste water and Irrigation
No of days for new connections	7 to 14 days	7days

16

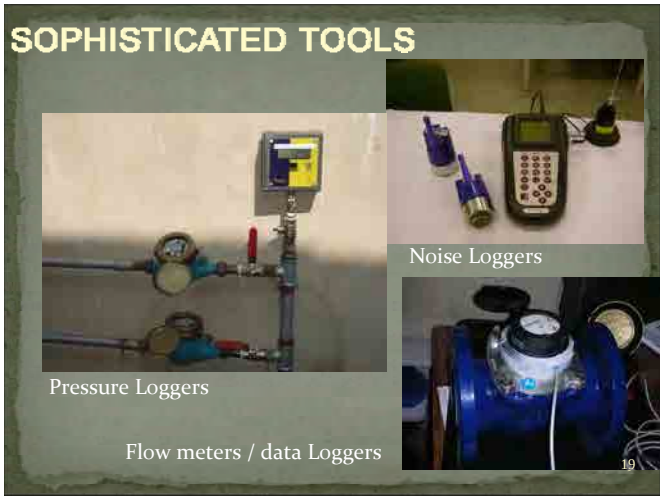
Glance at Similarities and Differences in Jordan & Sri Lanka

Description	Sri Lanka	Jordan
Billing	monthly	quarterly
Documentary work	More	Less
Inter cooperation with other institutions	To be developed	Excellent
Transition for GIS	-	01 year
No of team members	4 to 5	10
Private participation	To be developed	Satisfied
Public awareness	To be developed	Satisfied
Leak, Valve, Line detections	Same	Same
Preventive maintenance	To be developed	Once a six months

Sophisticated Tools

Ultrasonic Flow Meters

18

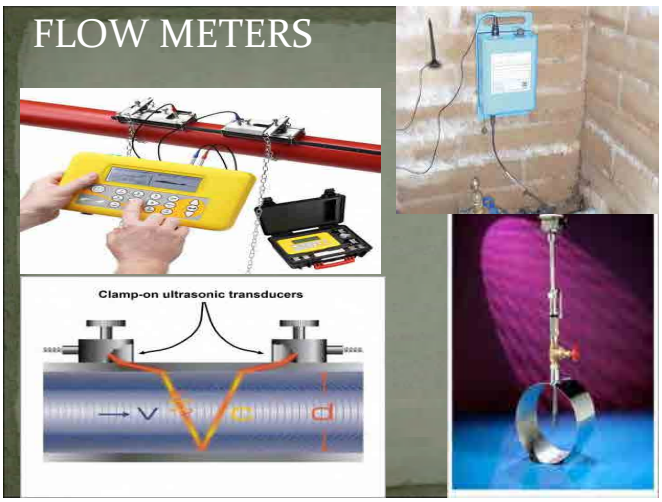

SOPHISTICATED TOOLS
Noise Loggers
Pressure Loggers
Flow meters / data Loggers
19


LEAKE DETECTORS
20


Leakage Van


PIPE LOCATER


NOISE
LOGGER


FLOW METERS
Clamp-on ultrasonic transducers

FLOW METERS

Sophisticated Tools

26

GIS Applications

27

Water networks and customers survey

28

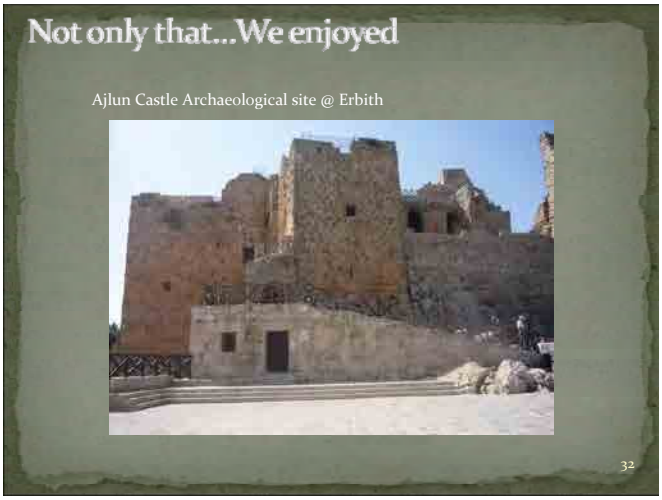
Map Preparation

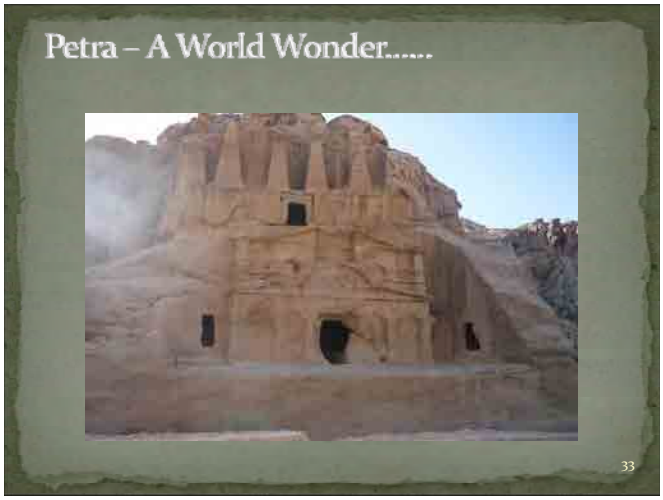
What to do in Sri Lanka

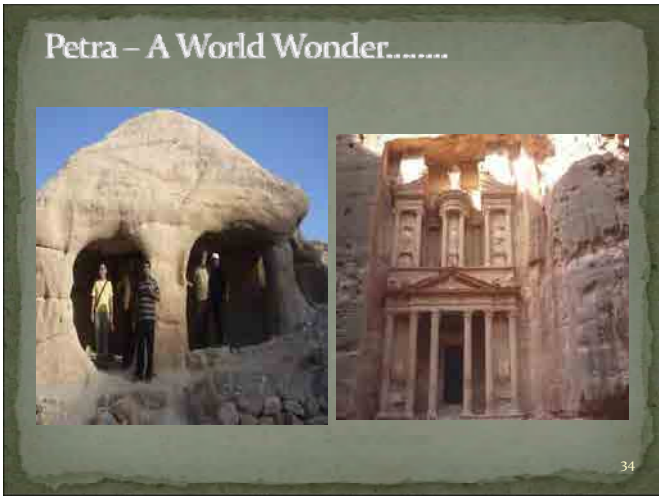
- Introduce GIS System
- Several data are available in Sri Lanka but not used.
- Develop the analysis of problems related to water supply and share the out comes with other offices through the periodicals or a easy way.
- Can introduced the pressure reducing valves to hilly areas like Kandy Region.
- Introduce the High Density Poly Ethylene (HDPE) Pipe. But very cost it.
- Provide the IT facilities and Improve the Computer Literacy of the officers .
- To be developed the Call Centre with modern facilities and skilled Officers.
- More attention to be paid for preventive maintenance and corrective maintenance.
- Better Co ordination with Police, CMC and other utility servicers such as Telecom, CEB, RDA Survey department & Trade Unions Etc.
- Improve the bill money collection systems with parallel to

30

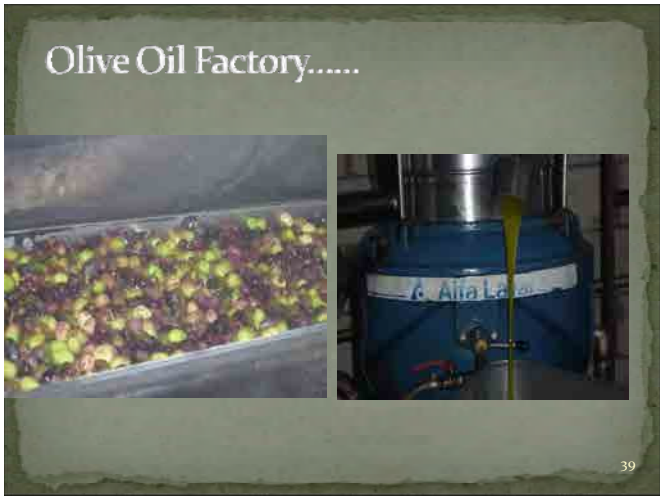

EXCHANGING SOUVENIR
31

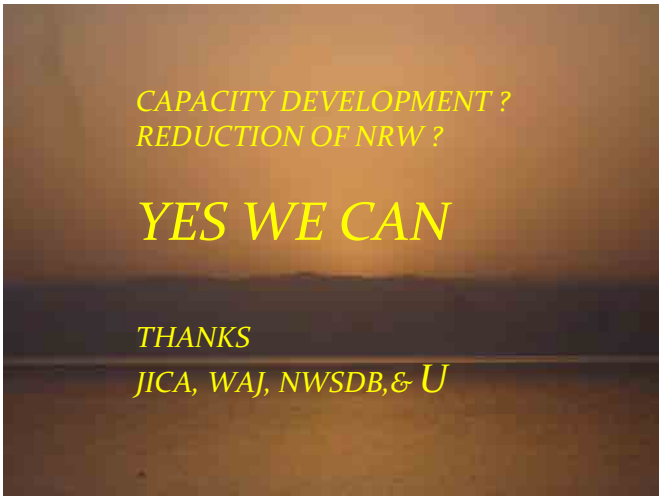

Not only that...We enjoyed
Ajlun Castle Archaeological site @ Erbith
32


Petra – A World Wonder.....
33

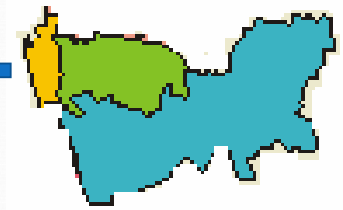

Petra – A World Wonder.....
34


Dead Sea.....
37


Olive Oil Factory.....
39


CAPACITY DEVELOPMENT ?
REDUCTION OF NRW ?
YES WE CAN
THANKS
JICA, WAJ, NWSDB,& U

Western Central Region



Colombo City

M(CC – North) M(CC – South)

AE –CC(North)

OIC (Kotahena)

1

Pilot Zone - Kotahena

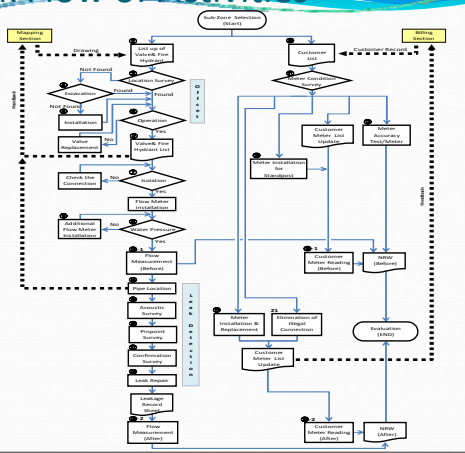
Introduction – Pipe born system commence in 1886 which is one of the oldest pipes lines in CC.

2

Activities Implemented Under JICA Project in Kotahena Pilot Zone

3

Work Flow of Activities



4

Main Work Flow of Activities

- Sub Zone Isolation
- Map Updating
- Consumer Survey
- Leakage Management
- Development of Further Sub Zones

5

Sub Zone Isolation in Kotahena

- Identification of Pipe Lines and Valve
  - Valve Tracing
  - Valve Condition Survey
  - Valve Repair if Any or New Valve Installation
- Bulk Meter Installation
- Isolation Confirmation Test

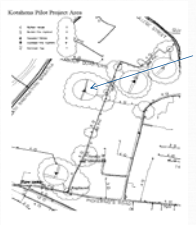
Kotahena Area

Distribution length: 1,360m
Number of House connection: 320

7

Map Updating

- Size and Material of Pipe line
- Side of the Pipe Lines
- Location of Valve
- Insert New Valves & Pipes



9

Consumer Survey

- Meter Condition
- Meter Accuracy Test
- Collection of Consumer details
- Acoustic Survey for service leak detection
- Checking and Legalizing of Illegal connections
- Metering of Unmetered Connections
- Defective meter replacement

10

Customer list

Customer meter check list

Name of Pilot area:
Name of Sub zone:

No.	Customer name	Customer ID.	Road name /House No.	Record / Previous month consumption (m3)	Survey / Meter condition (W, N, U, I, NA, O)	Family's Number	Number of tap	Tank Overhead Ground (Y, N)	Meter condition (W, N, U, I, NA, O)	Remarks
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

W: Working
N: Non-working
U: Unmetered
I: Illegal Connection
NA: Not Access
O: Others

Customer list should be prepared and all meter condition should be checked.

11

Water Leakage Management

- Visual Leak Repairs
  - Day and Night Appeared Leaks
    - Pin Points
    - Confirmation
- Active Leak Detection
  - Night Leak survey by Using Instruments
  - Step Testing

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13

14

Problems in Leakage Management

- Defective valves
- Pervious Repairs not properly done
- Less Cover in Service Lines
- Bundle Pipes
- Poor Workmanship in Illegal tapping
- Behaviors of Other Utility Agencies in Construction



Measuring of Free Water Supply

- Identification of Out Lets

Common Outlet	14

- Metering of Out Lets

Common Outlet	14

- Details of Consumption m³

Common Outlet	4m³/outlet/day

16

Development of Sub Zones

- Sub Zone K1
  - Number of Customers 369
  - Distribution Length - 3"CI 155.2 m
    4"CI 253 m
    5"CI 298.9 m
    160 mm PVC 716.7 m
- Sub Zone K2
  - Number of Customers 410
  - Distribution Length 3"CI 61.7 m
    4"CI 742.2 m
    5"CI 397.3 m
    63 mm PVC 245.1 m

17

Summary of Work Implemented

Summary of the Project

Area	Zone	Total Connection	No of Unmetered	Total Illegal	Total leak Repairing		Initial NRW	Interim NRW
					Main	Service		
Kotahena	K1	357	45	53	3	72	85.26	76.15
	K2	410	19	21	_	51	79.74	_

18

Problems Identification

- Deteriorated and Scaled CI Pipe Lines
- Bundle Pipes
- Defective & Buried Valves
- Defective Meters
- Wastage in Common Out Lets
- Impurities Inside the Pipe Lines

19

Disconnection of CI line and transfer of Connection to PVC

Bundle pipe replacement

20

Parallel Execution

- Works in K_2,K_3,K_4 & K_5 Sub Zones were Started in Simultaneously

21

Benefits

- Familiarizing with New Technology
- Methodical approach to address Water Loss Management
- Team Work Effects
- Sharing Knowledge With Japanese Experts
- In depth information about the existing system

22

Learning

- Importance of Valve and its Workability
- Importance of Realistic Map
- Leak Repair is not effective in a deteriorated system. It need to be
  - Replaced Bundle Pipes
  - Replaced Deteriorated CI Pipes
- House to house survey gave more information for O&M activities
- Effectiveness of Weekly Meeting

23

Thank You

شكرا جزيلا
有難うございます

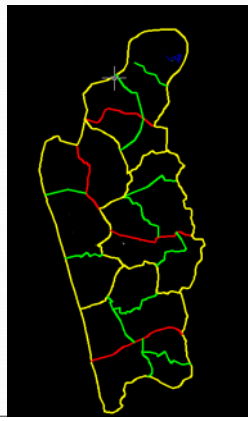
24

THE CAPACITY DEVELOPMENT PROJECT FOR NRW REDUCTION IN COLOMBO CITY

Borella Area

Present Situation of the Colombo City

- Area 37.4 sqkm
- No of Connections as at 2010 120000
- Administrative by Two Manager office , 4 AEE & 8 OICC with 24 Zone Officers
- NRW Percentage 50%



Purpose of the Project & Project Area

- NWSDB Capacity to implement NRW reduction activity in Colombo City is Strengthened
- Borrella Pilot Zone
  - Area nearly 4 sqkm
  - Total Connections 5000
  - Length of Pipe network - 32 km
  - Community consists of Domestic, Commercial & Tenement Gardens

Objective of the Project

- Management Capacity of Senior Officers of RSC (W-C) to Plan and Supervise NRW Reduction Activities is Enhanced
- Technical and Operational Capacity to Conduct NRW reduction activities by officer / Staff of RSC (W-C) is Developed

Work Flow of Activities

Sub Zone selection

Valve Locating & Sub Zone Isolation

Initial Inflow

Consumer Survey

Meter Accuracy Test

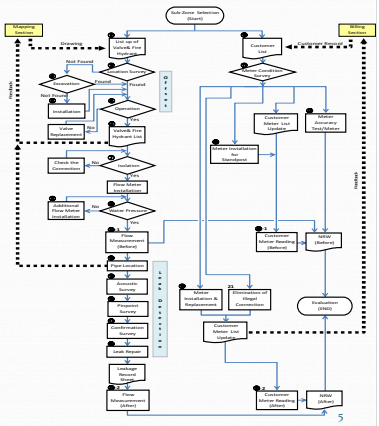
Leak Detection

Leak Repair

Further reduction of NRW

Observations

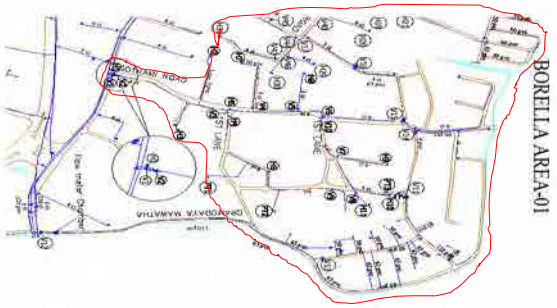
Project outcome



Selected Pilot Zones In Colombo City Area

⑥ Results of the Pilot Activities in Borella (AE, Colombo East - Borella)

Zone Map-B1



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Zone Map-B2

8

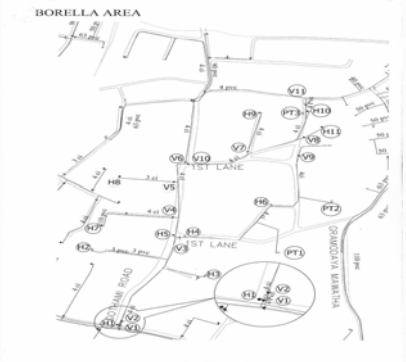
Zone Map-B3

9

Detecting buried lines & valves by using metal locator and pipe locator

10

Identification of Valves - Borella



11

Valve condition survey

Valve condition checking list

Name of Pilot area:
Name of Sub zone :

Item	No.	Size(mm)	Pipe material	Condition: Location (Existence, Buried)	Valve cover (OK, Non,)	Direction (Clockwise, Anticlockwise)	Operable (C, NC)	Number of rotation to be closed	Need for a replacement	Remarks
Valve	V-1									
	V-2									
	V-3									
	V-4									
	V-5									
	V-6									
	V-7									
	V-8									
	V-9									
	V-10									
Fire Hydrant	H-1									
	H-2									
	H-3									
	H-4									
	H-5									
	H-6									
Wash out	W-1									
	W-2									
	W-3									

	No.	Size	Material	Meter(Y, N)	Condition	Remarks
Stand post	PT-1					
	PT-2					
	PT-3					

All valves, fire hydrant,

12

- **Condition of boundary valves which are needed for the Isolation of the sub zone were checked.**
- **If they cannot completely close, they were replaced.**
- **Installed additional valves when required.**
- **Data sheet shall be filled.**

13

Valve Installation & Zone Isolation



14

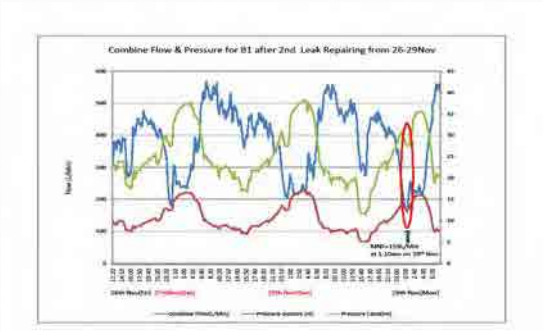
Initial Inflow & Pressure


Bulk meter readings


Pressure measurements

15

Obtain logger measurements



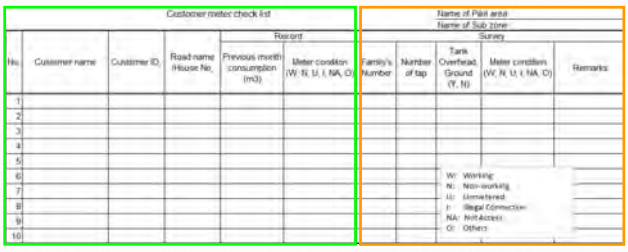
16

Preparation of customer list

- Prepare the customer list of sub zone including the customer name, customer-ID, address and meter-conditions.
- Customer meter condition were checked one by one house based on the customer list.

17

Customer list



Customer list should be prepared and all meter condition should be checked.

18

⑥ Results of the Pilot Activities in Borella (AE, Colombo East - Borella)

Customer List and Meter Condition Survey

19

Meter Accuracy test

20

Leak Detection

Acoustic survey

Pinpoint survey

Conformation survey

21

Leak map in zone B1

22

Leak Repairing

23

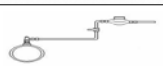
Leak Recording System

Leakage Record Sheet Ref. No 27

Borella -02

Date of survey:	27/10/2010	Street No,	
Account No,		House No,	Infront of 17A
Main Pipe	CIP, PVC, GP, Others( )	Location	Pipe , Connection , Valve , Others
		Condition	Hole , Crack , Brakeage , Packing , Unknown , Others
Diameter	mm	Cause	Corrosion , Water pressure , Deterioration (Aging) , Wrong Construction , Traffic load, Unknown , Others
House Connection	PVC , GP, Others( )	Location	Pipe , Connection , Valube , Others
		Condition	Hole , Crack , Brakeage , Loose Connection , Packing , Unknown , Others
Diameter	19 mm	Cause	Corrosion , Water-pressure , Less Adhesive , Deterioration , Wrong Construction , Traffic load , Unknown , Vandalism , Others
Depth	cm	Ground	Asphalt , Concrete , Gravel , Grass , Soil , Others
Leakage Size	Large , Medium , Small	Leakage Quantity (Measured)	

Point of Leakage



Date of Repair : , 2010 Time/ : ~ : (H)	Material	Excavation Size(m x m x m) Pipe (Dia: mm Length: m), Socket (Pis) , Elbow (Pis) Others ( ) Worker ( ) Other Expence( )

24

Further Reduction of Leakages

- Step Testing
- Results
  - Minimum Night Flow(MNF)
  - Zone 01–56 l/Min
  - Zone 02–24 l/Min
  - Zone 03–108 l/Min
  - Zone 04–100 l/Min
- Observations
  - No. of leaks-06(within zone-03 & 04)
- Present Status
  - Leak Repairing work is in progress.

5

Meter Installation for Stand post

- No. of Common Outlets -2
- No. of Removal-1
- No. of New Connection Provide-10
- Average Consumption - 360 m³/month

26

Finding of buried meter

27

Recent situation of old pipes& valves

28

Out Come of the Project-B1

Physical progress

- 10 new connections given
- 8 illegal connections detected
- 47 leaks repaired (12-main/35-service)
- 10 unmetered places metered
- 15 defective meters changed
- 1 common tap removed

29

Out Come of the Project-B1

Commercial progress (using billing details)

Month	Income of the year (SL.Rs.)		Amount of increase(SL.Rs.)
	2009	2010	
November	342,947.00	383,940.00	40,993.00
December	301,937.00	342,420.00	40,483.00

30

Work summery

Borella 3	Borella 2	Borella 1	zone name	
355	617	579	no of consumers	
0	6	2	no common taps	commen tap
0		12	consumption(m3/day)	
289		543	no of working	
1		12	no of unmeter	
13		15	no of deflection	
2		0	no of difficult to read	
3		0	no of disconnections	
0		10	new connection	
47		7	house closed	
19		8	no of illegal	
16		35	no of service leake	
3		12	no of main leake	
1190.2		653.1	inflow(m3/day)	before leak repairing
106.1		312	MNF(minimum)	
279.4		564	inflow(m3/day)	after leak repairing
54.5		159	MNF(minimum)	

31

Details of NRW reduction in B1

	Initial consumption	Interim consumption	Initial NRW	Interim NRW
Metered amount(m3/day)	383.1	449.8	40.27	20.08
Estimated amount(m3/day)	7.06	1.03		
Total amount(m3/day)	390.1	450.8		

32

Details of NRW reduction in B3

	Initial consumption	Interim consumption	Initial NRW	Interim NRW
Metered amount(m3/day)	179.14		84.20	32.7
Estimated amount(m3/day)	8.9			
Total amount(m3/day)	188.04	188.04		

Note- Interim NRW was calculated based on initial billing data.

33

Accomplishment

- B1 -Initial & interim NRW determined
- B2 -Once initial NRW established then Identified shortcoming to be rectified to determined the final NRW
- B3 -Initial & interim NRW established

Comparison with Program

- 2009Commencement of Project Nov. 2009
- Physical Progress 25%

34

Problems Encountered

- Inaccuracy of the current drawings
- Lack of valve location details
- Buried and non function condition of the existing valves
- Difficulty of gaining approval from local authorities (Presently RDA not giving approval to excavate their roads)
- Consumer relation problems
- Old & complicated service Distribution & High Leak System
- Scaling of old Distribution network
- Work with restriction due to Motor Traffic and City Congestion

35

How to Overcome

- Use of modern equipment (used to find buried valves and leaks)
- Regular meeting helps to share the experience, gain new knowledge and change bad attitudes
- Consumer related problems minimized by acknowledging the community about NRW activities
- Initiation of a leak detection and repairs
- Team Work & Commitment
- formation of periodic work program

36

Obtain benefits

- Able to update existing drawings
- Able to implement new re-numbering system to valve network and starting to maintain valve tie-measurements system
- Pressure increasing (in B1, some area's pressure increase from 2m to 6m)
- Encourage an improved service level to consumer
- Helps to minimized billing errors
- Able to include new consumers in to the billing system (By eliminating common taps and giving new connections to surround people)
- Increasing of consumer relationship
- Control of illegal connections, vandalism and misuse of supply
- Distributed more effectively
- Increasing of consumer satisfaction

37

Lesson Learn

It is found that the major reason for the NRW is due to the leaks of the existing pipe network

- night leak survey is very important
- rapid engagement to leak repair works is must

38

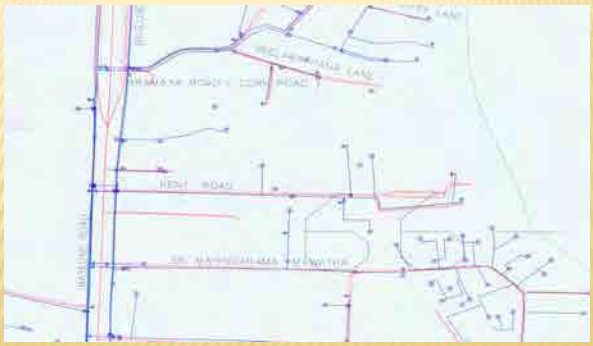
Thanks

For attention

39

⑧ Results of similar activities in Other areas (OIC Maligawatte)

MAP OF KENT ROAD



1

KENT ROAD

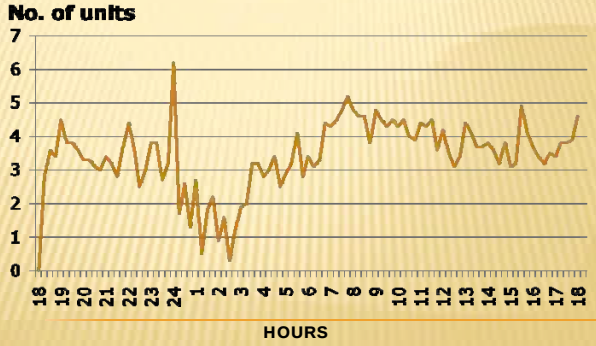
DEMATAGODA, COLOMBO 10, SRI LANKA.

No. of Connection = 228 nos.
Average daily consumption = 158 units /24 hrs
(According to billing)
Average daily consumption = 334.5 units /24 hrs
(According to bulk meter)
Initial NRW Percentage = (334.5-158) X 100
334.5
=52.76%

Conducted on 01.09.2010.

2

VARIATION OF FLOW PATTERN THROUGH OUT THE DAY



3

FOLLOWING STRATEGIES WERE APPLIED TO DETECT N.R.W.

- House to house awareness programme
- Mid night survey to detect visible leaks
- Acoustic survey with listening stick
- Pinpointing survey with electric leak detector
- Conformation survey with listening stick

4

RECTIFICATION WORKS DONE

- Fixing of 90mm dia. Bulk water meter at the main
- 2 nos. of visible main leaks
- 2 nos. of invisible main leaks
- Replacing the ball valve at the sump
- 20 nos. of invisible connection leaks
- 5 nos. of visible connection leaks
- Fixing a bulk water meter at water sump of the flat
- Fixing of water meters at unmetered premises.(4 houses & 2 common taps)

5

AFTER THE ALL RECTIFICATION WORKS

Actual Consumption = 256 units / 24 hr
(According to Bulk meter)
Percentage of Present NRW = (256 -156) x100 %
256
= 38%

Reduction of NRW/day = (52.76-38.00)%
= 14.76%
No. of units saving per year = 14.76*256*356
100
= 13,792 units
= 13,792,000 lts.

6

PINPOINTING SURVEY

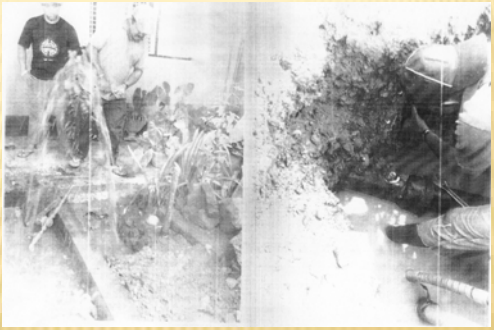
7

8

9

RECTIFICATION OF SERVICE LINE LEAK.

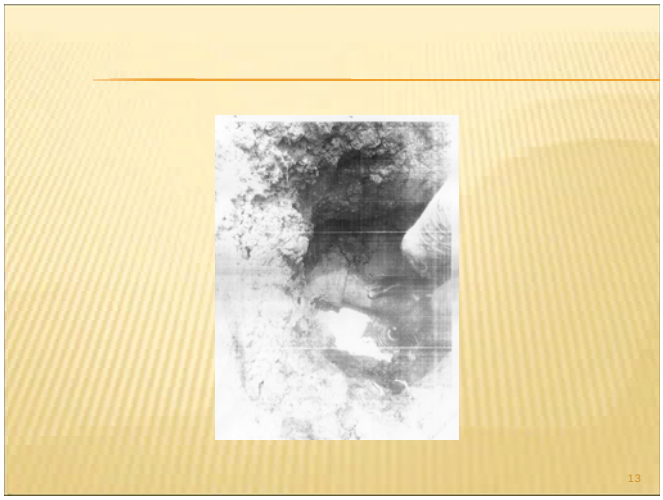
10



11

REPAIRING MAIN LINE LEAK

12



13

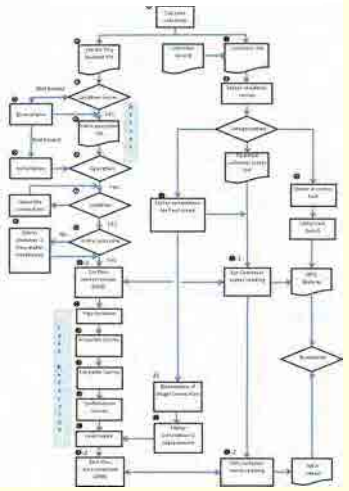
THANK YOU!

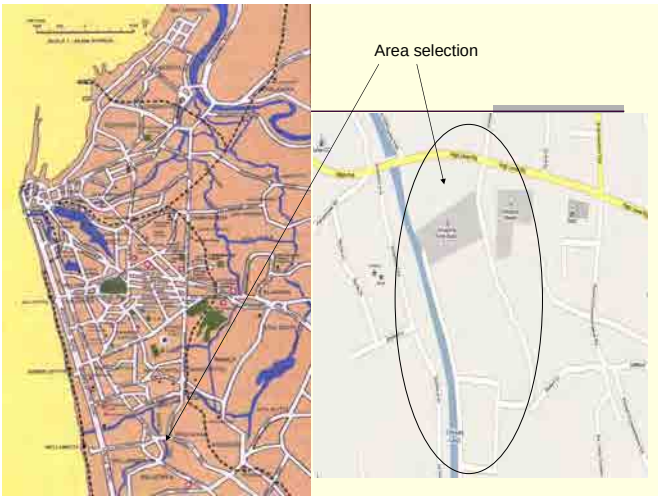
14

PROPOSED PILOT AREA
Area Engineer (CCS)
OIC (Pamankada)
2011-01-24

Selected area
KIRULAPURA PROJECT (KUBIKALE)

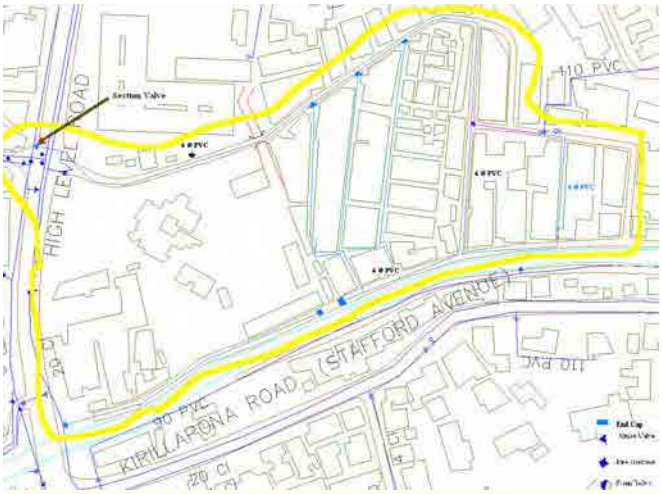
Activities to be done

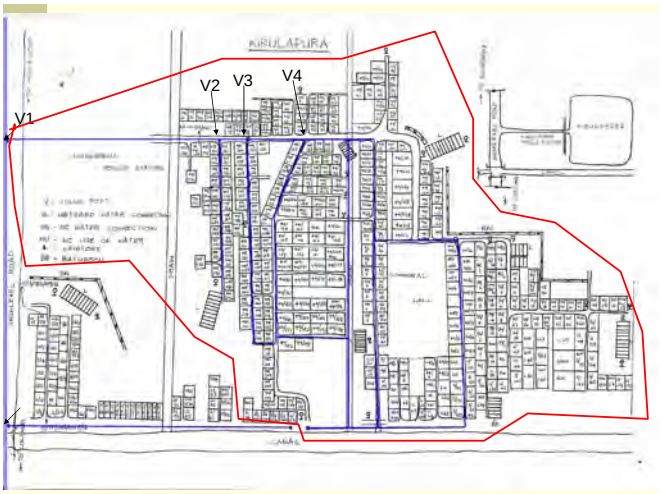




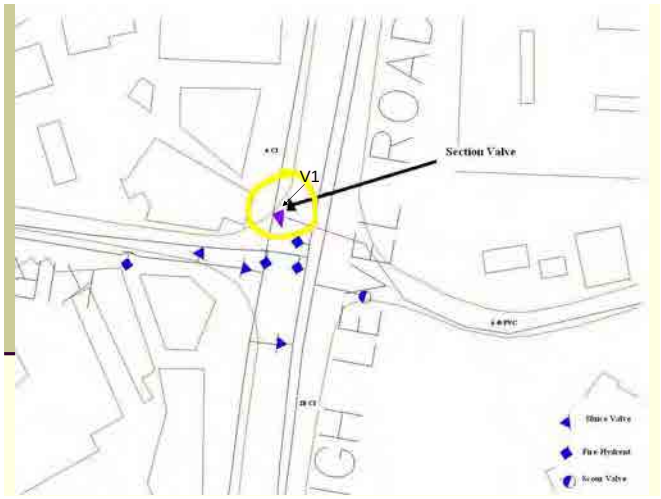
Reasons for selection of the Pilot Area

- Frequent water failure in the area due to Invisible leak – March 2010.
- High-density area.
- Easy Isolation area.
- To Improve the pressure in distribution system

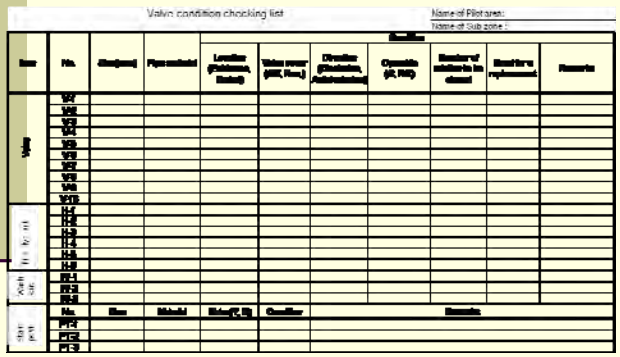




⑦ Results of similar activities in Other areas (AE Colombo South)



Valve Data Recording Sheet



MAIN VALVE

Section valve chamber

Meter Point

KIRULAPURA PROJECT

Available data

Based on MIS 2010

Year	2009	2009	2009	2009	2010	2010	2010	2010	2010
Month	September	October	November	December	January	February	March	April	May
Total Connection	536	538	538	538	538	537	539	538	538
Domestic	534	536	536	536	536	535	535	535	535
Nondomestic	2	2	2	2	2	2	4	3	3
Total Consumption	9,736	7,651	9,299	7,628	8,532	9,409	8,480	10,294	10,723
3 month Average	8,955.33	8,845.67	8,895.33	8,192.67	8,486.33	8,523.00	8,807.00	9,394.33	9,832.33
Total Revenue	245,257.65	150,939.17	217,434.39	155,733.50	195,959.55	229,479.64	198,774.50	254,420.33	271,943.60

Some Information's of this area

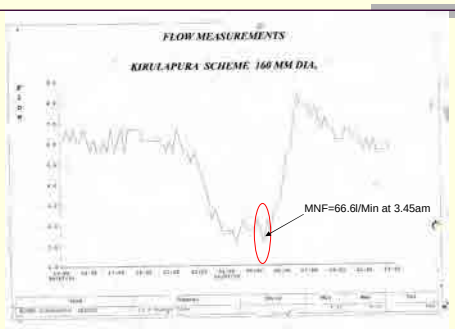
1.	Mean sea level (MSL) of selected area	……..
2.	Average Population	3500
3.	Religion type	Mixed
4.	Land area (App)	0.5 Km^2
5.	Education Level	Medium
6.	Income level	Medium
7.	Other water resources	One Dug well (Used for bathing)
8.	Number of Common tap	6 (bathing areas and toilets)
9.	District Secretarial area	Thimbirigasyaya
10.	Urban Council	CMC
11.	Police area	Kirulapone

Kubikale Pilot area Project Progress Report As at 2010-07-08

Number of Inspected	**529**
Inactive Account	**12**
Number of Consumers	**2497**
Number of Taps	**1530**
Over head Tank	**1**
Illegal Connection	**4**
Visible Leak	**11**
Disconnected	**15**
House Closed	**10**

Customer Survey Data

Measurements of Flow and Pressures



Initial Status of the Pilot Area

Bulk consumption for 24 hrs. (m^3)	456
Bulk consumption for 30 days. (m^3)	13680
Individual consumption (Including common outlets)- (m^3)	11091.33
Therefore Initial NRW (m3/month)	2588.67
Initial NRW As a percentage	18.9

Average Pressure (Outlets) - 4m

Visible leaks

Final Status of the Pilot Area

Bulk consumption for 24 hrs. (m^3)	427.4
Bulk consumption for 30 days. (m^3)	12822
Individual consumption (Including common outlets)-(m^3)	11928.13
Therefore Initial NRW m3 per month	893.87
NRW As a percentage	7

(7) Handout Materials for GIS Training from September 2011 to February 2012

List of Materials

①: Introduction to Coordinate System
②: Introduction to GPS
③: Introduction to GIS
④: Introduction to AutoCAD Map
⑤: Introduction to GPS (Seminar for Management Level)

Annex -3 Training Materials (7)

① Introduction to Coordinate System

Capacity Development Project for
Non Revenue Water (NRW) Reduction
In Colombo City.

Training program on
GIS Mapping
Introduction to Coordinate Systems

Tharanga Jayamanna
GIS Analyst
JICA Expert Team for
Capacity Development Project for Non Revenue Water (NRW) Reduction in Colombo City

Co-ordinate Systems

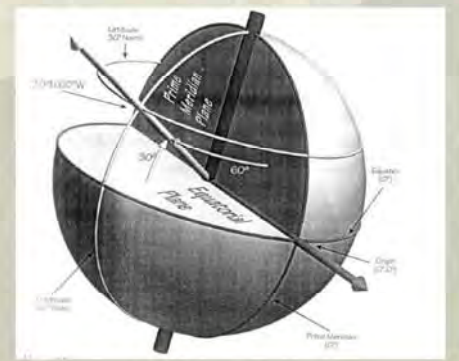
Absolute Co-ordinate Systems:

e.g. Latitude & Longitude

Relative Co-ordinate Systems:

e.g. Local Rectangular Cartesian Co-ordinate System

Latitude & Longitude



Latitude & Longitude

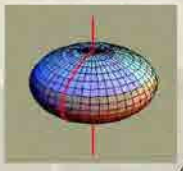
A Better Model for Earth

Precision of the measurements taken on the Earth has been increased tremendously. A series of gravity measurements were carried out from 1734-41. It was found that these measurements are not exactly tallying to the spherical model for the earth !

Conclusion: The earth is not an sphere ?

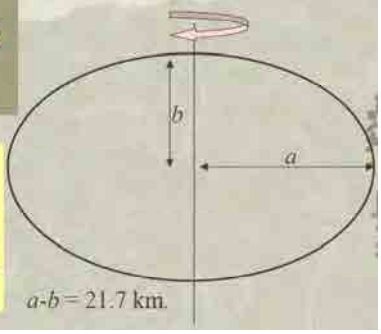
It is more closer to an ellipsoid !

Ellipsoidal Earth



$$f = \frac{a-b}{a}$$

$$e^2 = \frac{a^2-b^2}{a^2}$$



$a\text{-}b = 21.7$ km.

① Introduction to Coordinate System

Reference Ellipsoid Parameters

WGS84:

a = 6378137.000 m.

1/f = 298.25722357

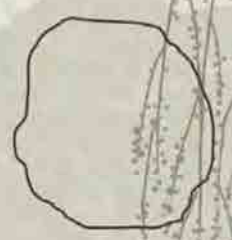
Everest:

a = 6377276.345 m.

1/f = 300.8017

Geoid

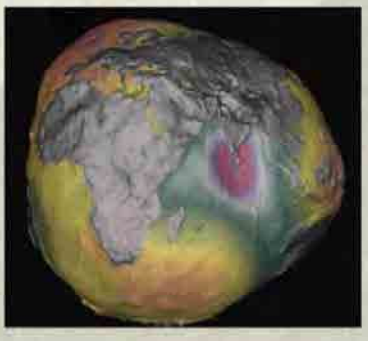
Undisturbed Sea Surface. This is considered as the shape of the Earth. It it defined as the Equipotential surface closely associated with the undisturbed sea surface.



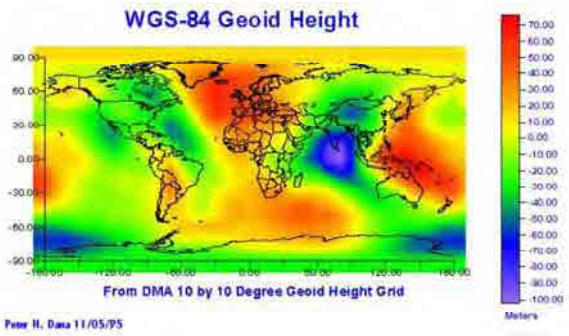
$$V = \sum_{n=0}^{\infty} \frac{1}{r^n} \sum_{m=0}^{n} \left(A_{n,m} P_{n,m}(\cos\theta) \cos m\lambda + B_{n,m} P_{n,m}(\cos\theta) \sin m\lambda \right)$$

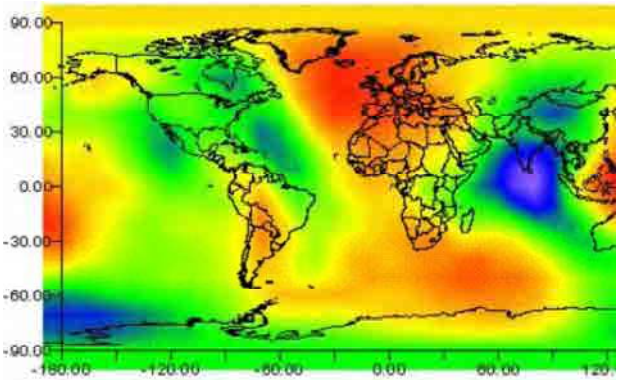
Geoid

Colour Coded to Show Deflection from WGS84

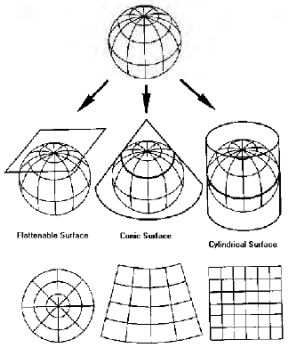


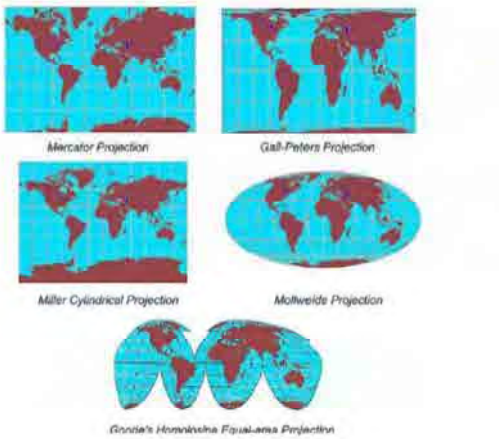
WGS84 Undulation



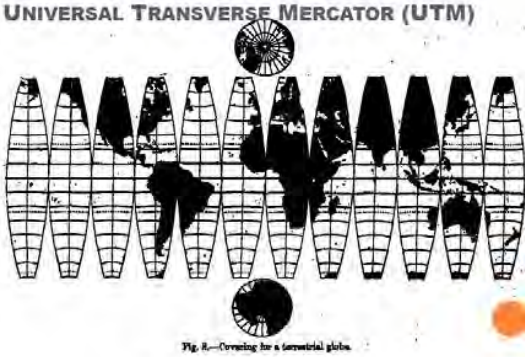


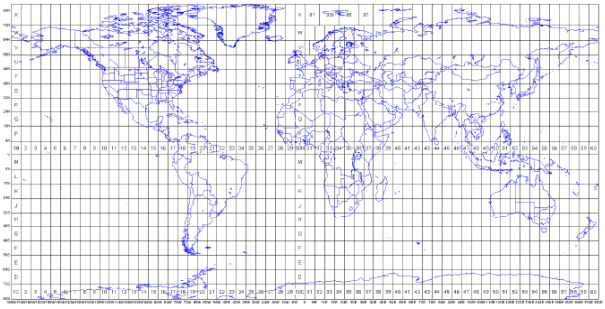
Map Projections (Examples)





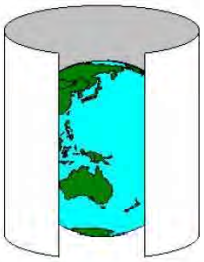
GLOBAL COORDINATE SYSTEMS
UNIVERSAL TRANSVERSE MERCATOR (UTM)



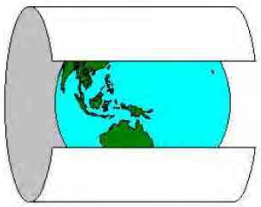


WHAT IS FOR SRI LANKA ?

- Best map projection for Sri Lanka is "Transverse Mercator"



Mercator projection

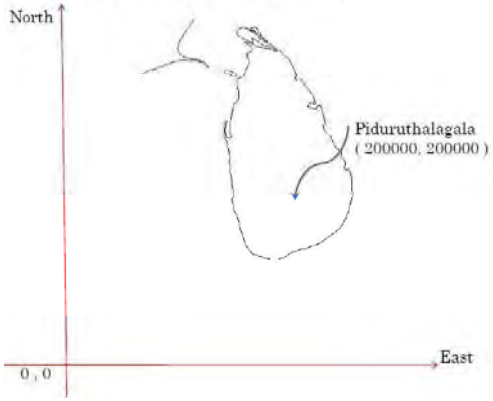


Transverse Mercator projection

MODELING THE EARTH

- Shape of the Earth (Equi-potential surface)
  - Geoid – Undulated shape
  - Modeled as a spheroid (Ellipsoid)
  - World standard spheroid – WGS84
  - Sri Lanka does not coincide with WGS84
  - Spheroid for Sri Lanka – Everest 1830

Sri Lankan Local Grid

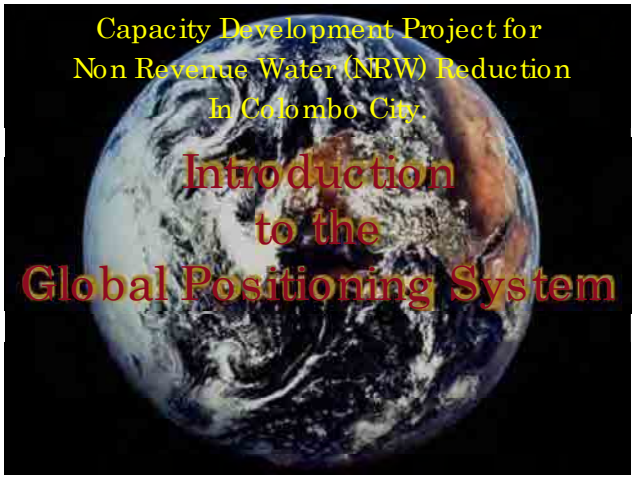


Local Coordinate Systems Sri Lankan Local Grid

- Origin at 200,000m west and 200,000m south to Piduruthalagala peak.
- Now we use 500,000 coordinate system as well.

Local Coordinate System – Parameters

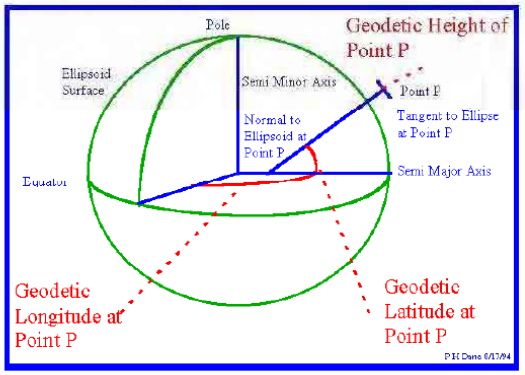
- Latitude of origin
  07.00048^0 N
- Longitude of origin (Central Meridian)
  80.77171^0 E
- Scale Factor
  0.999923841
- False Northing
  200000m
- False Easting
  200000m

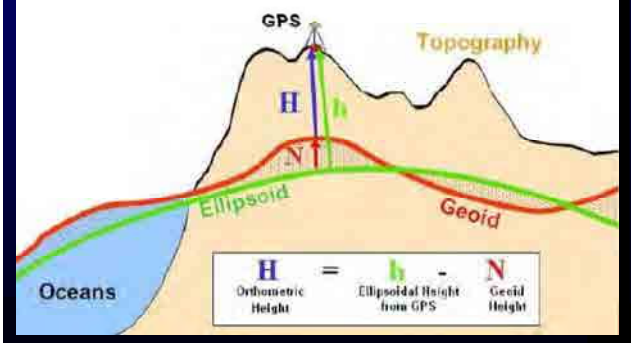


COORDINATE SYSTEMS

- Position is 'Relative'.
- "Coordinate Systems" are used to define "Position"
- 3D Space → 3 Parameters
  - Latitude, Longitude, Height (Global coordinates)
  - North coord., East coord., Elevation (Local coordinates)
  - X, Y, Z (Geo-centric coordinates)

GLOBAL COORDINATE SYSTEM





DATUM

- Orienting the suitable ellipsoid to fit in to the focused area is called 'Datum'
- Originally the ellipsoid is kept such that its' center coincides with the earth's center of gravity.
- Then it is moved along x, y and z axes. (3 translation parameters)
- Next it is rotated around x, y and z axes. (3 rotational parameters)
- Finally scale up or down accordingly. (1 scale parameter)

- Altogether 7 parameters are required.
- Datum used for Sri Lanka is called "Kandawala"

WHAT IS GPS

- A satellite based navigation system.
- Developed and owned by DoD – U.S.A.
- A.K.A. NavSTAR (Navigation System using Time And Ranging)
- 3 Segments
  - Space segment – Satellites
  - Control segment – Ground station
  - User segment – GPS receiver

WHY GPS

- Available around the globe
- Provide relatively accurate position data
- User can obtain coordinates without doing calculations and measurements
- Quick response
- Available in 24 / 7
- Can easily integrate with other systems
- Easy to use

DISADVANTAGES

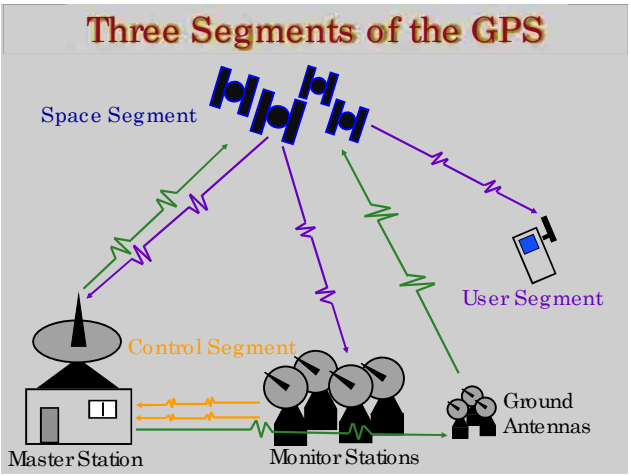
- Depended on U.S.A.
- Need for power source
- Does not work indoors

GPS AND GNSS

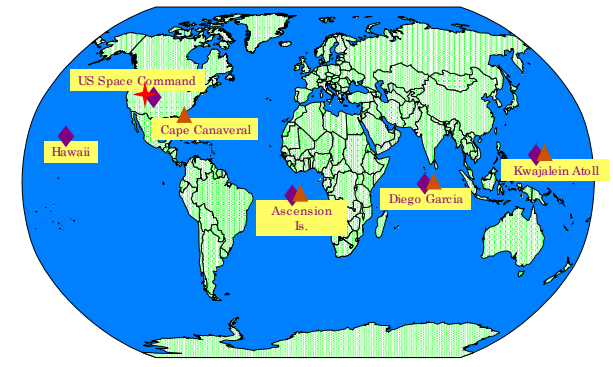
- GPS is a subsystem of GNSS
- GNSS ? – Global Navigation Satellite System
  - GPS (USA) - Global Positioning System
  - GLONASS (Russia) - *Global Navigation Satellite System*
  - GALILEO (Europe) - *European Satellite Navigation system*
  - BEIDOU (China) - *Beidou Satellite Navigation and Positioning System*
  - IRNSS (India) - *Indian Regional Navigational Satellite System*

How the GPS Works

Three Segments of the GPS

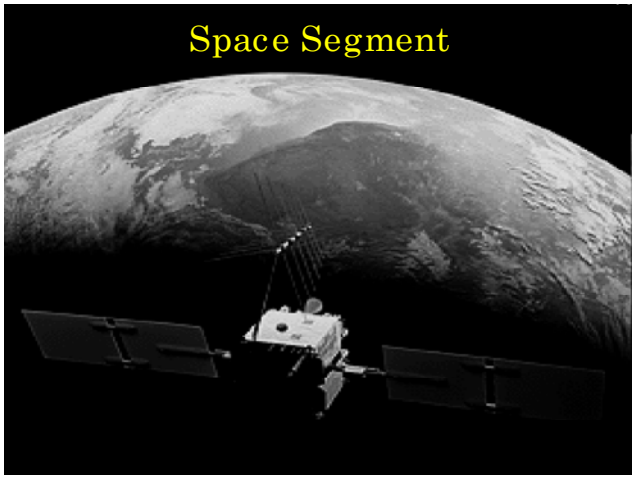


Control Segment



Master Control Station ♦ Monitor Station ▲ Ground Antenna

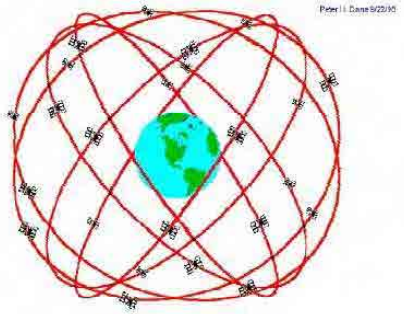
Space Segment



Major Segments - Space Segment

- 32 satellites in 6 orbits
  It was 24 Satellites, Now 32??
- Approximately 20,000km away
- Emit EM waves (travel at speed of light)
- Go around the earth approximately twice per day
- Have 4 atomic clocks on board

Space Segment (Cont...)



GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Attitudes, 55 Degree Inclination

User Segment

- Military.
- Search and rescue.
- Disaster relief.
- Surveying.
- Marine, aeronautical and terrestrial navigation.
- Remote controlled vehicle and robot guidance.
- Satellite positioning and tracking.
- Shipping.
- Geographic Information Systems (GIS).
- Recreation.

Four Primary Functions of GPS

- Position and coordinates.
- The distance and direction between any two waypoints, or a position and a waypoint.
- Travel progress reports.
- Accurate time measurement.

Position is Based on Time

Signal leaves satellite at time "T"

T

T + 3

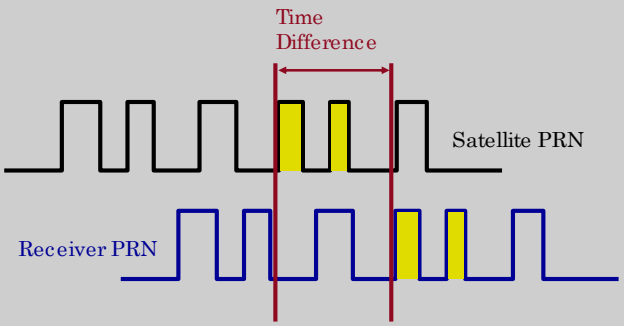
Signal is picked up by the receiver at time "T + 3"

Distance between satellite and receiver = "3 times the speed of light"

METHODS OF CALCULATING POSITION

- Pseudo Random Noise
- Carrier Phase Calculation

Pseudo Random Noise Code



What Time is it Anyway?

Universal Coordinated Time

Greenwich Mean Time | GPS Time - 13* | Zulu Time

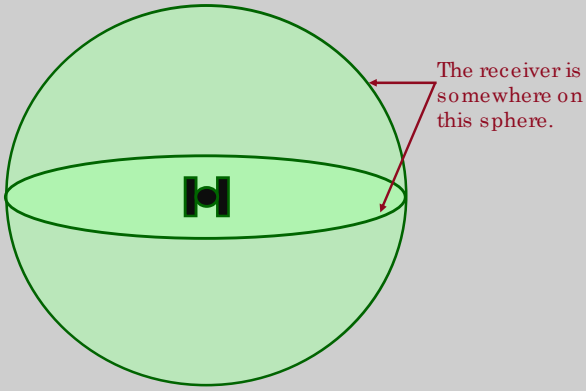
Local Time: AM and PM (adjusted for local time zone)

↕

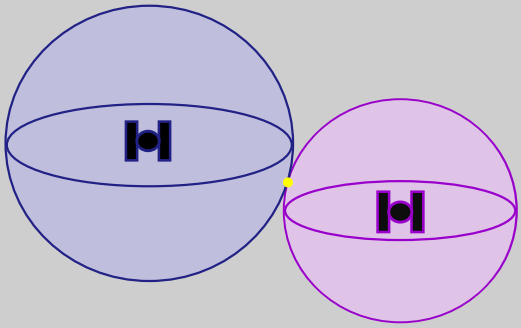
Military Time
(local time on a 24 hour clock)

*GPS Time is currently ahead of UTC by 13 seconds.

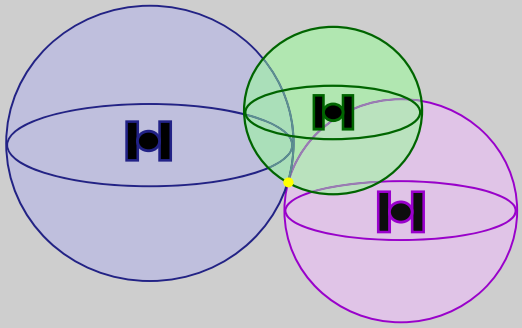
Signal From One Satellite



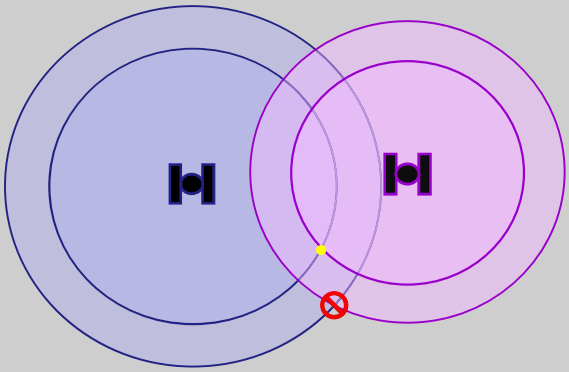
Signals From Two Satellites



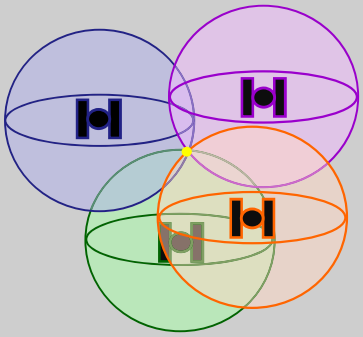
Three Satellites (2D Positioning)



Triangulating Correct Position



Three Dimensional (3D) Positioning



Sources of GPS Error

Standard Positioning Service (SPS): Civilian Users

Source	Amount of Error
Satellite clocks:	1.5 to 3.6 meters
Orbital errors:	< 1 meter
Ionosphere:	5.0 to 7.0 meters
Troposphere:	0.5 to 0.7 meters
Receiver noise:	0.3 to 1.5 meters
Multipath:	0.6 to 1.2 meters
Selective Availability	(see notes)
User error:	Up to a kilometer or more

Errors are cumulative and increased by PDOP.

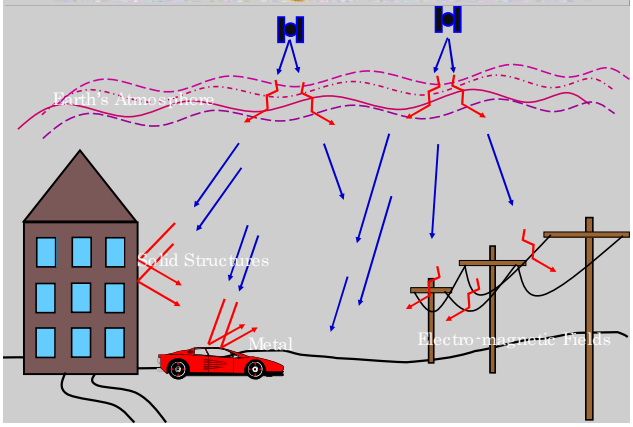
Error Correction

- Satellite Based Augmented Systems (SBAS)
  - WAAS
  - EGNOS
  - GAGAN
  - MSAS
- Differential GPS
  - Based station & Rover station
  - UHF transmitter at base & receiver at rover
  - Up to mm level accuracy

GPS Errors

	Standard GPS	Differential GPS
Ionosphere	5.0	0.4
Troposphere	0.5	0.2
Ephemeris	2.5	0
Satellite Clock	1.5	0
Receiver Noise	0.3	0.3
Multipath	0.6	0.6

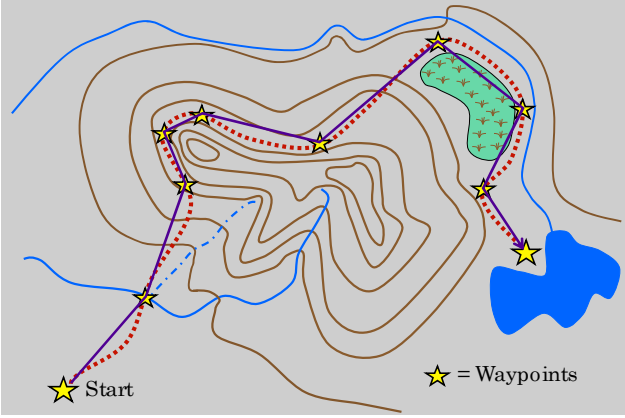
Sources of Signal Interference



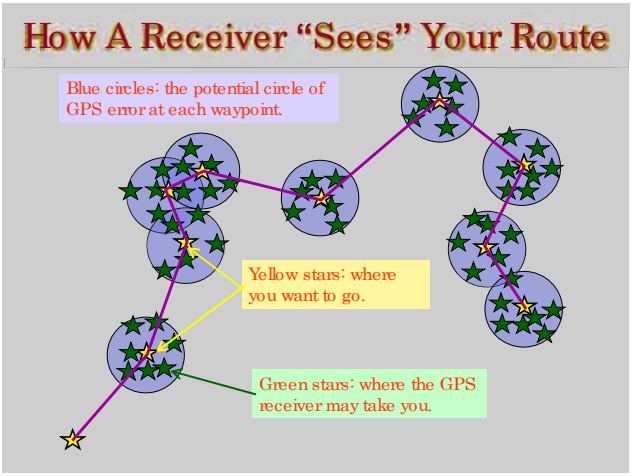
Waypoint

- A waypoint is based on coordinates entered into a GPS receiver's memory.
- It can be either a saved position fix, or user entered coordinates.
- It can be created for any remote point on earth.
- It must have a receiver designated code or number, or a user supplied name.
- Once entered and saved, a waypoint remains unchanged in the receiver's memory until edited or deleted.

Planning a Navigation Route



How A Receiver "Sees" Your Route

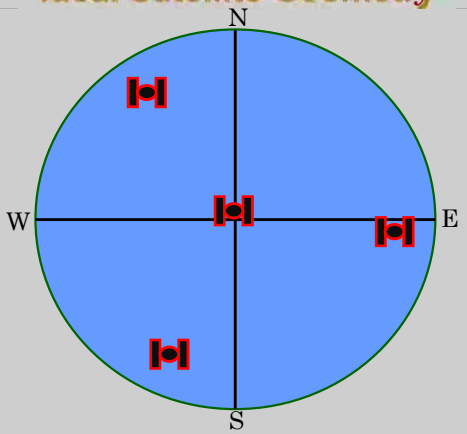


GPS Dilution of Precision and Its Affects On GPS Accuracy

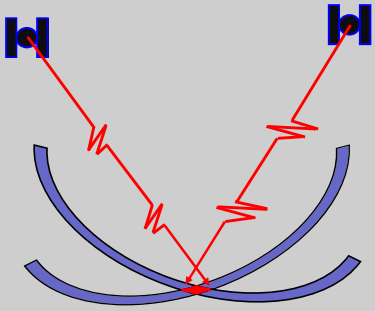
GPS Satellite Geometry

- Satellite geometry can affect the quality of GPS signals and accuracy of receiver trilateration.
- Dilution of Precision (DOP) reflects each satellite's position relative to the other satellites being accessed by a receiver.
- There are five distinct kinds of DOP.
- Position Dilution of Precision (PDOP) is the DOP value used most commonly in GPS to determine the quality of a receiver's position.
- It's usually up to the GPS receiver to pick satellites which provide the best position triangulation.
- More advanced GPS receivers can filter out poor DOP values.

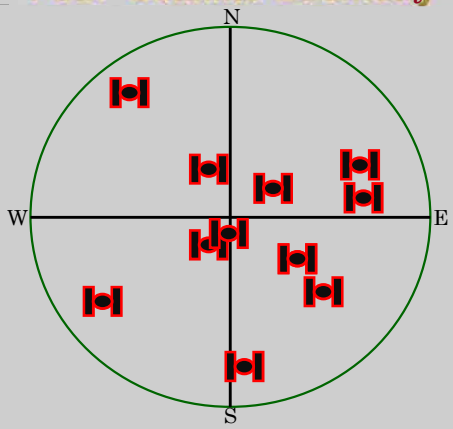
Ideal Satellite Geometry



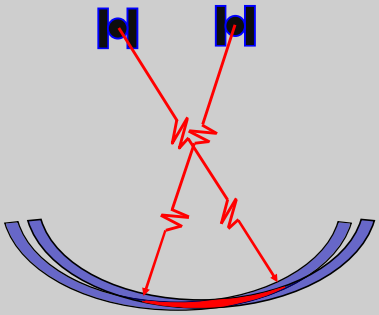
Good Satellite Geometry



Poor Satellite Geometry



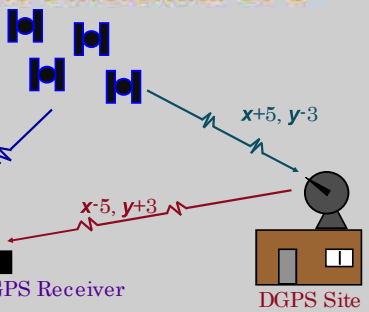
Poor Satellite Geometry



Differential GPS

- Realtime
- Post process

Real Time Differential GPS



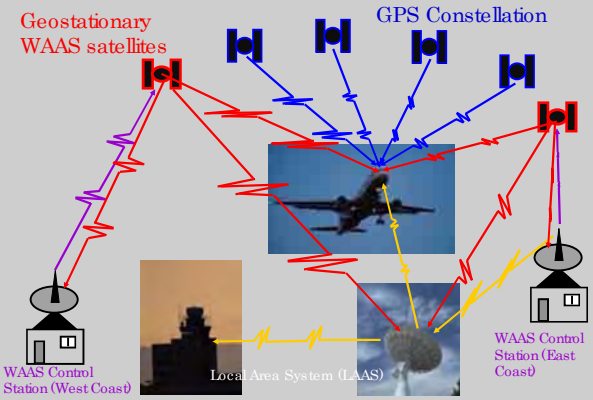
DGPS correction = *x*+(30-5) and *y*+(60+3)

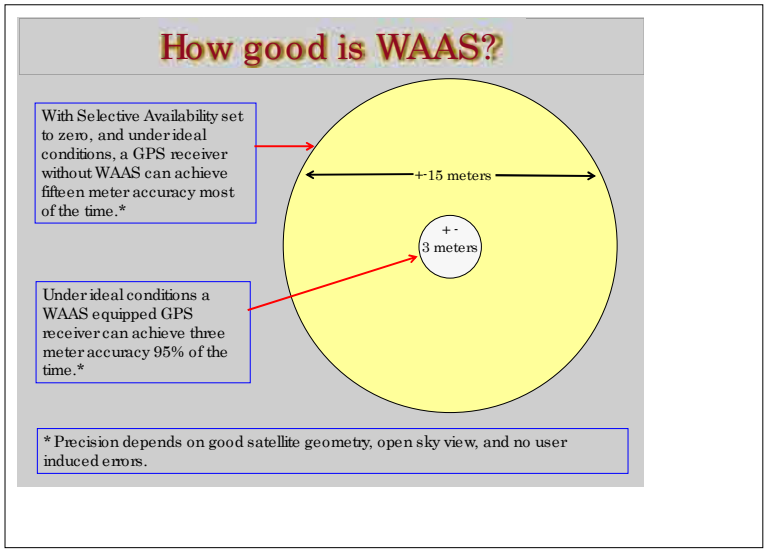
True coordinates = *x*+25, *y*+63

True coordinates = *x*+0, *y*+0

Correction = *x*-5, *y*+3

Wide Area Augmentation System



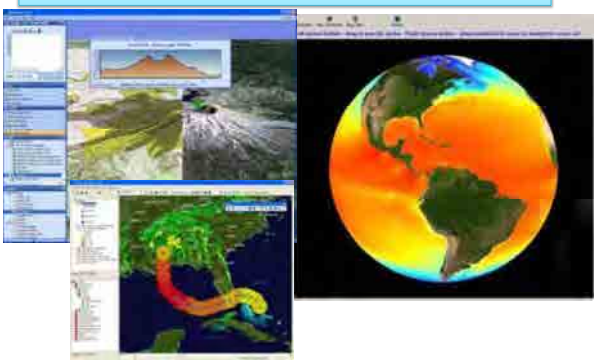

How good is WAAS?
With Selective Availability set to zero, and under ideal conditions, a GPS receiver without WAAS can achieve fifteen meter accuracy most of the time.*
+-15 meters
+ -
3 meters
Under ideal conditions a WAAS equipped GPS receiver can achieve three meter accuracy 95% of the time.*
* Precision depends on good satellite geometry, open sky view, and no user induced errors.

Capacity Development Project for
Non Revenue Water (NRW) Reduction
In Colombo City.

Training program on
GIS Mapping

Tharanga Jayamanna
GIS Analyst
JICA Expert Team for
Capacity Development Project for Non Revenue Water (NRW) Reduction in Colombo City

Introduction to GIS



GIS outline

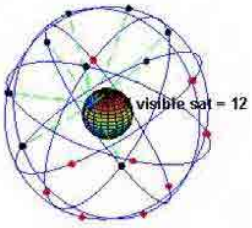
1. Geographic Information Technologies
2. What is GIS?
3. Components of GIS
4. Types of Data
5. GIS Capabilities

Geographic information technologies

- Three main types:
  - ✓ Global Positioning System (GPS)
  - ✓ Remote sensing
  - ✓ Geographic Information System (GIS)

Global Positioning System (GPS)

Global Positioning System refers to a system of satellites and receivers that allow people and devices to pinpoint their precise location on the earth.



Signals are received by a special electronic device called GPS Reciever

Remote sensing

Remote Sensing is defined as the acquisition of information about an object without being in physical contact with it

Use of Earth orbiting satellites to capture information about the surface and atmosphere below

What is GIS?

- In short: "computerized mapping software"
- Formal definition

❖ GIS is a Special kind of "Information System" that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data

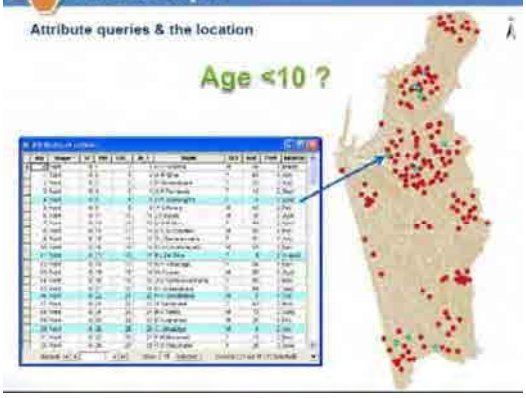
Special kind..??

"In a GIS you can store attributes with their locations"

An Example

Attribute queries & the location

Age <10 ?



An Example

Overlaying Capability

An Example

Overlaying Capability

Most of the Dengue patients are found in the areas where large number of slums & shanties are present

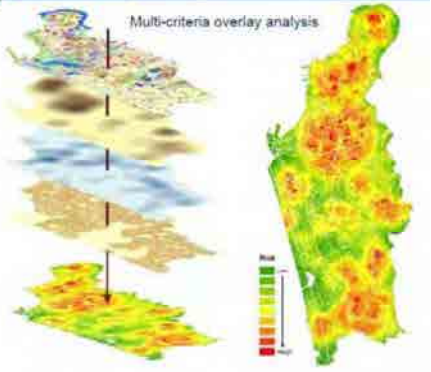
An Example

Proximity Analysis

Buffers are created at 300m distance from mosquito breeding locations (assuming that mosquitoes can fly 300m)

An Example

Multi-criteria overlay analysis



Components of GIS

Components of GIS

GIS Hardware

❖ Like any other computer

	Minimum Requirement for ArcGIS	An example for a better configuration
CPU Speed	1.6 GHz	1.86 GHz
Processor	Intel Core 2 Duo, Pentium 4 or Xeon Processors	Intel Core 2 Duo
Memory/ RAM	1 GB	4 GB
Disk Space	2.4 GB (Only the space required for ArcGIS)	160 GB + 500 GB (For data)
Graphics Card	An OpenGL 1.3 or higher compliant with 32 MB of video memory or higher	Nvidia Geforce 9600 with 512MB Video memory
Media Player	DVD Player	DVD Writer

Components of GIS

GIS Hardware

❖ With some extra components perhaps

- Maps come on big paper
  - Need big printers and plotters to make map output from GIS - Plotter
  - Need big devices to scan and input data from maps to GIS - Scanners

Components of GIS

GIS Software

Essential software elements that must allow the user input, store, manage, transform, analyse and output data

Software Developer	Main GIS Software
Environmental Systems Research Institute (ESRI)	ArcGIS
Autodesk	AutoCAD Map 3D
Pitney Bowes	Mapinfo Professional
Bentley Systems	Microstation
MicroSoft	MapPoint
Intergraph	Geomedia
Manifold Software	Manifold
SuperMap Software	SuperMap Deskpro
TatukGIS	TatukGIS Editor
WTH Engineering	Think GIS
GEOWAY Information Technology	GEOWAY
The Quantum GIS project	QGIS (Free Open Source)
GRASS Development Team	GRASS (Free Open Source)

Components of GIS

People and GIS

❖ No GIS exist in isolation from the organizational context

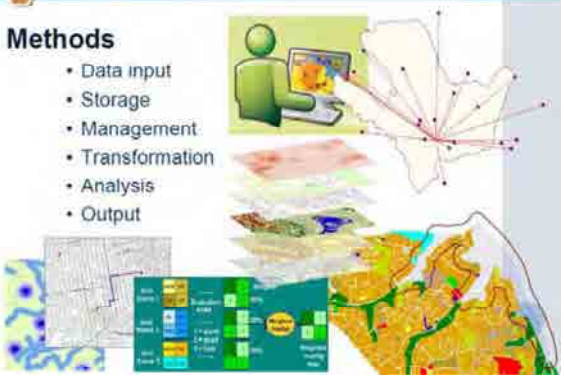
❖ There must always be people to plan, implement and operate the system

❖ Make decisions based on output

Components of GIS

Methods

- Data input
- Storage
- Management
- Transformation
- Analysis
- Output



Components of GIS

Data

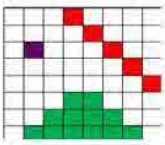
- Two basic types of Data
  - Attribute Data
  - Spatial data

Components of GIS

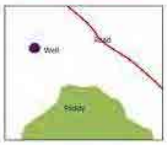
Data

- Spatial data

Raster Data



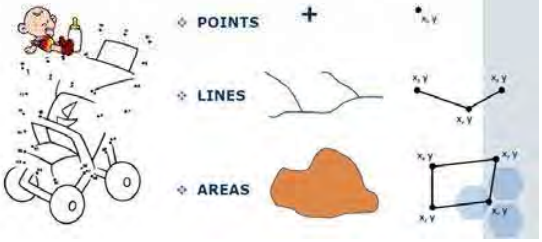
Vector Data



Components of GIS

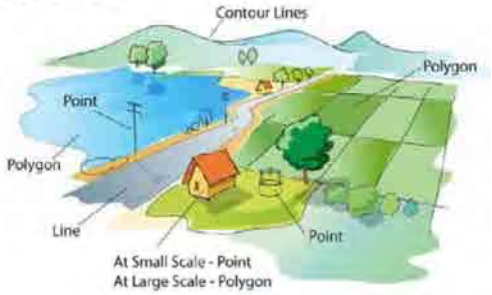
Vector Data

In the vector model, real world objects are stored as **points**, **lines**, and **polygons**



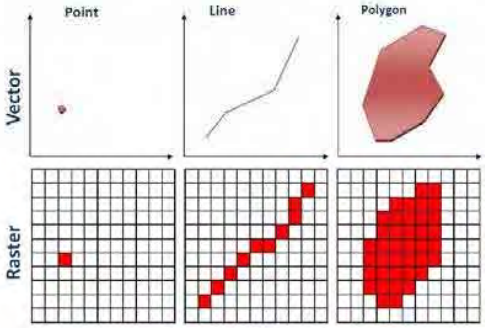
Components of GIS

Vector Data



Components of GIS

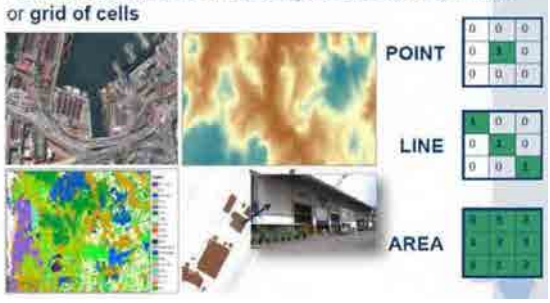
Comparison between Raster and Vector



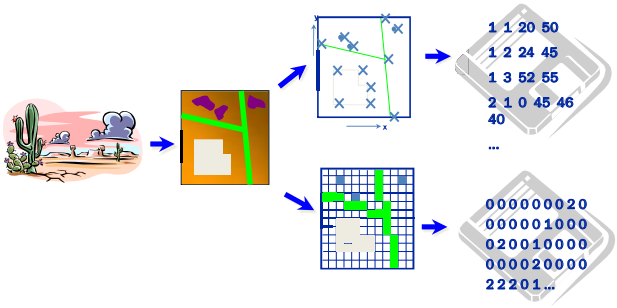
Components of GIS

Raster Data

In the vector model, real world objects are stored as matrix or grid of cells



Modelling the real world

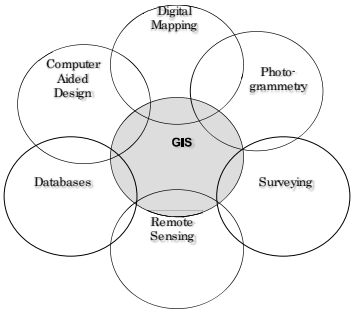


Why GIS?

- GIS adds "space" to research dimensions
  - Geographical significance & patterns
    - Does location make any difference ?
      - i.e. Real estate – location, location, location..
    - Are there any patterns ?
      - i.e. Migration patterns? How did the disease spread?
  - Geographical relationships
    - Are A and B in this location related ?
      - i.e. Crime rate and average housing value
  - Prediction & Information management
    - How many people will be affected by flooding ?
    - Create a list of residents affected by it using GIS-

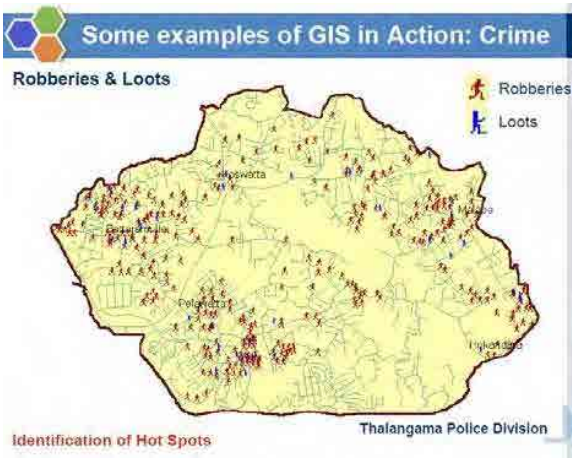
Application Areas of GIS

- Agriculture
- Environmental Management
- Water Resources
- Conservation
- Health
- Defense and Intelligence
- Forestry
- Emergency/Disaster Management
- Land Administration
- Civil Engineering
- Community Mapping and Analysis
- Marine and Coast
- Energy and Climate Change
- Homeland Security
- Law Enforcement
- Fire Protection
- Urban and Regional Planning
- Telecommunications
- Water/Wastewater
- Transportation
- Electric and Gas
- Surveying
- Mining
- Banking and Financial Services
- Insurance
- Media and Press
- Public Works
- Elections
- Real Estate Valuation
- Facilities Management

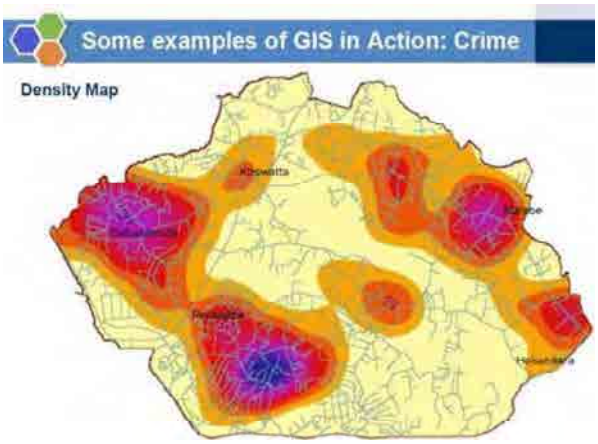


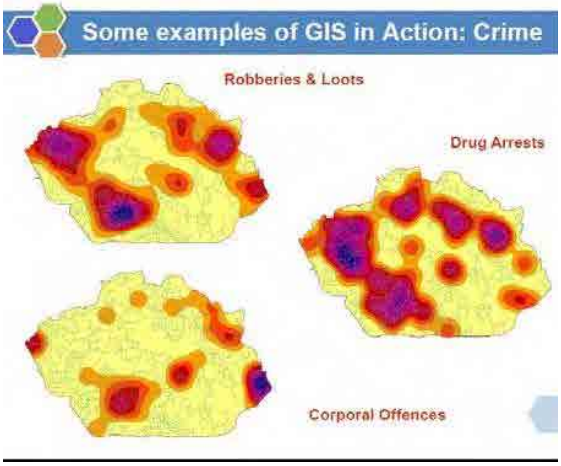
Cross-disciplinary nature of GIS

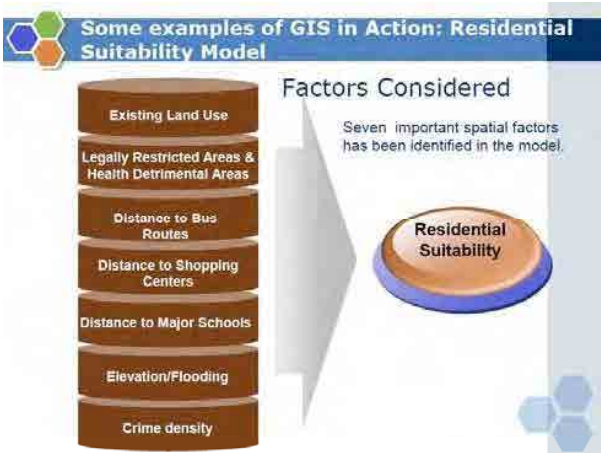
Some examples of GIS in Action: Crime

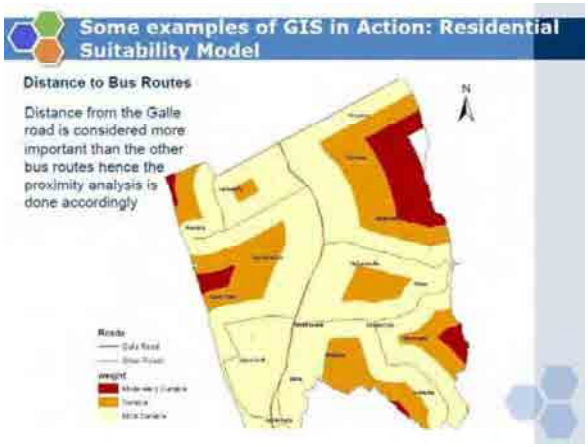


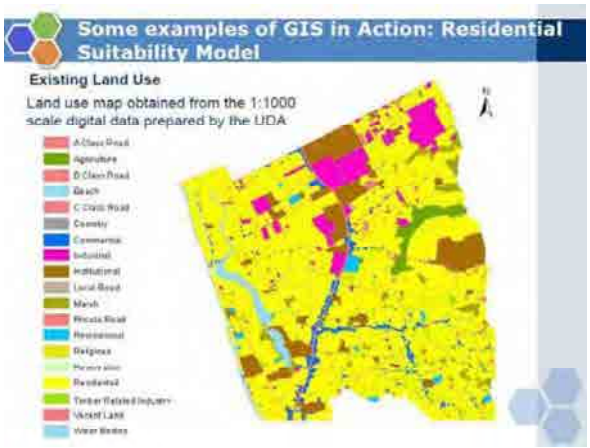
③ Introduction to GIS

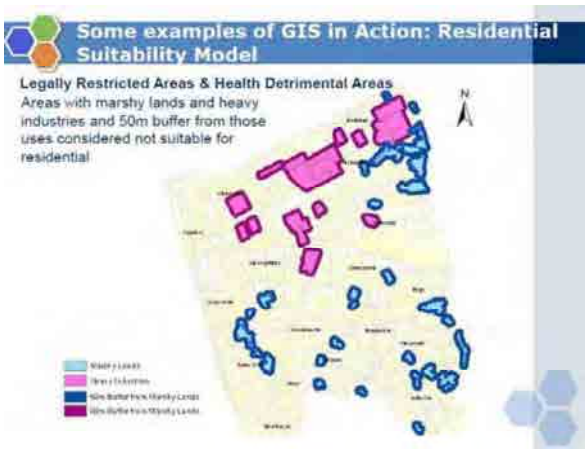












Some examples of GIS in Action: Residential Suitability Model

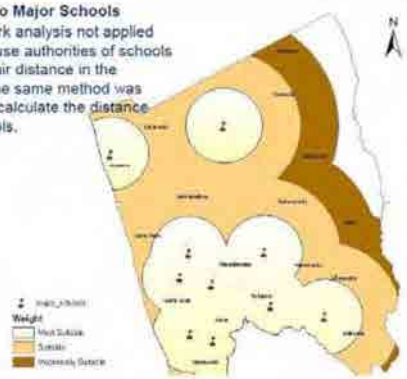
Distance to Shopping Centers

Within Mortuwa MC area 3 major shopping centeres can be identified. Moratuwa town, katubadda junction & Rawathawatta. Distance from main shopping centers were taken along the road network and the service areas were demarcated with polygons

Some examples of GIS in Action: Residential Suitability Model

Distance to Major Schools

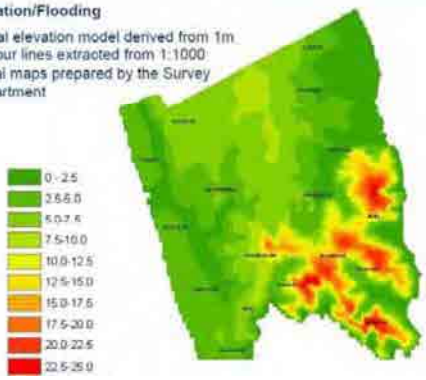
The network analysis not applied here because authorities of schools are using air distance in the practice, the same method was applied to calculate the distance from schools.



Some examples of GIS in Action: Residential Suitability Model

Elevation/Flooding

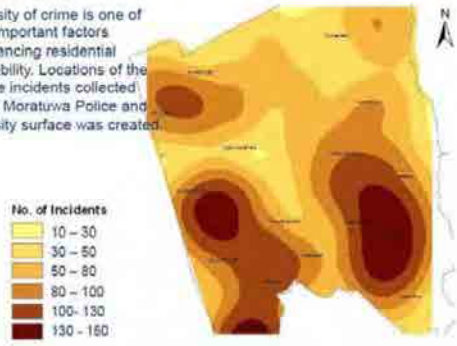
Digital elevation model derived from 1m contour lines extracted from 1:1000 digital maps prepared by the Survey Department



Some examples of GIS in Action: Residential Suitability Model

Crime Density

Density of crime is one of the important factors influencing residential suitability. Locations of the crime incidents collected from Moratuwa Police and density surface was created.



Scale

Individual factors were ranked into four classes as follows.

Value	3	2	1	Restricted
Suitability Category	Most Suitable	Suitable	Moderately Suitable	Restricted

Value 3 was given for the areas where the considered factor is presented in favorable for human living and value 2 was given for the next positive attribute. Considering the scarcity of land in the area, when there is no physical or legal constraints but not much favorable for residential uses are given value 1 and considered as moderately suitable.

The areas where there are any physical or legal restrictions were considered as restricted areas that cannot be developed into residential purposes.

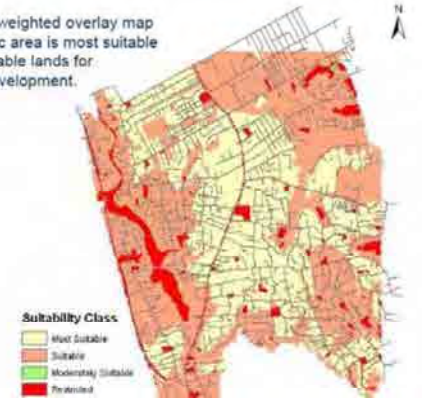
Weights

In addition to given scales onto individual factors, each factor was weighted based on their significance on the model. Related literature on previous studies and expert knowledge was base for the weight given.

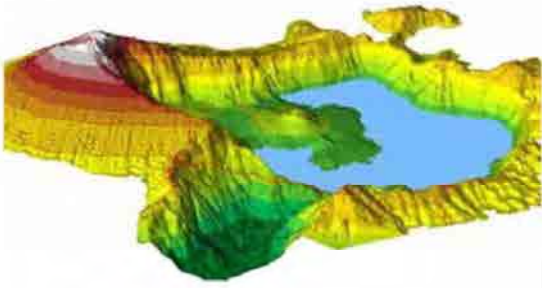
Residential Suitability Model

Weighted Overlay Map

According to weighted overlay map 47% of the mc area is most suitable and 34% suitable lands for residential development.



Some examples of GIS in Action: 3D



Some examples of GIS in Action: 3D

Thank You!

Sources:
Lecture notes (PGIS – University of Peradeniya)
by Mr Prabath Malavige.
http:// resources. esri.com.