Embassy of the Kingdom of the Netherlands
Dhaka, Bangladesh

Bangladesh Water Development Board (BWDB)
Department of Agricultural Extension (DAE)

Training Report

International Water Week and Netherlands/UK Water Policy Approaches

1 to 12 November 2015

BETS Ltd

Socioconsult Ltd. for sustainable development

FEMCONSULT

Mott MacDonald

International Water Week
and
Netherlands/UK Water Policy Approaches

December 2015

Blue Gold Program

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- We use electronic faxing when practicable
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- We use recycled paper when possible
- Reducing paper in the office creates a better working environment for our staff and our clients

We believe that you, as one of our esteemed clients, will share our concern to conserve precious resources for the benefit of our planet and its inhabitants.

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
01	6/12/2015	ALM Abdur Rahman Tajul Islam Masud Ahmed Mahfuzur Rahman Md. Kamalur Rahman Talukder Alamgir Chowdhury	Alamgir Chowdhury	Guy Jones	v0

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Content

1. Introduction

1.1 Mission Purpose

A senior team from Bangladesh participated in a mission to the Netherlands and UK from 1st to 12th November 2015. The purpose of the mission was to:

- attend the international water week conference in Amsterdam;
- discuss current Dutch practices with life cycle costing and asset management of water infrastructure, and related technical, legal, financial, managerial aspects of maintenance;
- discuss current international practices in flood modelling and management;
- discuss current international practices in asset management.

1.2 Team Composition

The team consisted of the following staff:

1. ALM Abdur Rahman, Additional Secretary, Ministry of Water Resources, Dhaka
2. Tajul Islam, Joint Secretary, Ministry of Water Resources, Dhaka
3. Masud Ahmed, ADG Planning, BWDB, Dhaka
4. Mahfuzur Rahman, Chief Planning, BWDB, Dhaka
5. Md. Kamalur Rahman Talukder, Project Director, SWAIWRPM Project, BWDB, Dhaka
6. Alamgir Chowdhury, Deputy Team Leader, Blue Gold Program, BWDB, Dhaka

1.3 Mission Program

A summary program of the mission was as follows:

- Attend the Amsterdam International Water Week Conference (2-4 November)
- Discuss Dutch practices on asset management and life cycle design of water infrastructure, and related technical, legal, financial, managerial aspects of maintenance with Mr. Michael Bentvelsen and Mr Henk Weijers (5 November)
- Visit the Regional Water Authority Brabantse Delta at Breda to discuss water management using a dashboard of key indicators, and to visit Deltares to discuss on the current international practices in flood modelling and management with Mr. William Oliemans and Mr. Klaas-Jan Douben (6 November)
- Visit the Delta Program and storm surge barrier (Rotterdam) with Dr. Rien Dam (9 November)
- Discuss current international practices in asset management at Mot MacDonald Offices in London and Cambridge (10-12 November)
- Visit the Thames Storm Surge Barrier in London, UK with Mr. John Prytherch (11 November).

2. Experience and Observations

2.1 The Netherlands

2.1.1 AIWW Sessions (3 and 4 November)

The Bangladesh team members participated in a number of presentations during 3day long conference. On day-1 they participated in the inaugural session – a number of eminent scientists and leaders of water sector expressed their views on AIWW conference and finally was opened by Mrs. Melanie Schultz van Haegen, Minister Infrastructure and Environment, Government of the Netherlands

On the second day, the team participated at the Bangladesh Platform moderated by Mr Ben Lamoree. Mr Carel de Groot, 1st Secretary presented the updates of Dutch activities (past and present) in Bangladesh with a special focus on Delta plan and Blue Gold Program from the same platform.

The team also attended the presentation on Delta Plan in Bangladesh presented by Project Director and Team Leader of the project and the Blue Gold Program innovation fund procedures presented by Mr Boudewijn Sterk (see Appendix 1). A number of questions were raised from the audience for further clarifications on some issues and on behalf of Blue Gold Mr Boudewijn and Alamgir responded to those questions.

The senior members of the Ministry of MoWR and BWDB were supportive on the presentation of Mr. Boudewijn Sterk especially the Chief Planning and ADG were keen to have this fund for the development of water infrastructures in BD for improved water management. All of them were keen to know further details about the methodology and use of this fund. Apart from these presentations, the team participated at Integrated Water Resource Management based on the Egyptian experience on Nile River Irrigation Project.

On the third day, the team participated in a few more presentations; Climate Change Adaptation - experience in Ethiopia a+nd Public Policy Governance and Planning.

2.1.2 Dutch Regional Water Authority (5 and 6 November)

On 5th November 2015 the team members participated in the presentation and discussion on the (a) Dutch practices with Life Cycle Cost/Design and Asset Management of water infrastructure (see Appendix 2), and related technical, legal, financial, managerial aspects of maintenance. (b) Experience of Union of Dutch Water Management Authorities (see Appendix 3). Along with Bangladeshi participants many other Dutch experts were also attended in the presentation including Mr. Martin Bos, last 1st Secretary (Water Sector), EKN, Dhaka.

All the senior members of the Ministry of MoWR and BWDB appreciated the presentation on LCC/D. The BD team made positive remarks regarding the practices and approaches and commented about its suitability in Bangladesh. They immediately interacted with the experts of the Dutch Water Authority about the subject and requested them to extend their support to Bangladesh. Mr. Michael Bentvelsen and Mr.

Henk Weijers informed the BD team about the possibility of further cooperation in organizing training on life cycle design and Asset Management for the technical personnel of BWDB. Mr. Martin Boss also responded on few questions.

On 6th November the team members visited the Regional Water Authority Brabantse Delta at Breda and participated in a discussion to use of dashboards for water management. Everybody in the team was convinced about this approach. However, it demands huge information which is not readily available for our polders. However, the team requested them to make a proposal including a list of required information to start a pilot exercise in a polder.

The team visited Deltares and had discussion on the current international practices in flood modelling and management. Deltares followed up the subject on current international practices in water management, perused the discussion on Dashboard and presented further in detailed. The Deltares arranged the visit at their flood modelling lab and its facilities.

2.1.3 Delta Program and Storm Surge Barrier (9 November)

All the team members except Mr. ALM Abdur Rahman, Additional Secretary, Ministry of Water Resources visited the Delta Program and Storm Surge Barrier in Rotterdam arranged by Euroconsult Mott MacDonald. It is mega and a prestigious project of the Netherlands Government. The Dutch community is proud and this project; which shows the technical capacities of the Dutch scientists and seriousness of the Government.

2.2 UK

2.2.1 International Practices in Flood and Asset Management (10 and 12 November)

All BD members participated in the presentation on current international practices in asset management of water infrastructure (see Appendix 4) including the issues of environment and climate change internationally (see Appendix 5) with support from Mot MacDonald. These presentations were organised at Mott MacDonald's offices in London and Cambridge. There were also presentations on the construction of major barrages in Egypt (see Appendix 6) and Pakistan (not included here).

2.2.2 Thames Tidal Barrier (11 November)

A visit was also made to the Thames Barrier – whose purpose is to prevent the floodplain of all but the easternmost boroughs of Greater London from being flooded by exceptionally high tides and storm surges moving up from the North Sea.

Through this visit the team shared the experience (see Appendix 7) of Environment Agency of UK on practical aspects of operation and maintenance for major water infrastructure assets, and – acknowledging current guidance on climate change and changes in predictions for sea-level rise and climate change over the century -what actions the Environment Agency (which has responsibility for operating and managing the barrier) will need to take in the short term, medium term and long term (to the end of the century).

APPENDICES

1. Blue Gold Program Innovation Fund - 3rd November 2015
2. Life Cycle Cost /Design (LCC/D) Blue Gold , Bangladesh - 5th November 2015
3. Presentation Bangladesh 1 Gouda (Focusing Union of Dutch Regional Water Authority) – 5th November 2015
4. Asset Management (what we do and why we do it) – 12th November 2015
5. Climate Resilience (a view from Mott MacDonald) -12th November
6. Assiut Barrage (to rehabilitate or to rebuild) – 10th November 2015
7. Thames Tidal Defenses -11th November 2015

Innovation Fund

3rd November 2015

Blue Gold Innovation Fund

BG program background 1/13

Blue Gold project

- **Collaboration** between the Government of Bangladesh and the Government of the Netherlands on water management.
- **Project horizon** from 2013 to 2019
- **Program budget** of € 57.7 mil, of which 84% is financed by the Embassy of the Kingdom of the Netherlands (EKN) and 16% by the Government of Bangladesh (GoB)
- **Implemented** by Bangladesh Water Development Board (BWDB), Department of Agriculture Extension (DAE) and Euroconsult Mott MacDonald (MMD).

Blue Gold Innovation Fund

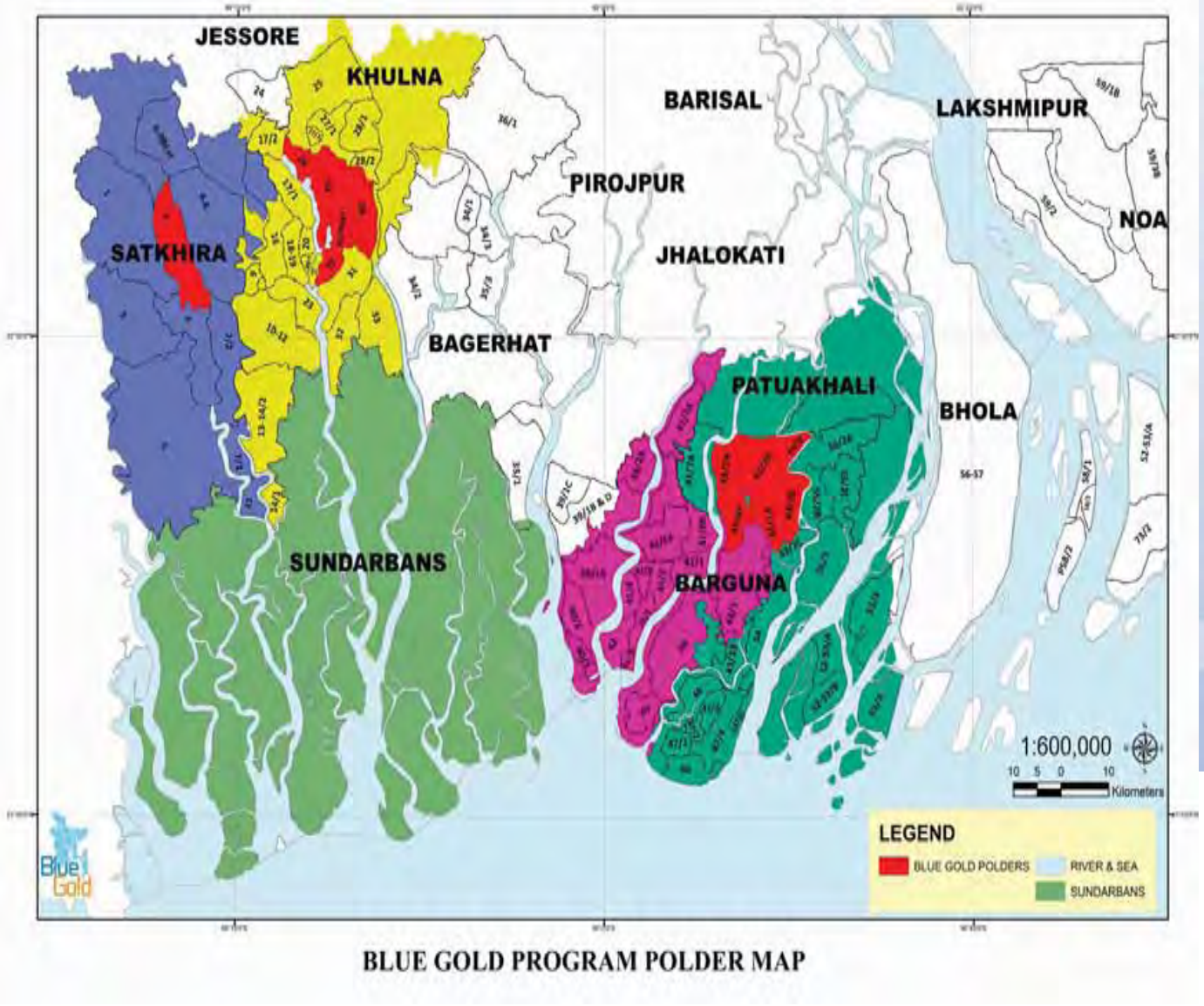
BG program background 2/13

Implementation and budget

- **Primary focus** on water management in polders in coastal regions
- **Supplementary focus** on improving living conditions of 150,000 coastal people
- **Earmarked budget**
  € 15.7 mil for financial assistance to BWDB
  € 995k for financial assistance to DAE
  € 31.3 mil for technical assistance by MMD.

Blue Gold Innovation Fund

BG polders



BLUE GOLD PROGRAM POLDER MAP

Blue Gold Innovation Fund

BG objectives 4/13

Overall objective: Reduce poverty for 150,000 households living in the selected polder areas.

How: By improving living conditions via integrated water resources management, aimed at enhanced production and business linkages.

Where: remote and isolated agriculture areas – poor infrastructure

low tech farming - saline intrusion - water hindrance – flooding

poor drainage

Aim: Mobilize community ('polder model') Boost productivity

Improve agriculture value chain Develop business

Develop water infrastructure resources

Blue Gold Innovation Fund

BG objectives

1. Organize the communities in water management groups / cooperatives

2. Protect the communities and their land (risk reduction)

3. Increase agricultural / fisheries / livestock production

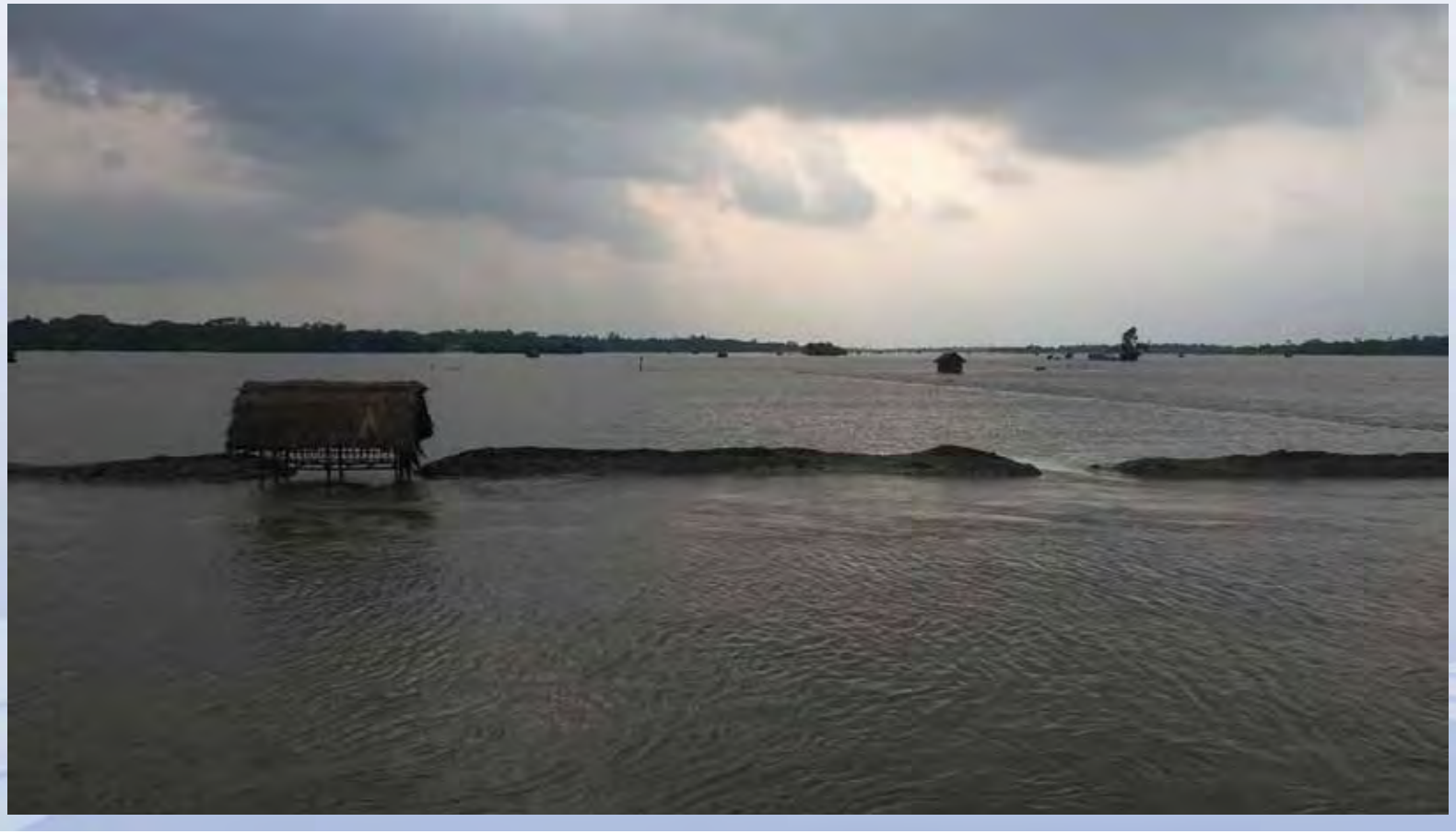
4. Improve marketing by developing business links with private sector (value chain development)

Blue Gold Innovation Fund

Damaged Embankment 6/13

Blue Gold Innovation Fund

Damaged Embankment 7/13



Blue Gold Innovation Fund

Silted up canal

Blue Gold Innovation Fund

Silted up canal

Blue Gold Innovation Fund

Innovation Fund - Background 10/13

Innovation Fund size is € 4.3 million.
Divided into two separate funds: the Water Management Fund (€ 2.4 mil) and the Productive Sectors Fund (€ 1,9 mil).

Setup to support the development of the BG program area

Utilized to establish linkages between BG and Bangladesh- and Netherlands-based businesses

Benefit for the Blue Gold program is mandatory herein, trade links with the Netherlands are desirable.

Blue Gold Innovation Fund

Innovation Fund – Themes 11/13

Call for proposals – the four themes:

1. Innovative methods for low cost river bank protection
2. Innovative methods for small scale sediment removal or dredging
3. Agro food processing and market linkage creation
4. Use of ICT as a base for information distribution

Launch of first tender aimed at January 2016

Budget for each theme is fixed at €500k

Blue Gold Innovation Fund

Innovation Fund - Selection 12/13

General selection criteria

- Proposals that fit the BG goals, with a market focus and long term outlook
- Linkages between the Netherlands private sector and Bangladesh

Roadmap of implementation

- BG IF as 'kickstarter'
- Extension through finance instrument of the Netherlands Enterprise Agency (RVO)
- Earmarked budget €500,000 per theme

Blue Gold Innovation Fund

Contact

Thank you

For queries, please contact:

Boudewijn Sterk

boudewijn.sterk@bluegoldbd.org

Life Cycle Cost /Design (LCC/D)

5th November 2015

Hoogheemraadschap van Rijnland

Life Cycle Costing / Designing Blue Gold, Bangladesh

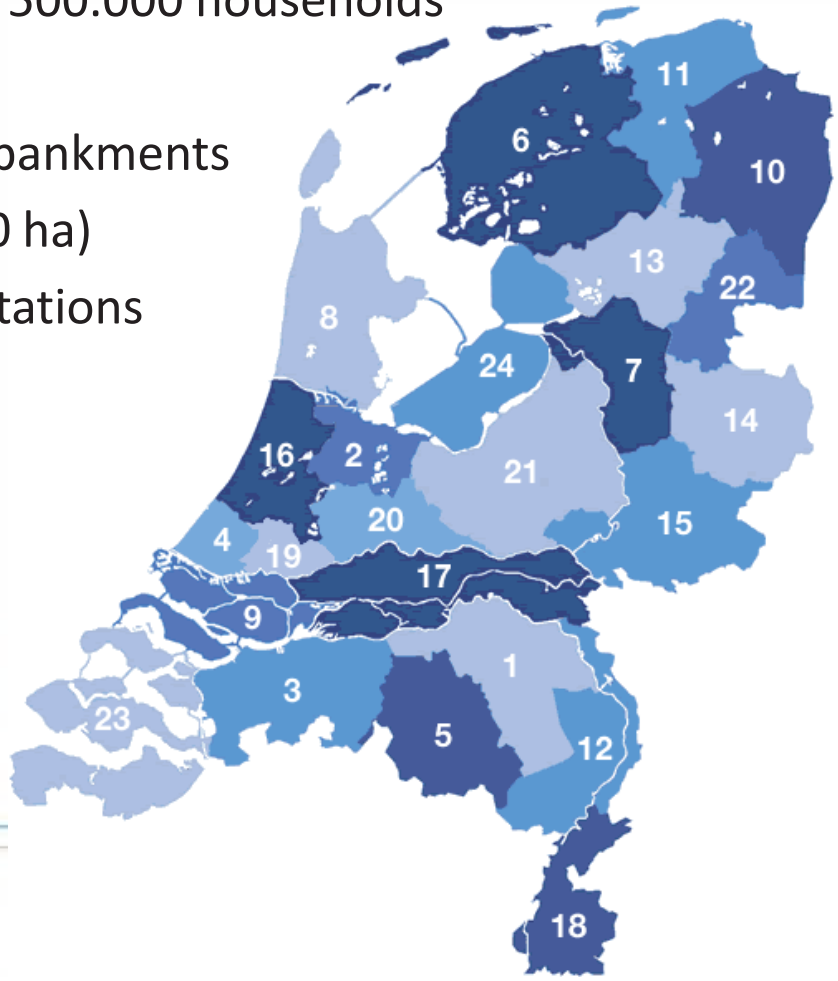
5 November 2015 Rijnland Henk Weijers DWA- Michael Bentvelsen

Introduction

- Regional Water Authority Rijnland
  - 1.3 million inhabitants, appr. 1.000 km2, 500.000 households
  - Tax income appr. 160 million per year
  - 200 polders; 82 km. Dikes; 1.300 km embankments
  - 13.000 km canals / internal lakes (12.400 ha)
  - 2.500 weirs, 1.600 inlets, 800 pumping stations

- Assetmanager Water System
  - Safety against flooding
  - Water control

- Reconnaissance Mission jan. ‘15



Contents

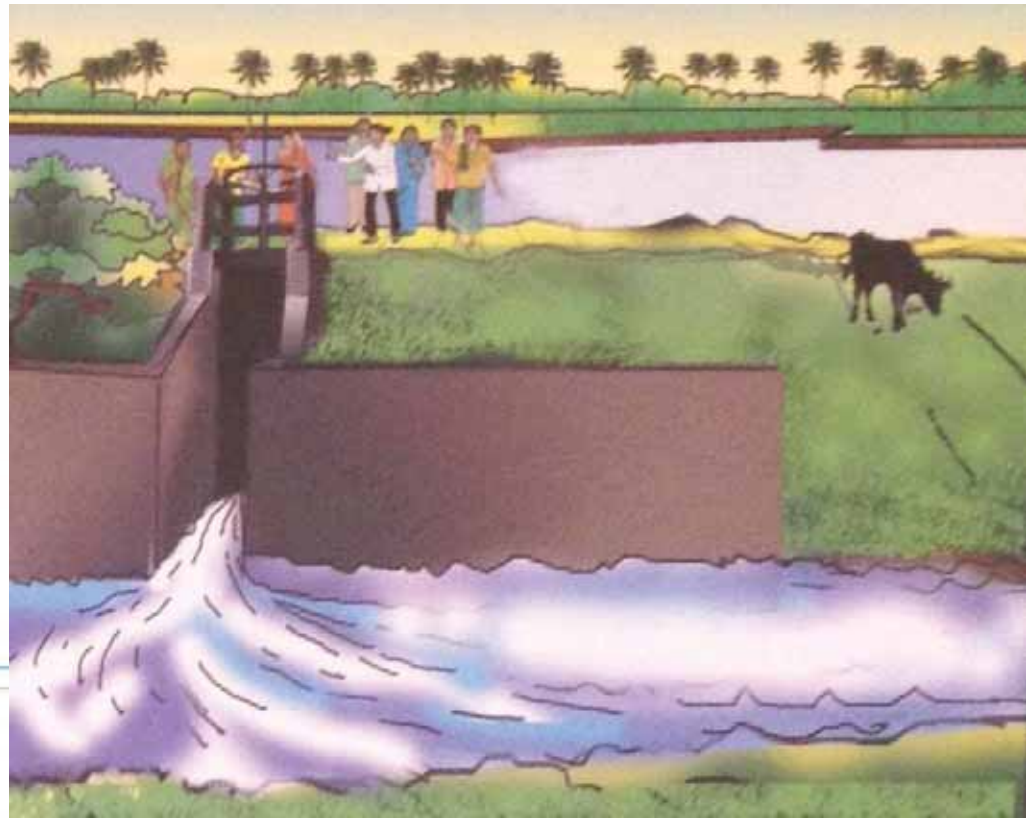
1. Assetmanagement
   a. Objects and systems
   b. Function, Risks and Costs

2. Life Cycle Costs
   a. Investments
   b. Operation and maintenance
   c. Risks

3. Life Cycle Designing
   a. Materials
   b. Process improvements

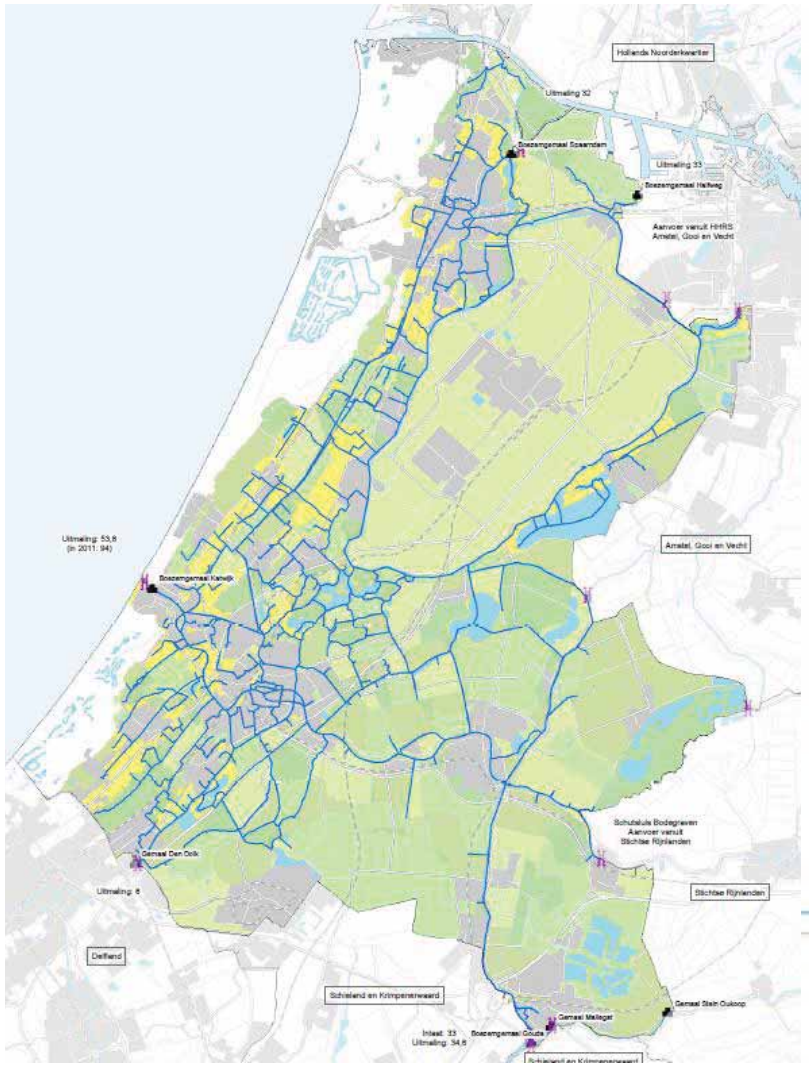
Assetmanagement: objects and systems

- A polder is a system of objects (assets)
  - Goal:
    - land for economic activities;
    - Safe living area
  - System of Assets:
    - Embankments / dikes
    - Canals (incl. revetments)
    - Sluices (outlet/inlet structures)
    - Weir
    - Pumping station



Polder system

Central system Rijnland



Polder 31 Khulna region

Function, Risks and Costs

System function, e.g.

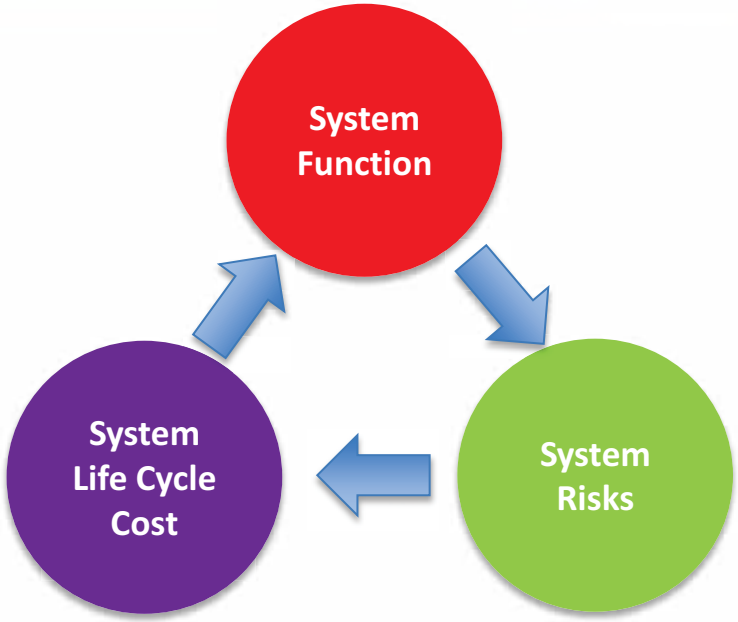
- economic production
- living space

System Risks

- crop failure by waterlogging
- thread of flooding

Life Cycle Cost

- investments
- operation and maintenance



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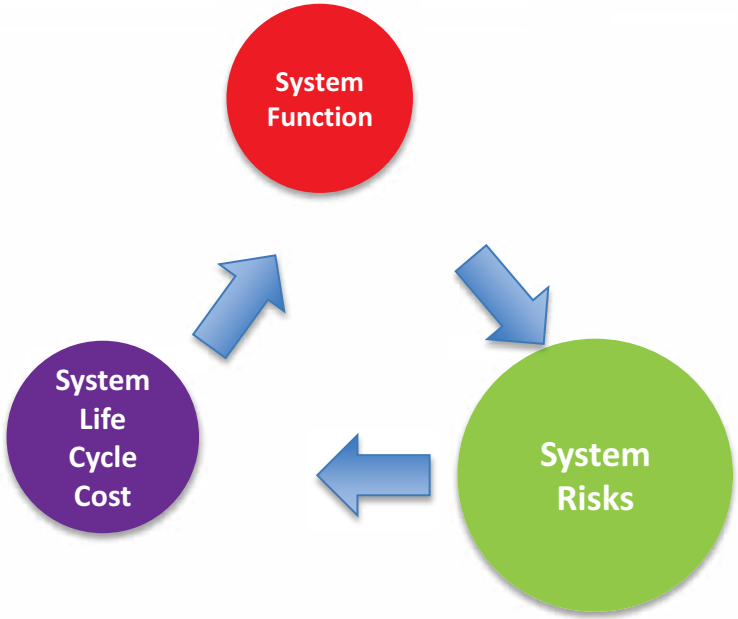

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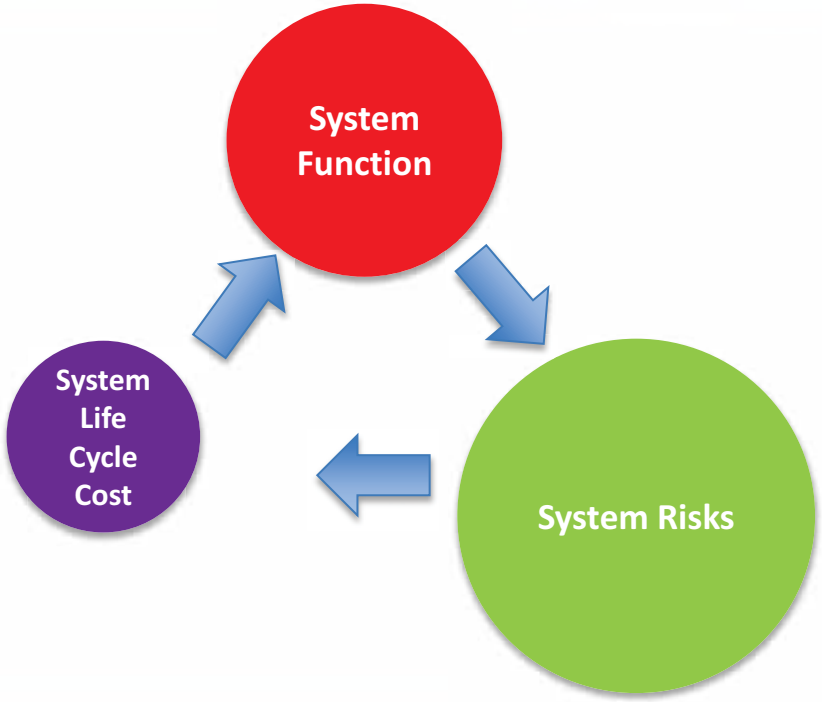

Function, Risks and Costs

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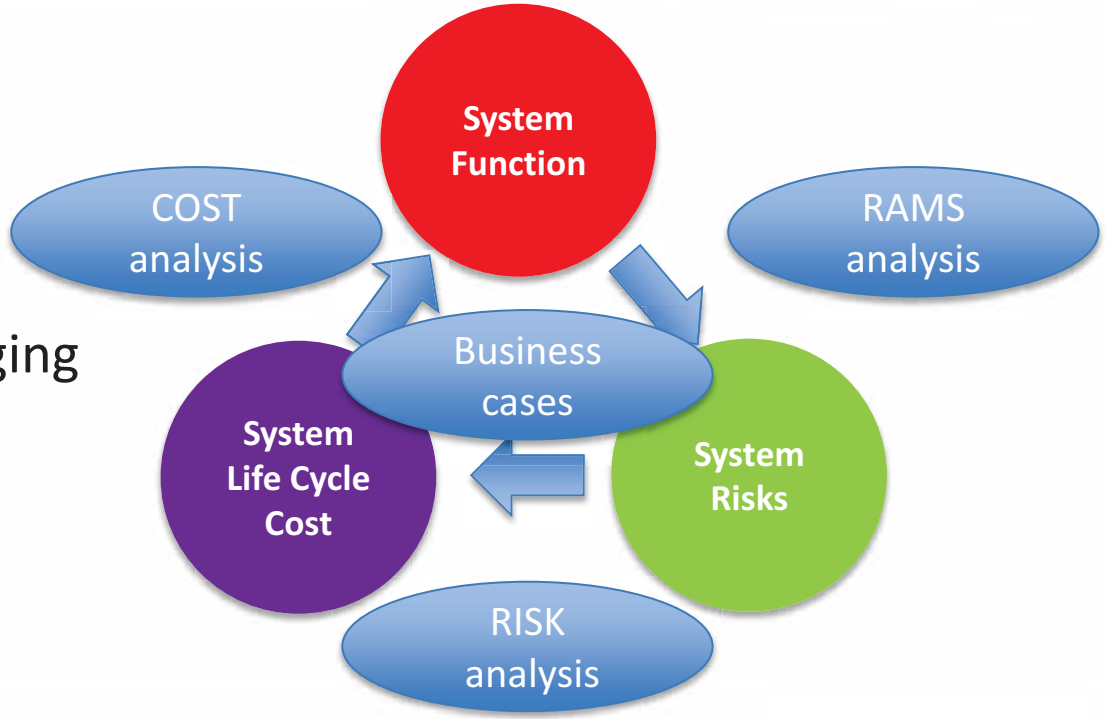
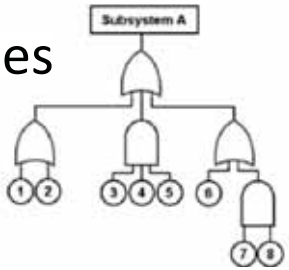
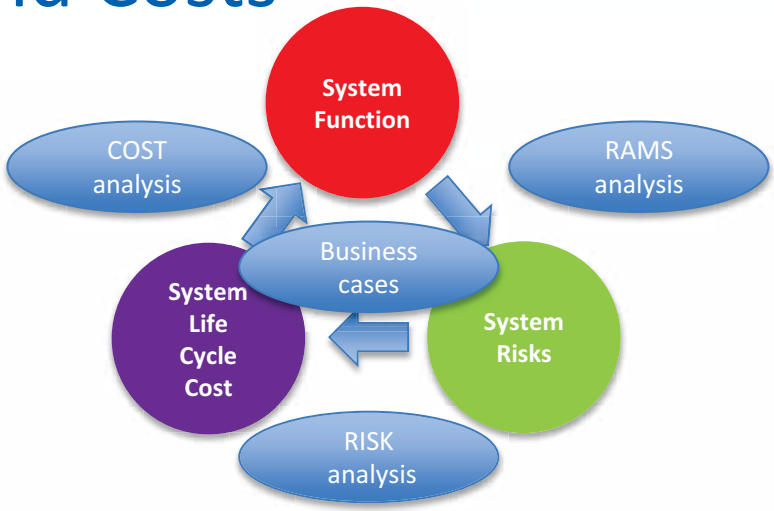


Function, Risks and Costs

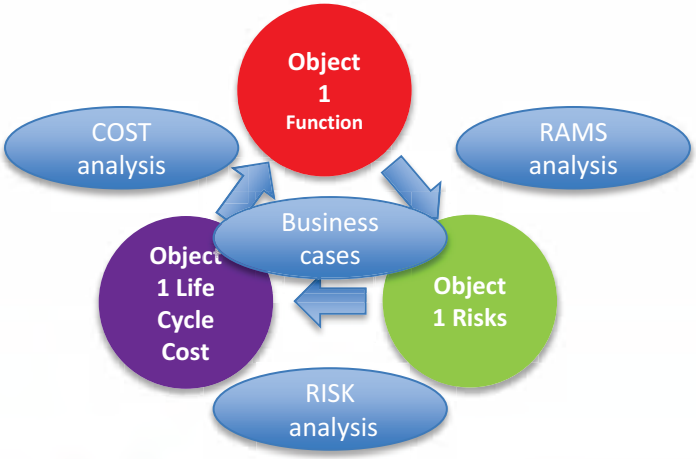
Systems and objects

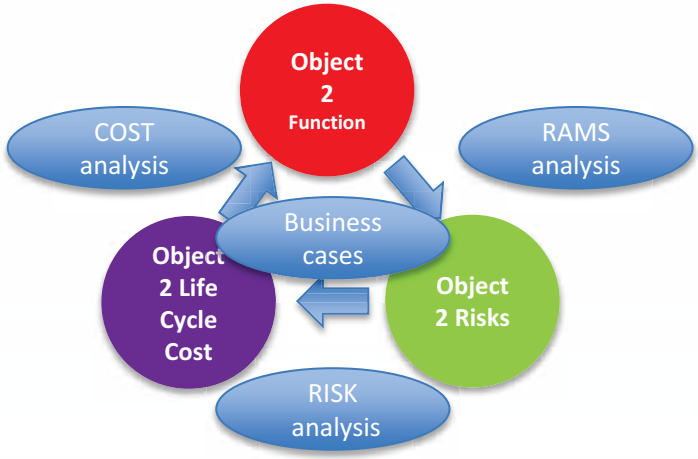
Failure trees





Tactical level





Etc. ….

Operational level

Hoogheemraadschap van Rijnland

Life Cycle Costing: investments

Long term goals

- Land reclamation
- Large reconstructions
- System adjustments

- Long term debts, redemption
- Interest, inflation, income (tax)

- Business cases: profits vs. costs+risks

Life Cycle Costing: operation and maintenance

short term costs

- Maintenance e.g.:
  - Dredging canals (5-10yrs)
  - Painting sluices,
  - Releveling embankments

- Operation e.g.:
  - Opening and closing of gates
  - Avoiding encroachment of canals or embankments
  - Cleaning canals (yearly)

Hoogheemraadschap van Rijnland

Life Cycle Costing: Risks

		A	B	C	D	E
		Negligible	Minor	Moderate	Significant	Severe
E	Very Likely	Low Med	Medium	Med Hi	High	High
D	Likely	Low	Low Med	Medium	Med Hi	High
C	Possible	Low	Low Med	Medium	Med Hi	Med Hi
B	Unlikely	Low	Low Med	Low Med	Medium	Med Hi
A	Very Unlikely	Low	Low	Low Med	Medium	Medium

- Risk = chance x effect (loss)
- Nett present value of loss

- Low cost, high risk

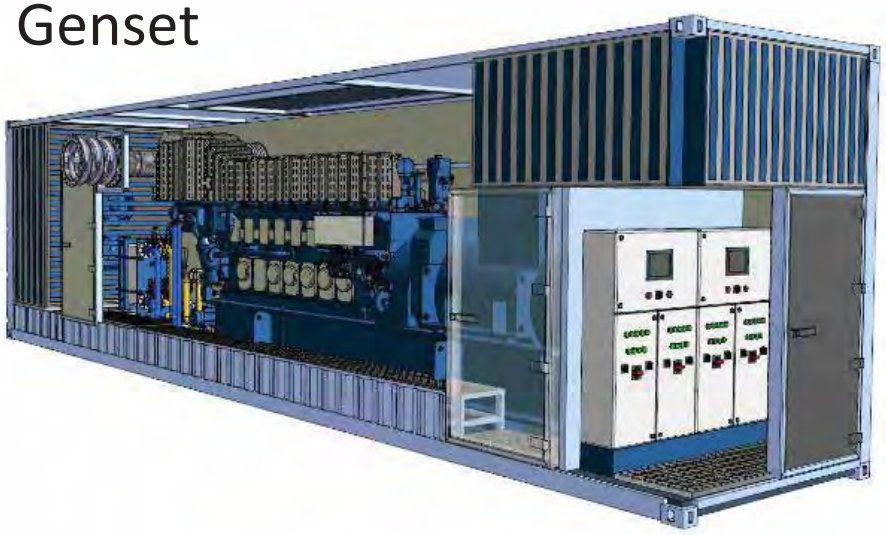
Life Cycle Costing: Risks

- Risk Counter Measures:
  - Investment
  - Maintenance
  - Operation
- RAMS-analysis

Sand bags

Peak storage area

Genset



Storm Surge Barrier

Life Cycle Costing: business case

- Pumping Station Spaarndam / Gouda
  - 35m3/sec, H= 0,3m / 0,5-3,2m
- Investment:
  - From diesel to electric engines
  - New engines after 15-18 yrs
- Maintenance:
  - Diesel overhaul every 6 yrs
  - Skilled staff

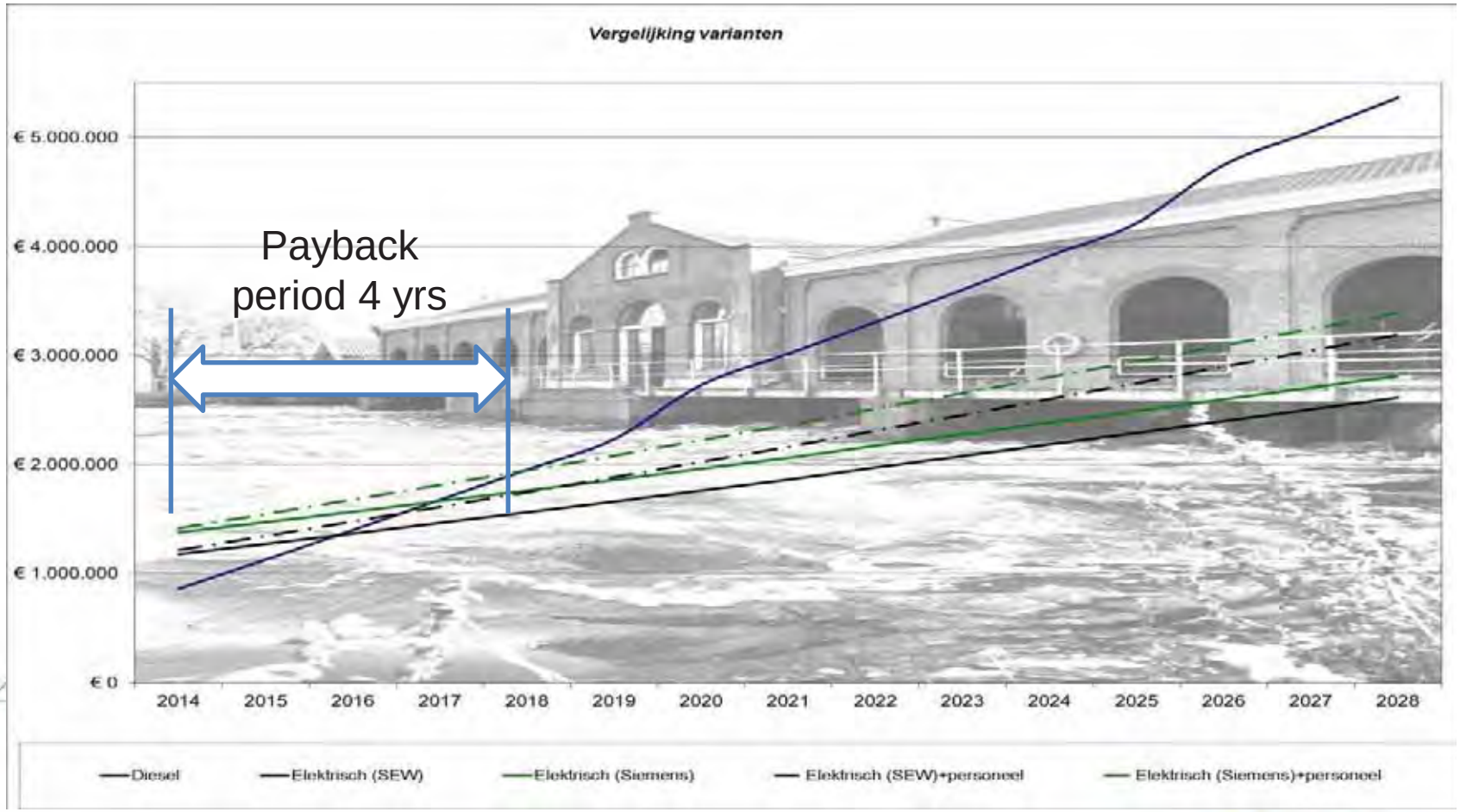
Life Cycle Costing: business case

- Operation:
  - Electricity: unmanned operation from central control room possible
  - Less energy from operation at low tide
  - Pumpspeed controlable

- Risks:
  - Power cuts: genset required?
  - Working with high voltage vs. rotating parts

Life Cycle Costing: business case

- Pumping Station Spaarndam
  - 35m3/sec, H= 0,3m



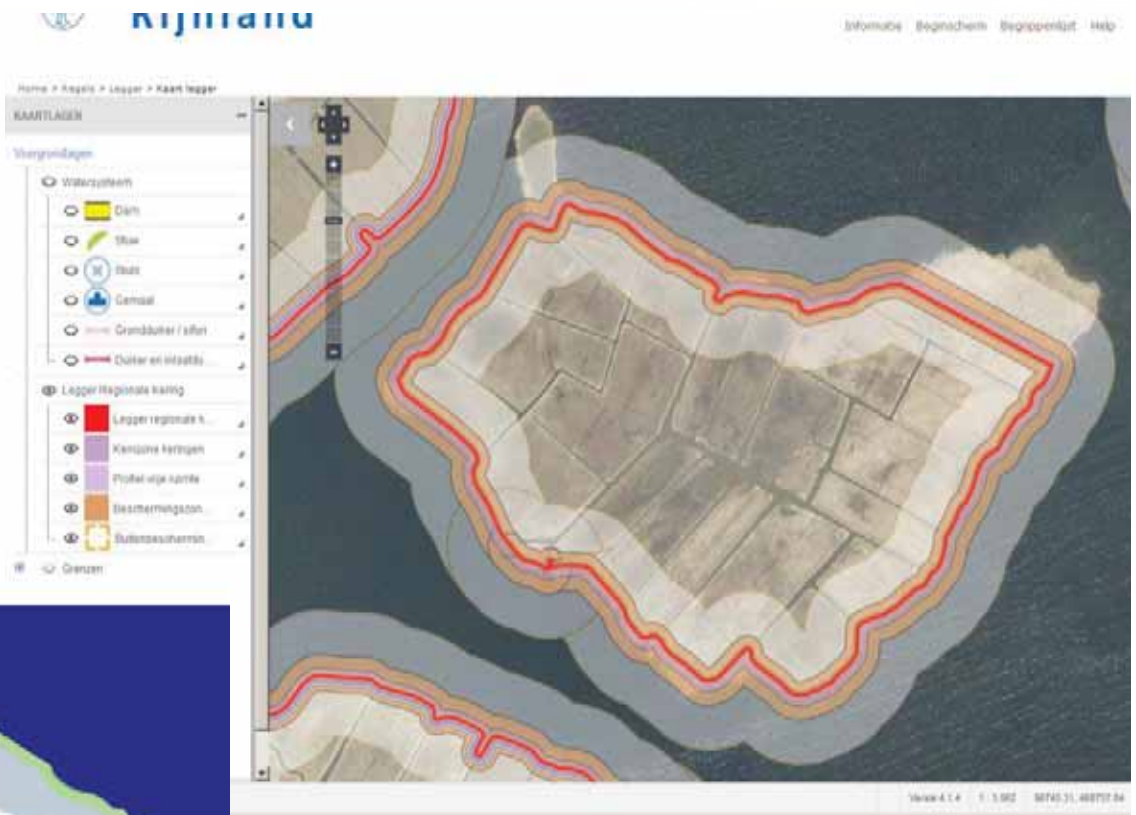
Life Cycle Designing: maintainability

- Lifetime of materials
  - Concrete: appr. 50 years
  - Metal: appr. 15 years
  - Wood: appr. 10-25 years
- Replacement of elements
- RAMS:
  - Reliability
  - Availibility
  - Maintainability
  - Safety

Rijnland

Life Cycle Designing: Space for Future Development

- Regulation of space around embankments and canals
- Ownership or limitation of property rights



Rijnland

Life Cycle Designing

- Close the learning circle:
  1. Design and Construct
  2. Maintain and Operate
  3. Monitor and evaluate
  4. Adjust Designs and Secure Changes
- Workshops to learn from field experience (evaluation)
- Secure Changes

Questions / Discussions?

Dutch Regional Water Authority

5th November 2015

SHARING KNOW-HOW IN INTEGRATED WATER RESOURCES MANAGEMENT PRACTICES IN EGYPT

Bart Pastor,

5th of November 2015, Lelystad

DUTCH WATER AUTHORITIES

Waterschap Aa en Maas

world waternet

HOOGHEEMRAADSCHAP DE STICHTSE RIJNLANDEN

Waterschap De Dommel

NWB FONDS

Water Governance Centre

Holding Company for Water and Wastewater

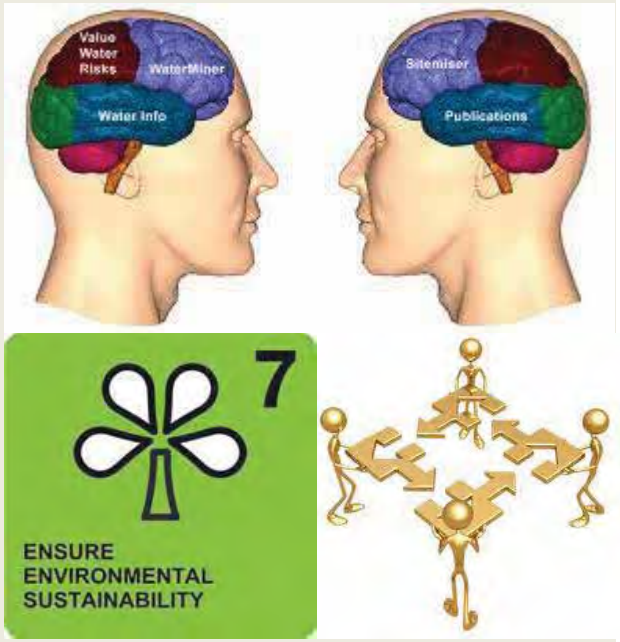
وزارة الموارد المائية والري

MINISTRY OF WATER RESOURCES AND IRRIGATION

FOCUS UNION OF DUTCH REGIONAL WATER AUTHORITIES

MOTIVATION FOR COOPERATION

- Millennium development goals;
- Knowledge exchange;
- Improving relations;
- Attractive employer.



PRINCIPLES FOR COOPERATION

Water Operators Partnership (WOP)

- Sharing and developing know-how;
- Mutual benefit;
- No investments;
- Long lasting cooperation.

Equality

Software

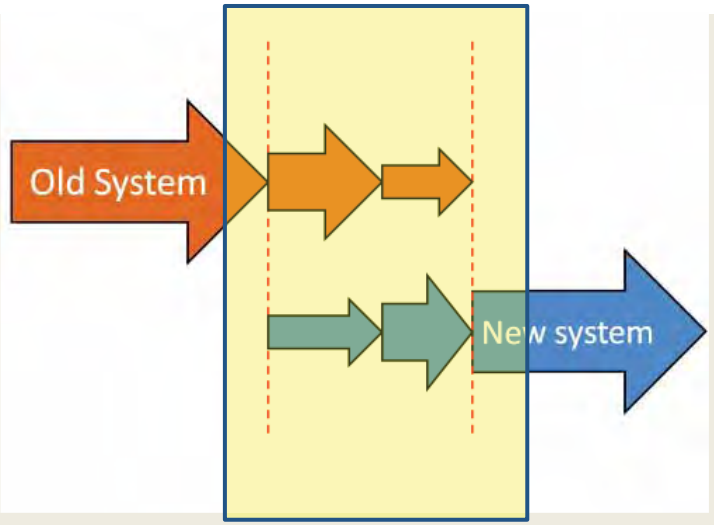
No hardware

APPROACH

- Integrated Water Recourses Management at regional level
- Multidisciplinary teams;
- Transfer hands-on experiences.

STRENGTH

Need assessment 5 W



Transition stage Plan-do-check-act

Cost effective implementation

management, operation and maintenance

CURRENT PARTNERS

Dutch water authorities

- Regional Water Authority Aa en Maas
- World Waternet
- Regional Water Authority Stichtse Rijnlanden
- Regional Water Authority the Dommel
- Brabant Water
- Water Governance Centre

Egyptian Water authorities

- Ministry of Water Resources
  - Fayoum, Beni Suef, Monofeya, Beheira
- Ministry for Waste and Wastewater Utilities
- Holding Company for Water and Wastewater
  - Fayoum, Beheira

CURRENT WOP ACTIVITIES

Capacity Development on water and waste water

- Training centre
- Optimisation of water and wastewater treatment
  - Beheira

Water Quality Management

- Waste water treatment
- Water pollution control
  - Fayoum and Beheira, el Rashita Branch

Channel rehabilitation & maintenance

- Irrigation improvement
- Weed and silt and solid waste management
  - Monofeya, Beni Suef, Fayoum

Integrated Water Resources Management

- Plan-do-act-check
- Users' involvement
- Solid waste management
  - El Mamoudiya district

WOP ACTIVITIES ON CHANNEL REHABILITATION & MAINTENANCE

Objectives and products

Prober water distribution and minimize water loses

- ✓Road map
- ✓Handbook rehabilitation & maintenance
- ✓Masterplan for channel rehabilitation and maintenance

Pilots

- Fayoum; Gravity
- Beni Suef; Nile valley
- Monefeya; Delta

January – June 2013

FINDINGS WOP- CHANNEL REHABILITATION

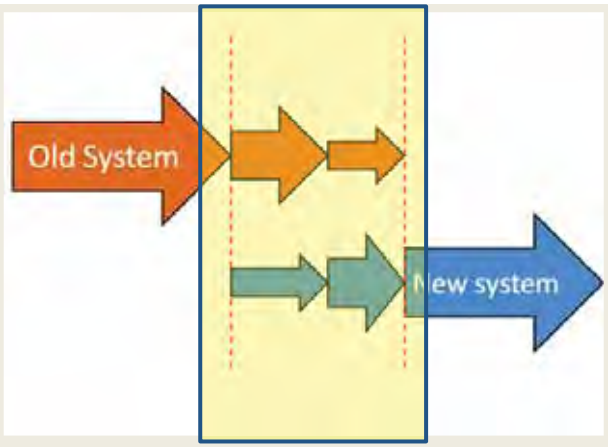
Need assessment

- Decreased rehabilitation
  - Less engineering on its original design
  - More engineering on its purpose
- Improved maintenance
  - Less silt removal
  - More weed removal and or solid waste removal

Cost effectiveness

- Frequency of maintenance
  - Less to appearance of weed
  - More to effect of weed infestation on the performance
- Maintenance target
  - More focus on maintaining the performance/canal cross-section
  - Less focus on removal of weed/rubbish

PRIVATE SECTOR INVOLVEMENT



Introduction of improved techniques for mowing and garbage removal in other and similar countries

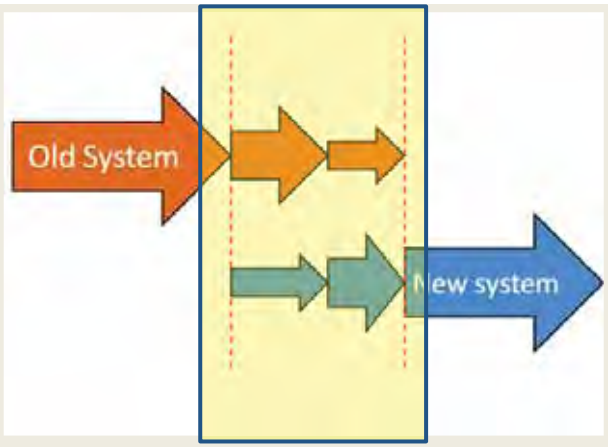
Off site staff training

Using dedicated equipment

On site operator training

Learning by doing

CONCLUSIONS WOP - CHANNEL REHABILITATION



Fayoum
50% of canal reaches are not sensitive for maintenance

Monofeya
Decreased maintenance budget by 30%

Transition

- Maintenance technique
  - From silt removal -> mowing and or solid waste removal

Outcome

- Less operational cost
  - Savings on frequency of maintenance
  - Savings on rehabilitation
  - Higher expenditure on weeding
- Continuous performance
  - Improved water distribution
  - Less water losses
  - Higher agricultural yields

SHARING KNOW-HOW IN INTEGRATED WATER RESOURCES MANAGEMENT PRACTICES IN EGYPT

DUTCH WATER AUTHORITIES

Waterschap Aa en Maas

world waternet

HOOGHEEMRAADSCHAP DE STICHTSE RIJNLANDEN

Waterschap De Dommel

Water Governance Centre

NWB FONDS

Holding Company for Water and Wastewater

MINISTRY OF WATER RESOURCES AND IRRIGATION

Asset Management

12th November 2015

ASSET MANAGEMENT

What we do

Why we do it

Alice Mortimore 12/11/15

Mott MacDonald

AGENDA

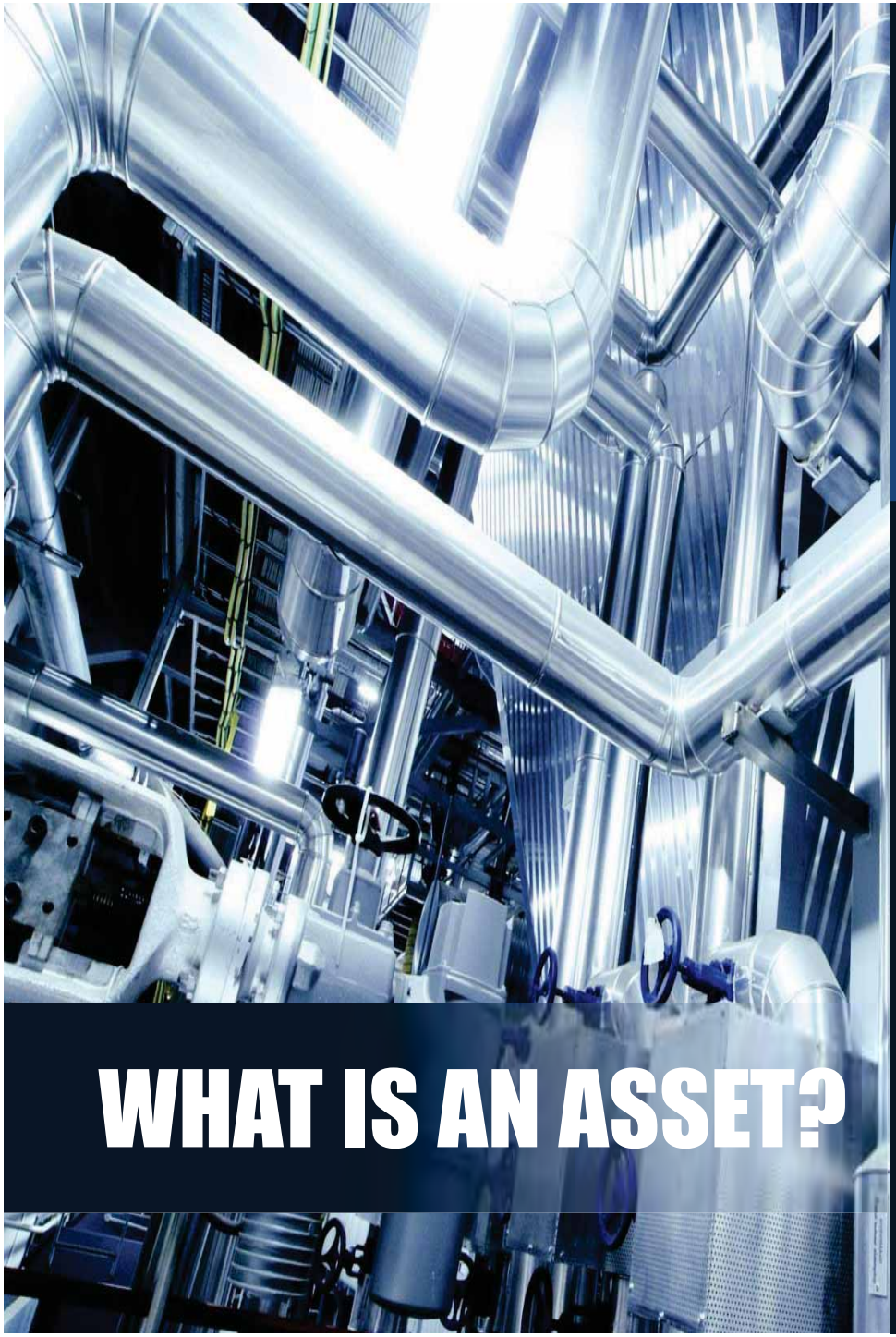
Asset Management

Principles

Benefits

QUESTIONS AND DISCUSSION

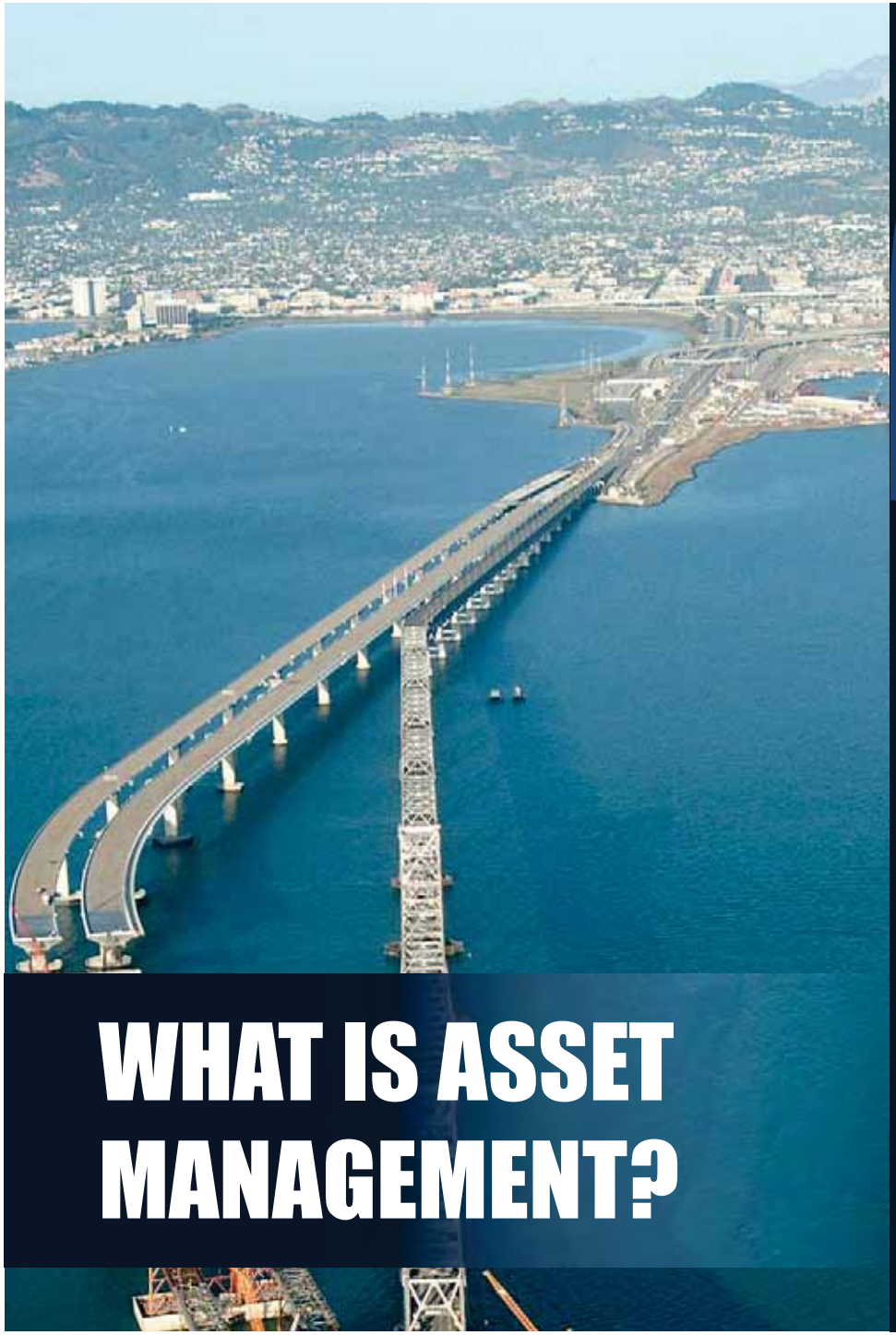
Case Studies



WHAT IS AN ASSET?

Item, thing or entity which has potential or actual value to an organisation

ISO 55000:2014

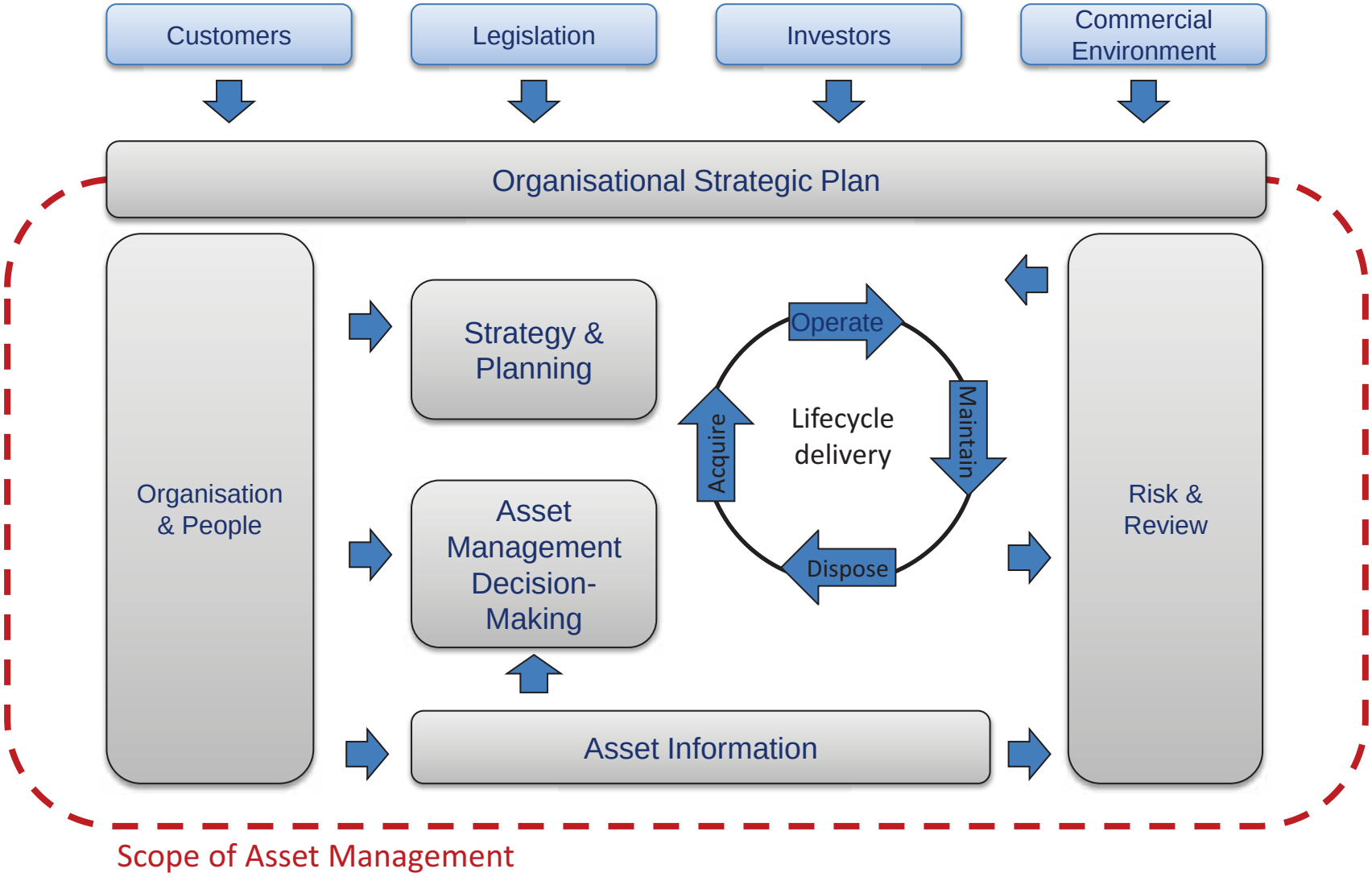


WHAT IS ASSET MANAGEMENT?

Coordinated activity of an organisation to realise value from assets

ISO 55000:2014

ASSET MANAGEMENT SCOPE



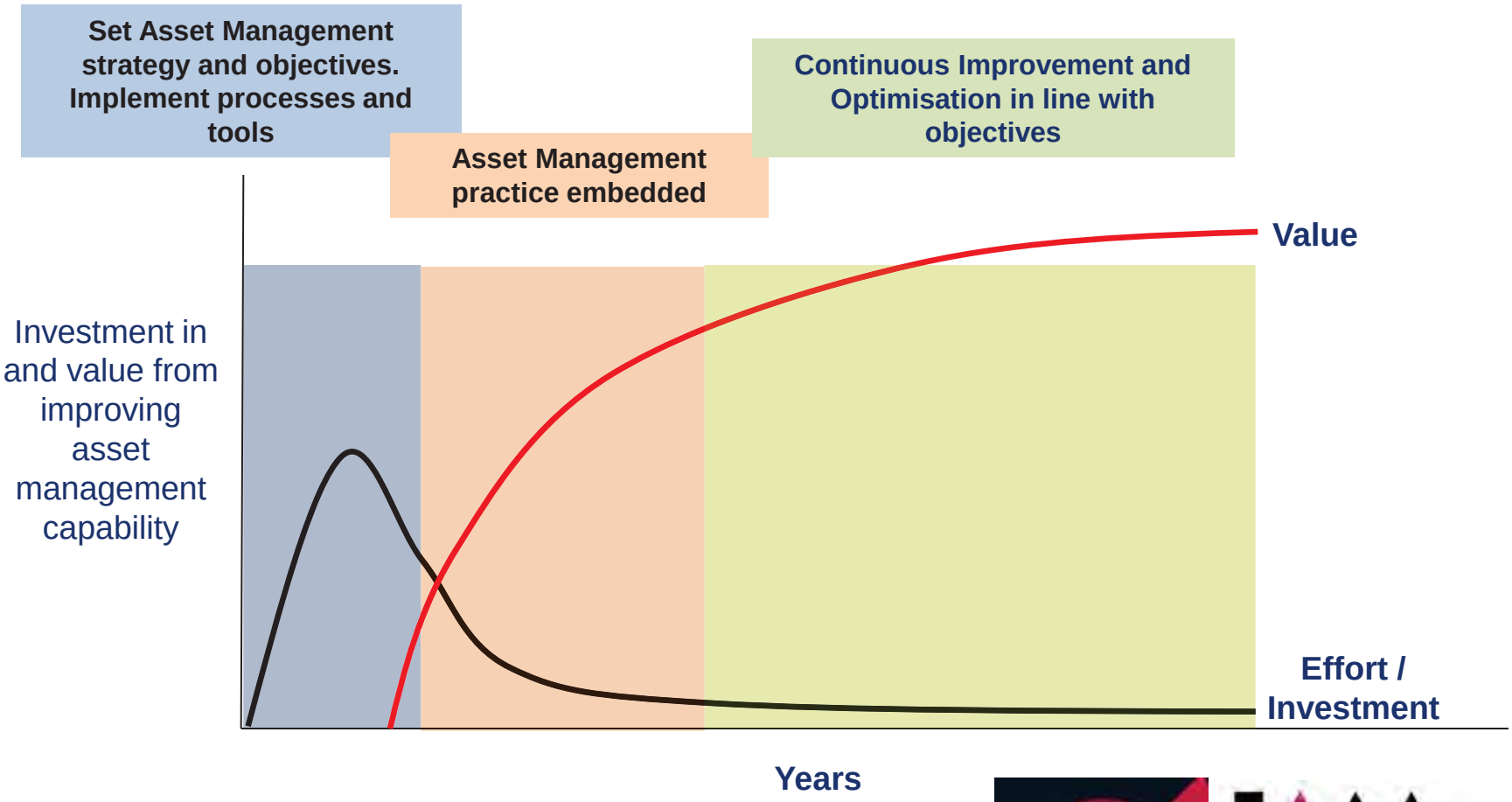
WHY DO ASSET MANAGEMENT?

Performance Improvement	Cost Efficiency	Understand and Manage Risks	Stakeholder Satisfaction

=

Achieve Objectives

ASSET MANAGEMENT IMPROVEMENT



ISO:55000 asset management

endorsed ASSESSOR

ASSET MANAGEMENT CAPABILITY IMPROVEMENT - SOUTHERN WATER

2.3m population

1m properties

2k
More than 2,000 staff

14,000km water mains

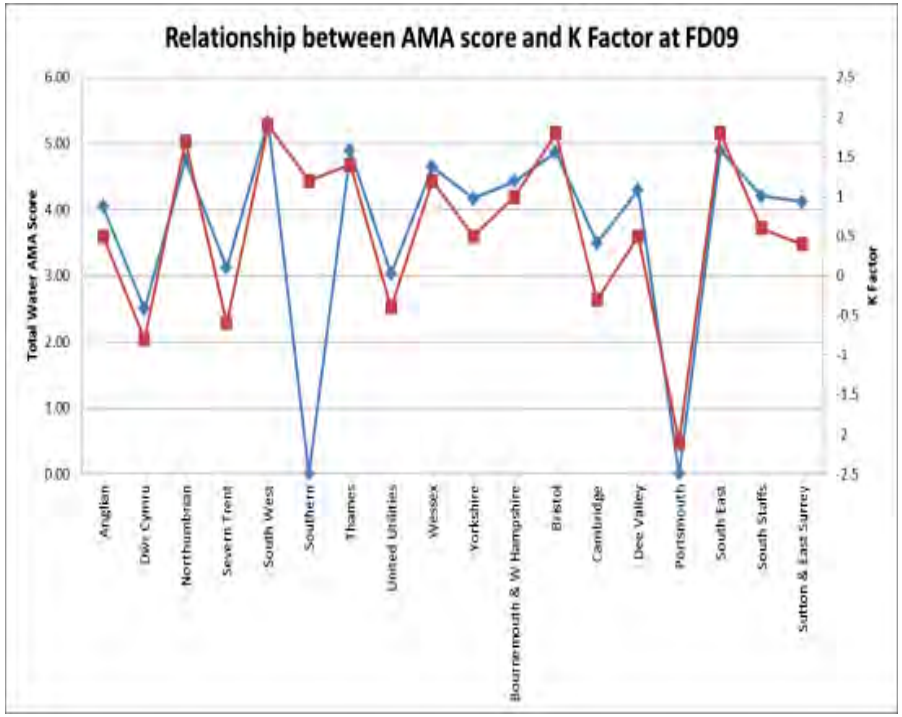
£2.6bn
Current investment programme

Tough settlement in 2009

22,000km length of sewers

ASSET MANAGEMENT CAPABILITY IMPROVEMENT - SOUTHERN WATER

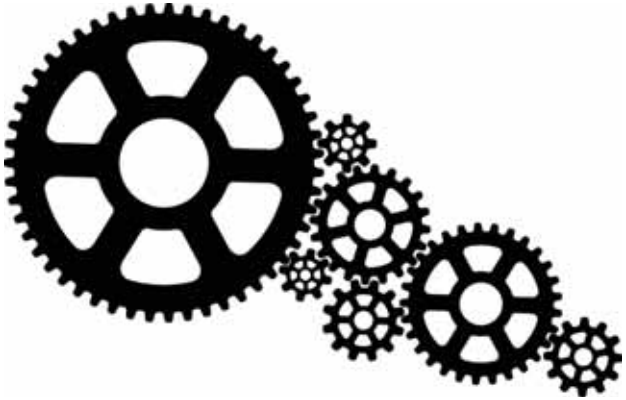
- Challenged by regulator for:
  - Poor performance
  - Poor AM capability
  - Poor efficiency
- MM appointed to:
  - Determine current AM capability
  - Define improvement activities
  - Deliver improvements
  - Define benefits of improving AM capability

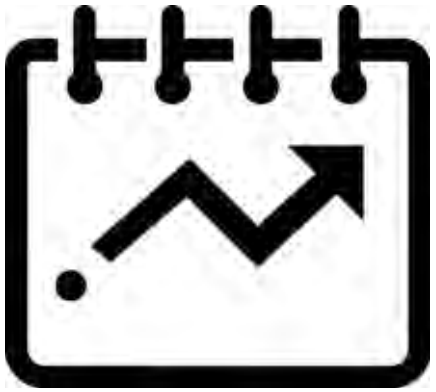


	AMA Score Water Inf	AMA Score Water Non-Inf	AMA Score Sewerage Inf	AMA Score Sewerage Non-Inf
Industry Best	3.72 SVT	3.60 SVT	3.63 WSX	3.59 SVT
Industry Worst	2.7 SRN	2.58 SRN	3.03 SRN	2.65 SRN
Industry Average	3.38	3.18	3.36	3.22

ASSET MANAGEMENT CAPABILITY IMPROVEMENT - SOUTHERN WATER

- Benefits realised
  - ✓ Improved effectiveness in Asset Management processes leading to estimated savings of 12%
  - ✓ AM capability improved from 2.8 (lowest in industry) to 3.85 (above industry average)
  - ✓ Allowed wholesale Totex increased at PR14 to £2.64B
  - ✓ Development of an ‘exit strategy’ to embed corporate knowledge and reduce reliance on external partner
  - ✓ Creation of ‘value’ measures aligned to baseline to track benefits realisation





ASSET MANAGEMENT CAPABILITY IMPROVEMENT - WELSH WATER

3m population

1.4m properties

3k

More than 3,000 staff

27,000km water mains

£2.6bn

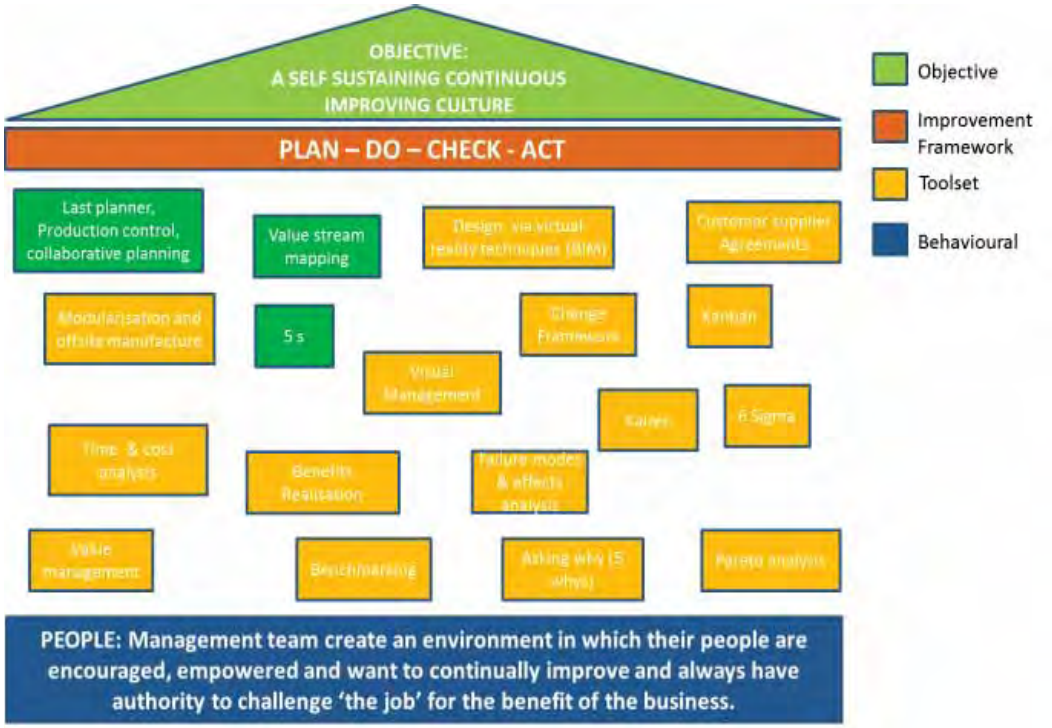
Current investment programme

Tough settlement in 2009

19,000km length of sewers

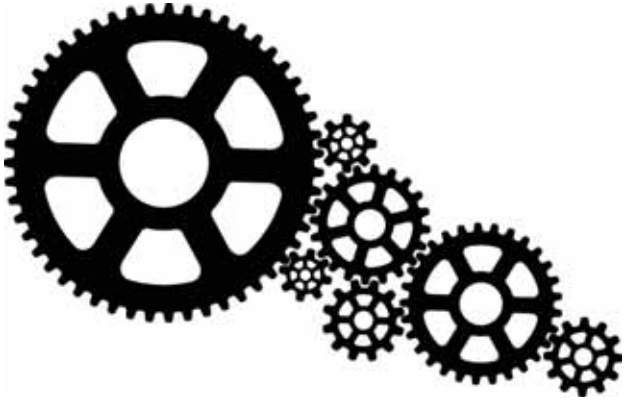
ASSET MANAGEMENT CAPABILITY IMPROVEMENT - WELSH WATER

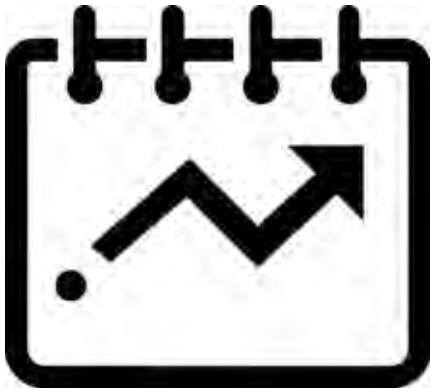
- Challenged by regulator for:
  - Poor performance
  - Poor AM capability
  - Poor efficiency
- MM appointed to:
  - Support in improving AM capability
  - Delivered through a suite of projects (operational, AM, engineering, change etc)



ASSET MANAGEMENT CAPABILITY IMPROVEMENT - WELSH WATER

- Benefits realised
  - ✓ £5m of capital efficiencies
  - ✓ Reduction in the number of failing works from 22 to 10 within 12 months
  - ✓ Extraction of 10% of process time for delivery of capital projects
  - ✓ Within three years Welsh Water had already achieved upper quartile performance in terms of Asset Management capability
  - ✓ Regulator ‘endorsed’ an increase in wholesale totex at the recent price control





ASSET MANAGEMENT & ISO55000 ADVISORY - NUCLEAR DECOMMISSIONING AUTHORITY

MM support since 2011

PAS55 Support

>£3b total expenditure

ISO55000 Support

Responsibility for overseeing decommissioning of 17 nuclear sites across UK

Sites date from 1940s and 1950s

5 SLCs

USING OUR INGENUITY TO CREATE LASTING VALUE FOR ALL

www.mottmac.com

Mott MacDonald

Climate Resilience

12th November









CLIMATE RESILIENCE

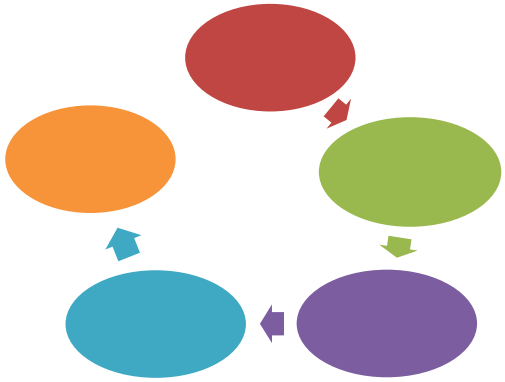
A VIEW FROM MOTT MACDONALD

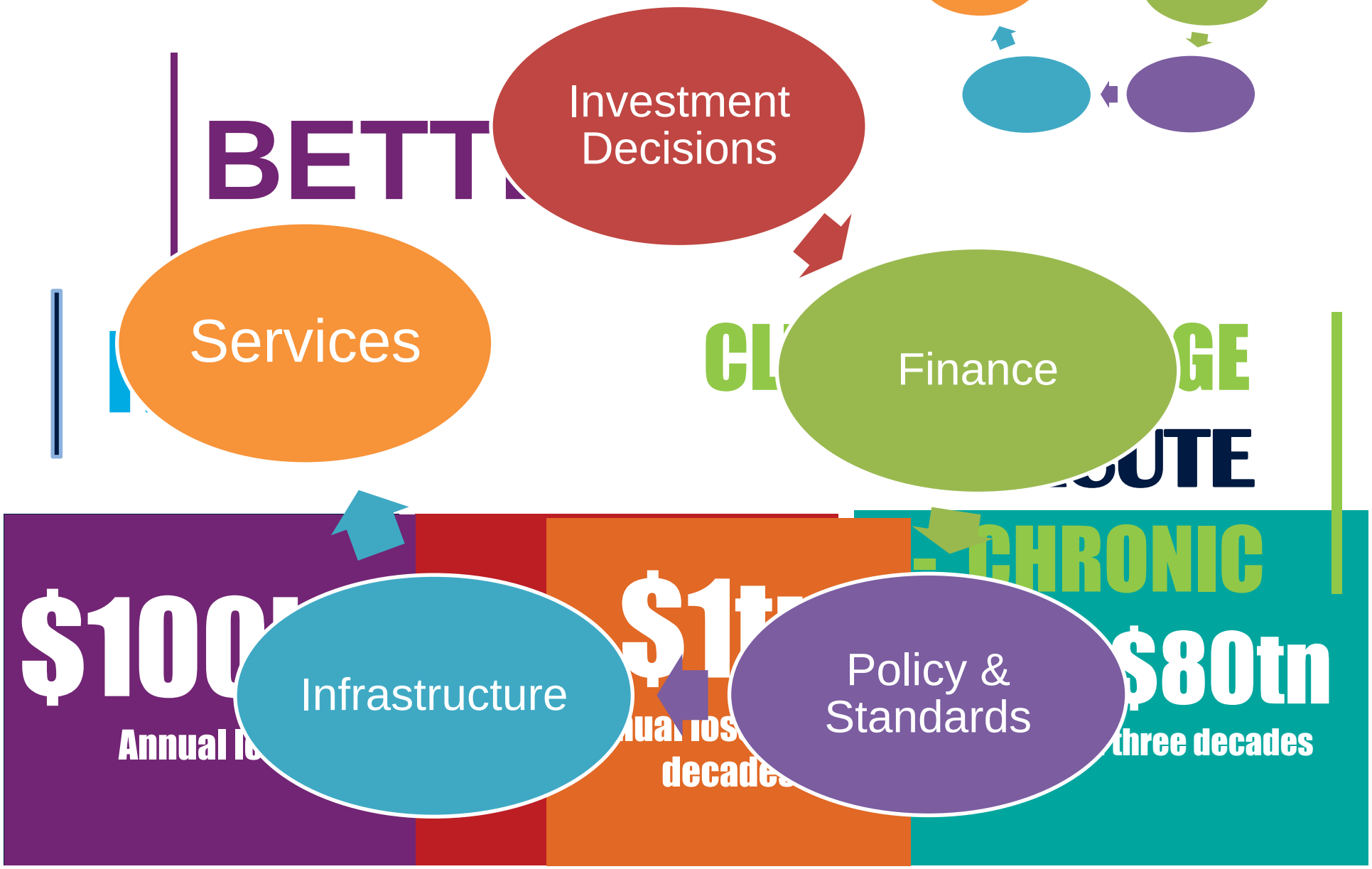
Mott MacDonald

RESILIENCE

- ***[Climate] Resilience is the process of adapting infrastructure, and society as a whole, to the impacts of [climate] change; to allow businesses and systems to evolve into a more robust state better able to withstand the increasing impacts from [climate] change as well as [non-climate] adverse events.***

SYSTEM RESILIENCE





SHIFTING THE NORM

Small Change in the mean

Extreme events

- Heat Waves
- Floods
- Droughts
- Storms
- Hurricanes

Large change in magnitude and frequency of extreme events

ACUTE

CHRONIC

Mott MacDonald

“There were 3 ways in which climate

PHYSICAL RISKS....

LIABILITY RISKS....

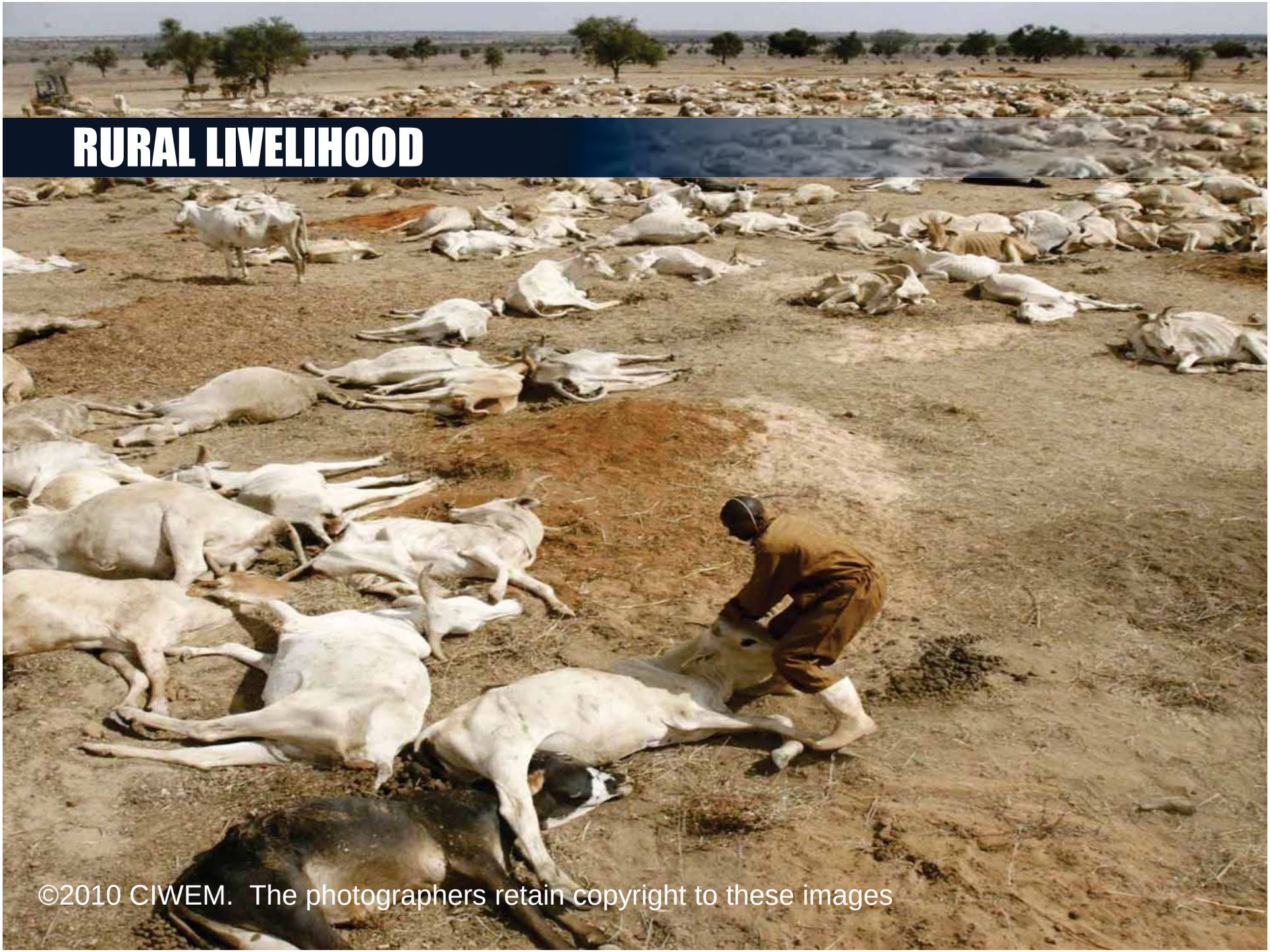
TRANSITION RISKS....

”

MARK CARNEY - CHAIR FINANCIAL STABILITY BOARD - SEP ‘15

POWER

RURAL LIVELIHOOD



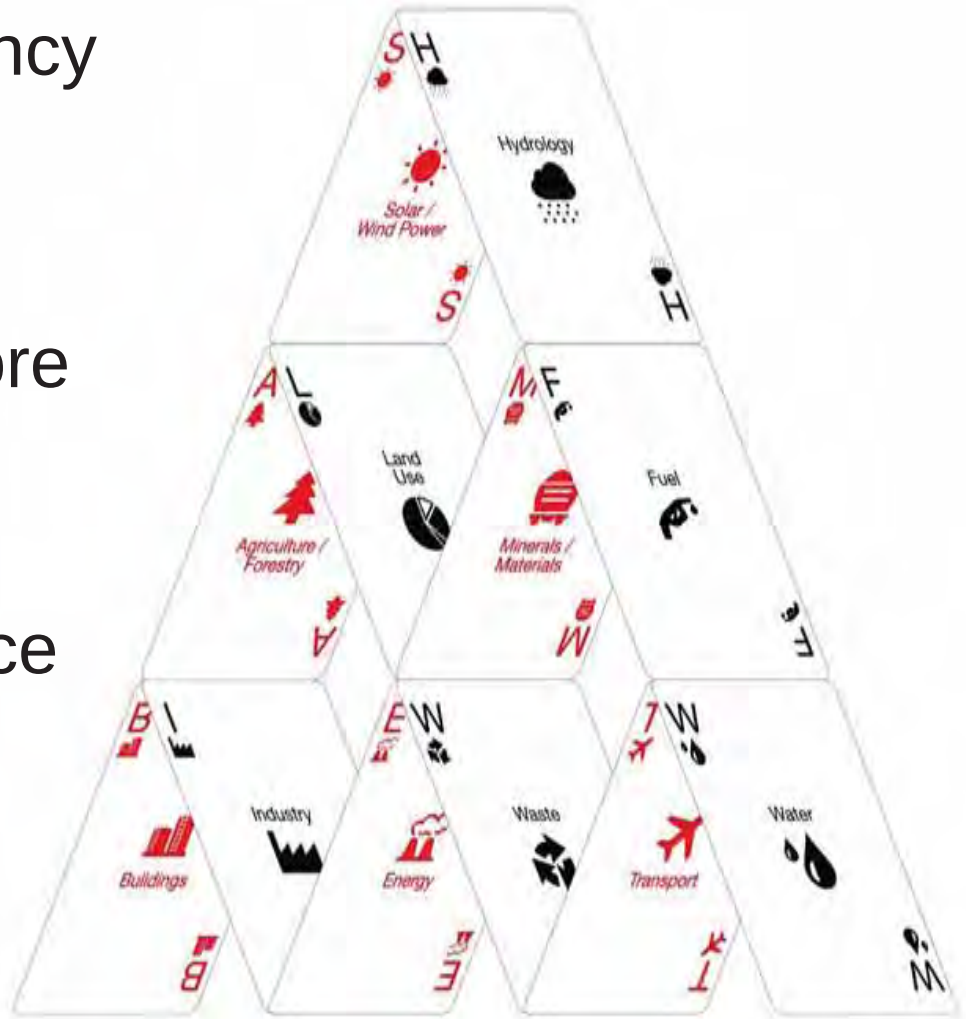
URBANISATION

URBAN ECONOMY

CRITICAL INFRASTRUCTURE

SYSTEM OF SYSTEMS

- Drivers of cost efficiency
- Systems increasingly interconnected
- Systems reliant on core processes
- ***Inter***-connection becomes ***over***-reliance



THE 4 'R's OF RESILIENCE

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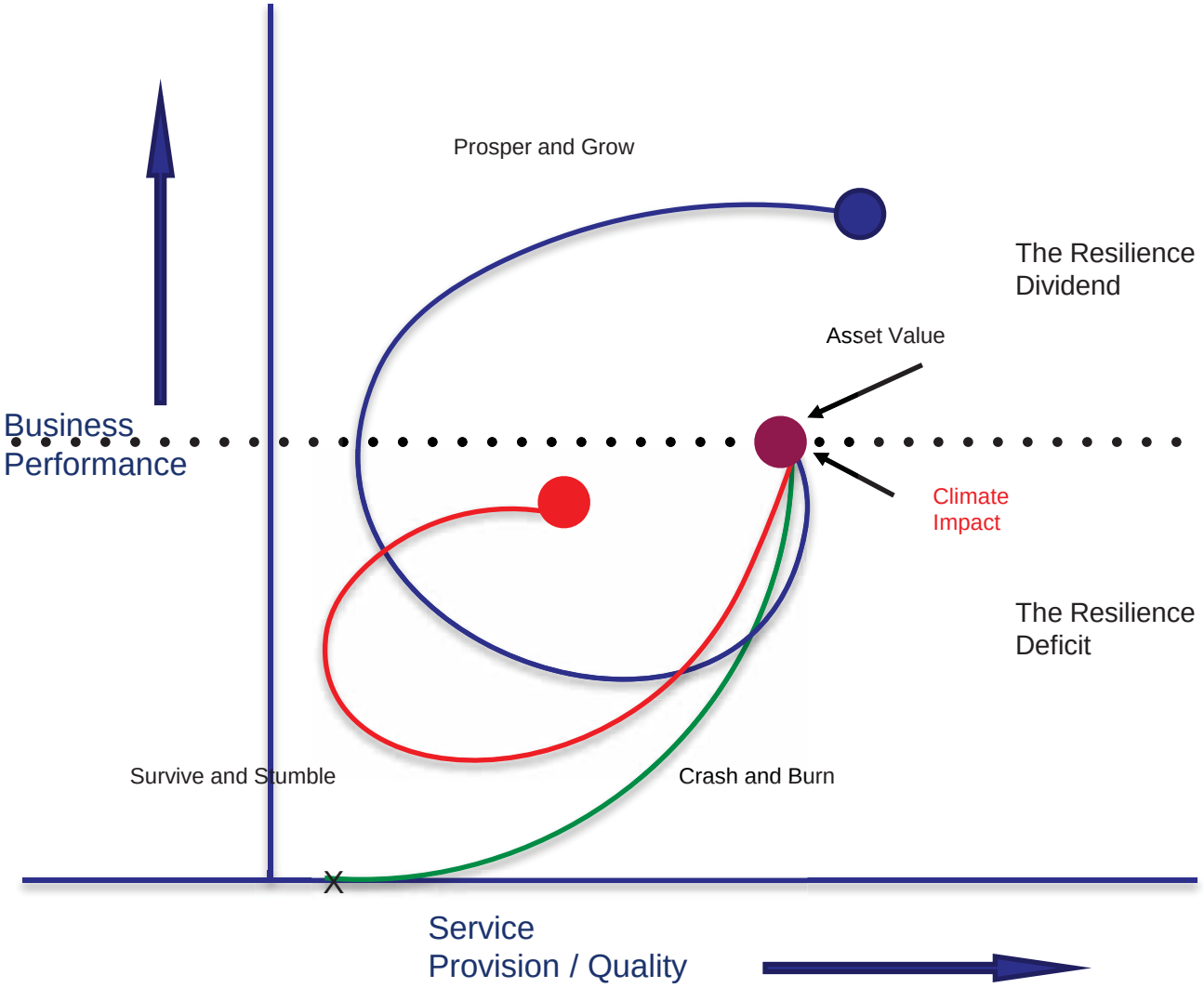
RESILIENT DIVIDEND



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THE ROUTE TO 'RESILIENCE'

- Manage risk & Uncertainty
- Build internal capacity
- Know your extended 'market chain'
- Look for the Resilience Dividend

CLIMATE RESILIENCE

A VIEW FROM MOTT MACDONALD

Mott MacDonald

Assiut Barrage

10th November 2015

Assiut Barrage
- to rehabilitate or to rebuild -

Tim Hill

Mott MacDonald

The Project

"To investigate the present structural and operational conditions at the barrage and to outline options for the future."

Options Evaluated:

- Do nothing
- Construction of a new barrage
- Rehabilitation of the existing barrage

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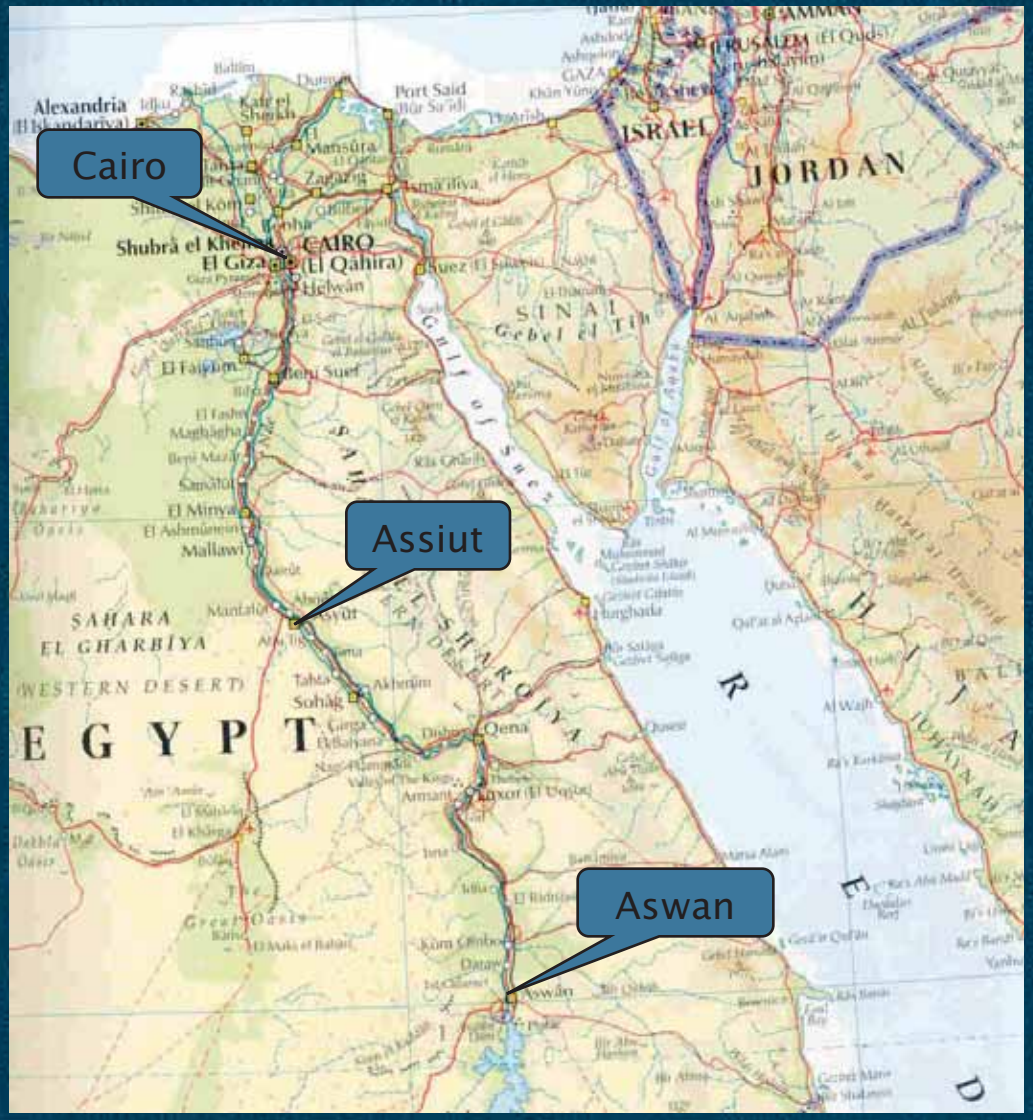
Assiut, Egypt



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Construction History

• Original construction	1898-1902
• Rehabilitation	1934-1938
• Head Regulator rehabilitation	1960's
• New stoplogs and lock gates	1970's
• Grouting works at the barrage	1980's

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Assiut Barrage

- Third barrage on the river Nile downstream of Aswan
- Designed to discharge 14,000 m^3/s (500,000 ft^3/s)
- 810m long; 15m high; 110 vents; 4.2m head
- Primary purpose is to provide sufficient flow for the Ibrahimia canal system
- Secondary purpose is to partially regulate flows to the Delta

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Assiut Barrage
Aerial View

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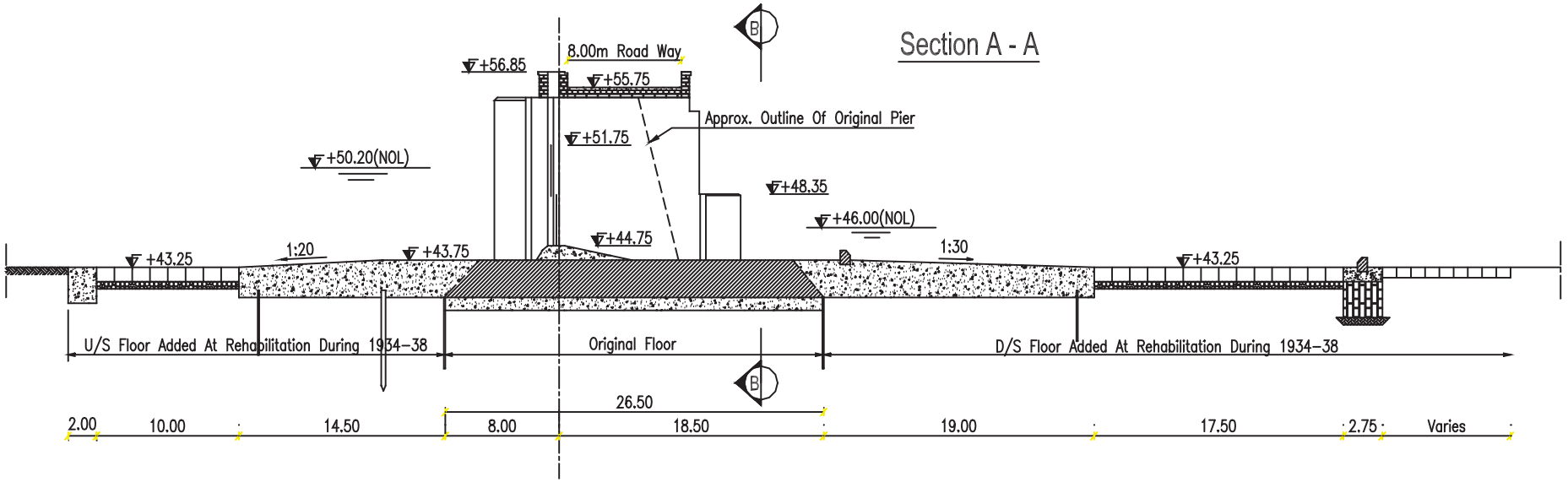

Assiut Barrage
Typical Cross Section

Mott MacDonald

Assiut Barrage
View from Downstream

Mott MacDonald

Assiut Barrage
View from Upstream

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Assiut Barrage
Gate Bays from Upstream

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Assiut Barrage
Navigation Lock

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Assiut Barrage
Vent Dewatering and Inspection

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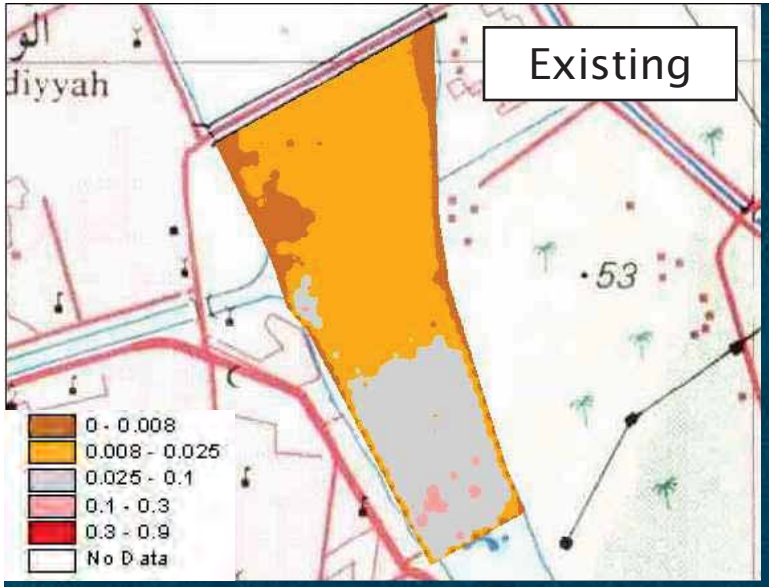

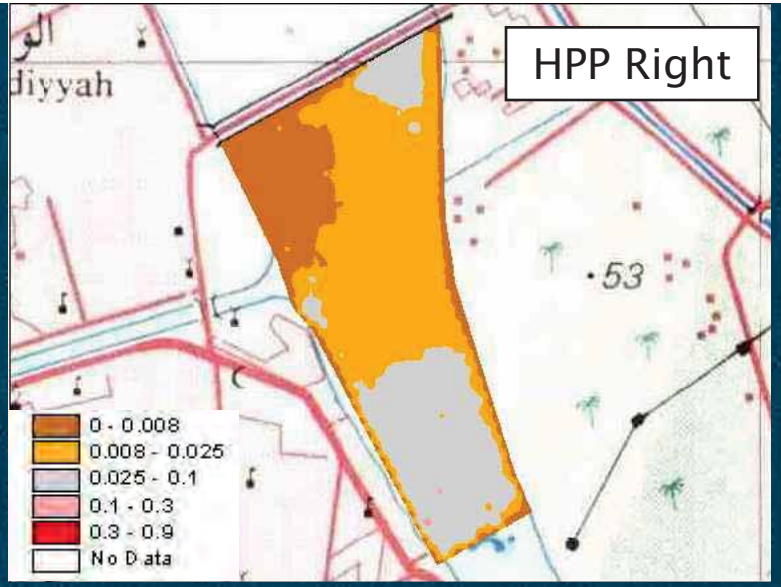

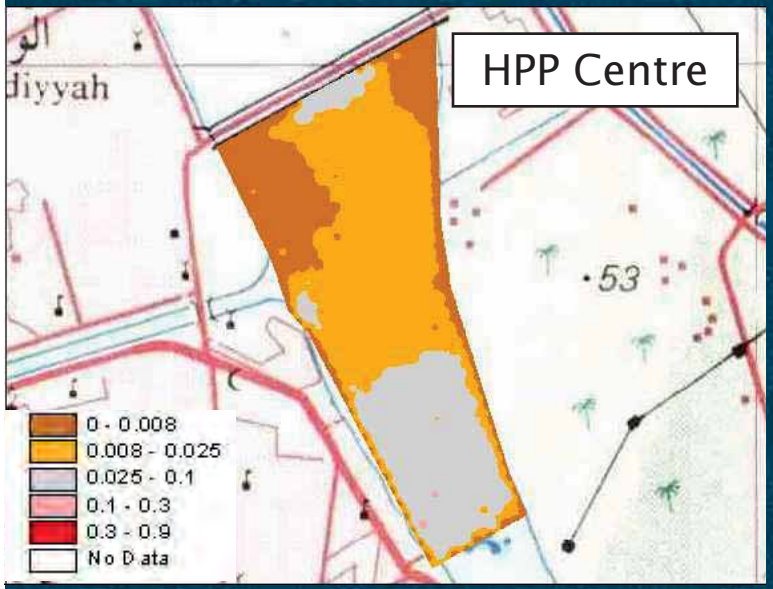

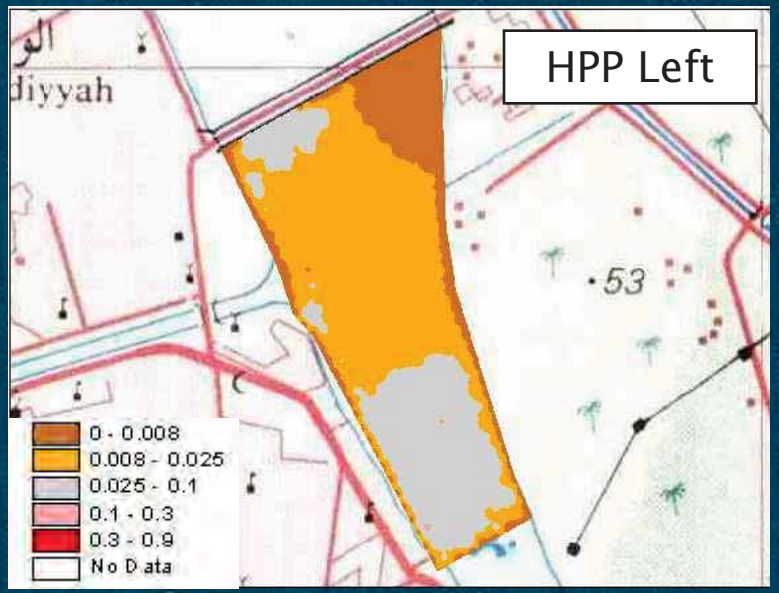

Hydraulic River Modelling Results
Bed Velocities (m/s)

Mott MacDonald

Scheme	Total cost (with HPP)	Total cost (without HPP)	Cost of 32MW HPP component
Rehabilitated barrage	255.5 M Euro	141.3 M Euro	114.2 M Euro
New barrage	277.9 M Euro	172.8 M Euro	105.1 M Euro

Assiut Barrage
Summary of Scheme Costs

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Thames Tidal Defences

11th November 2015

Thames Tidal Defences

Steve East
Engineering Manager

Presentation outline

- Flood risk in London
- Developing defences
- Thames Tidal Defences
- Tidal forecasting
- Flood Warning Service
- Barrier operation
- Looking ahead

Environment Agency

FLOOD RISK

Flood risk in London

Various sources of flooding:

- Tidal
- River
- Surface water
- Groundwater
- Sewer

Environment Agency

Historic flooding

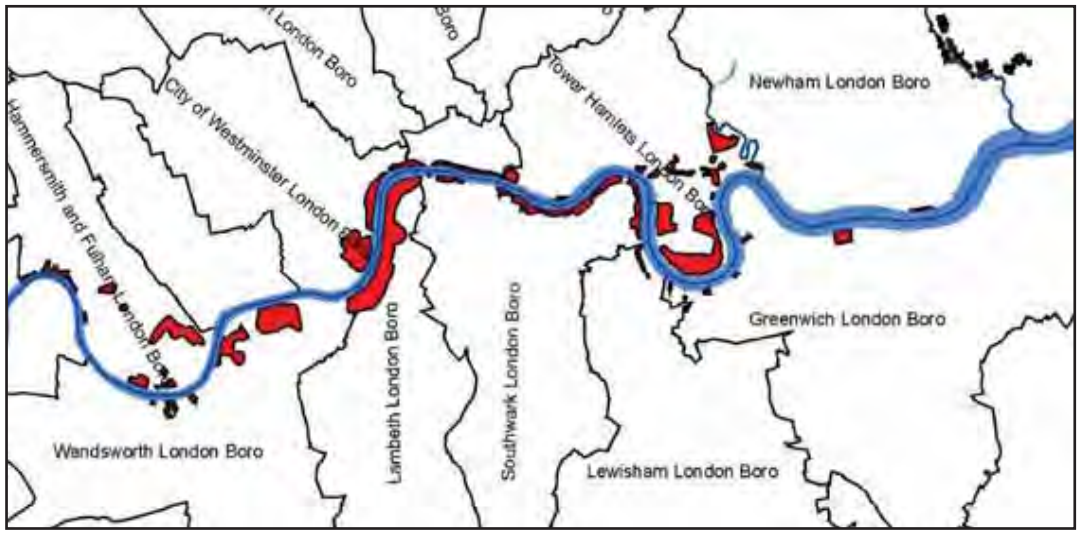
Environment Agency

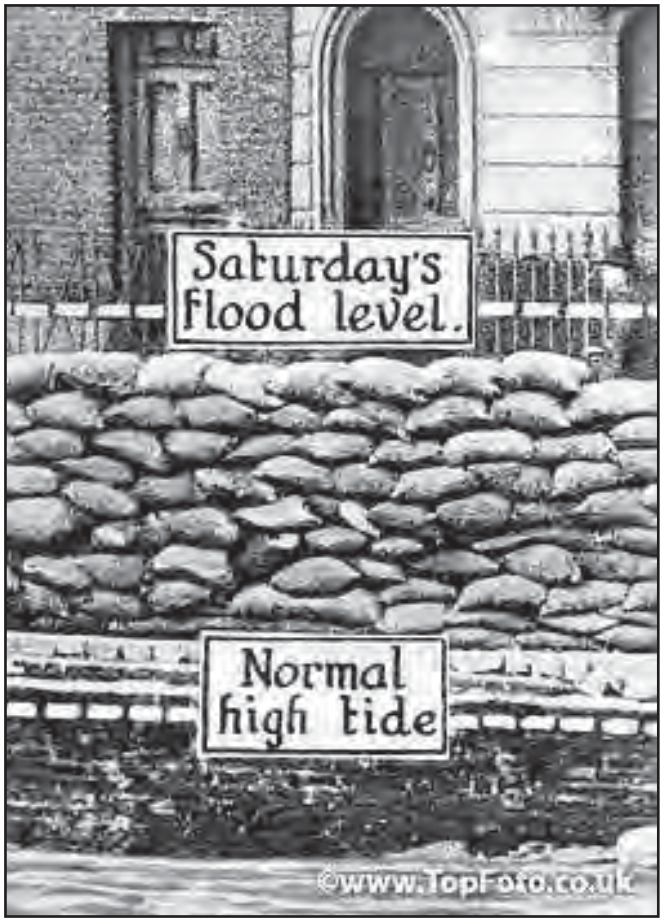
Historic flooding

Anglo Saxon Chronicle 1099
"...on the Festival of St Martin the sea flood sprang up to such a height and did so much harm as no man remembered that it did before and this was the first day of the new moon..."

Another flood recorded on the same day in 1236:
"…which caused the marshes about Woolwich to be all at sea wherein boats and other vessels were carried in the stream. In the great Palace of Westminster men did row in wherries in the midst of the hall…"

1928 London flooding





Environment Agency

1953 East Coast Surge

3,000 AWAIT RESCUE BOATS

"DAILY MIRROR" REPORTERS

THREE thousand people in Plaistow and West Ham, in the worst-hit flood areas of London, were waiting last night for rescue by a fleet of small craft rounded up by the Thames Police.

For hours, strings of boats sailed up the streets to houses and blocks of flats where whole families were at the upper windows.

"Children first" was the order. They were ferried to high ground, where convoys of trucks took over and ran a shuttle service to improvised refuges centres.

The caravans float like matchboxes

By NOEL WHITCOMB

LOOKING down from an aeroplane on the watery tragedy that hit England yesterday, it was not so much the appalling pictures of Mablethorpe, Canvey Island and Great Yarmouth that struck home the full horror wrought by the great sea.

It was sights like the farmer standing on his roof, surveying the sandy beach that had been his fields; the flotilla of painted boats at Skegness which turned out to be no flotilla at all, but Butlin's camps.

It was the sight of a farmer with two of his horses standing on the cart; of two bodies, which might have been animals but didn't look like it, floating from a "single work and hope and saving, suddenly washed out by the sea and the wind.

We zoomed down to look at a lighthouse—and found it was a windmill.

It wasn't possible to follow the old, familiar coastline, for it has disappeared. This storm has changed the map.

Just Twisted Metal

Playgrounds, raising greens and funfairs are not where they used to be. They are, in many places, just struts of twisted metal.

Caravans float like matchboxes. Red, white and green holiday villas are in the sea. In what must have been the front garden of one such villa

Drowned in Air Raid Shelter

A man aged seventy was drowned in an air-raid shelter when a stream feeding the Thames at Barnes overflowed, and a raging torrent swept along Rectory-road. For ten years Herbert Haines had slept in the shelter in a garden of one of the houses there—"to be away from the noise." In the darkness he was trapped before the alarm could be raised.

A watchman at a factory on the Belvedere Marshes, near the Thames Estuary, was drowned when he, too, was caught by the sudden torrent which roared through a breach in the river bank.

A police launch saved people marooned in their houses as the water spread over an area of 700 acres of the marshes.

For hours, in the early morning, police radio cars toured riverside areas of London, warning sleeping families to get up—and in some cases to flee from their threatened houses.

USELESS EUSTACE

"Naturally I haven't spoken to you all the evening—I didn't like to interrupt!"

THE ISLAND OF NO NEWS

"DAILY MIRROR" REPORTER

WHAT has happened to the 200 men, women and children on Bowness

Daily Mirror

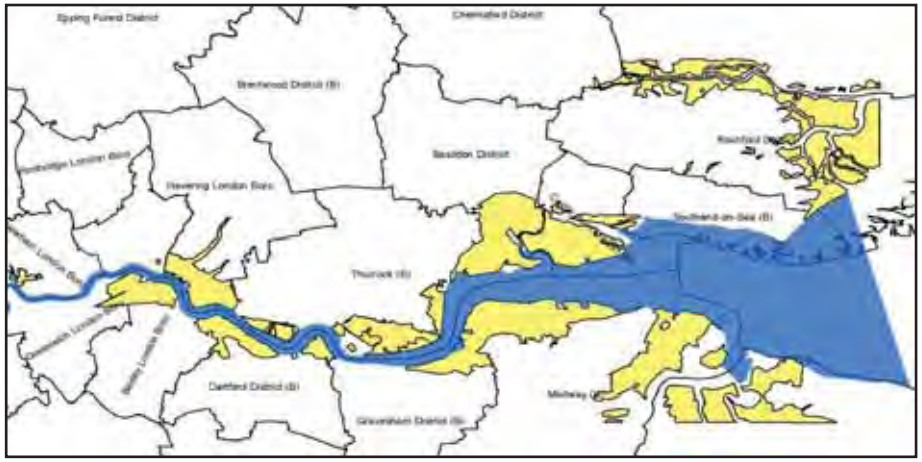
FORWARD WITH THE PEOPLE

FRIDAY FEB. 2 1953

No. 15,308

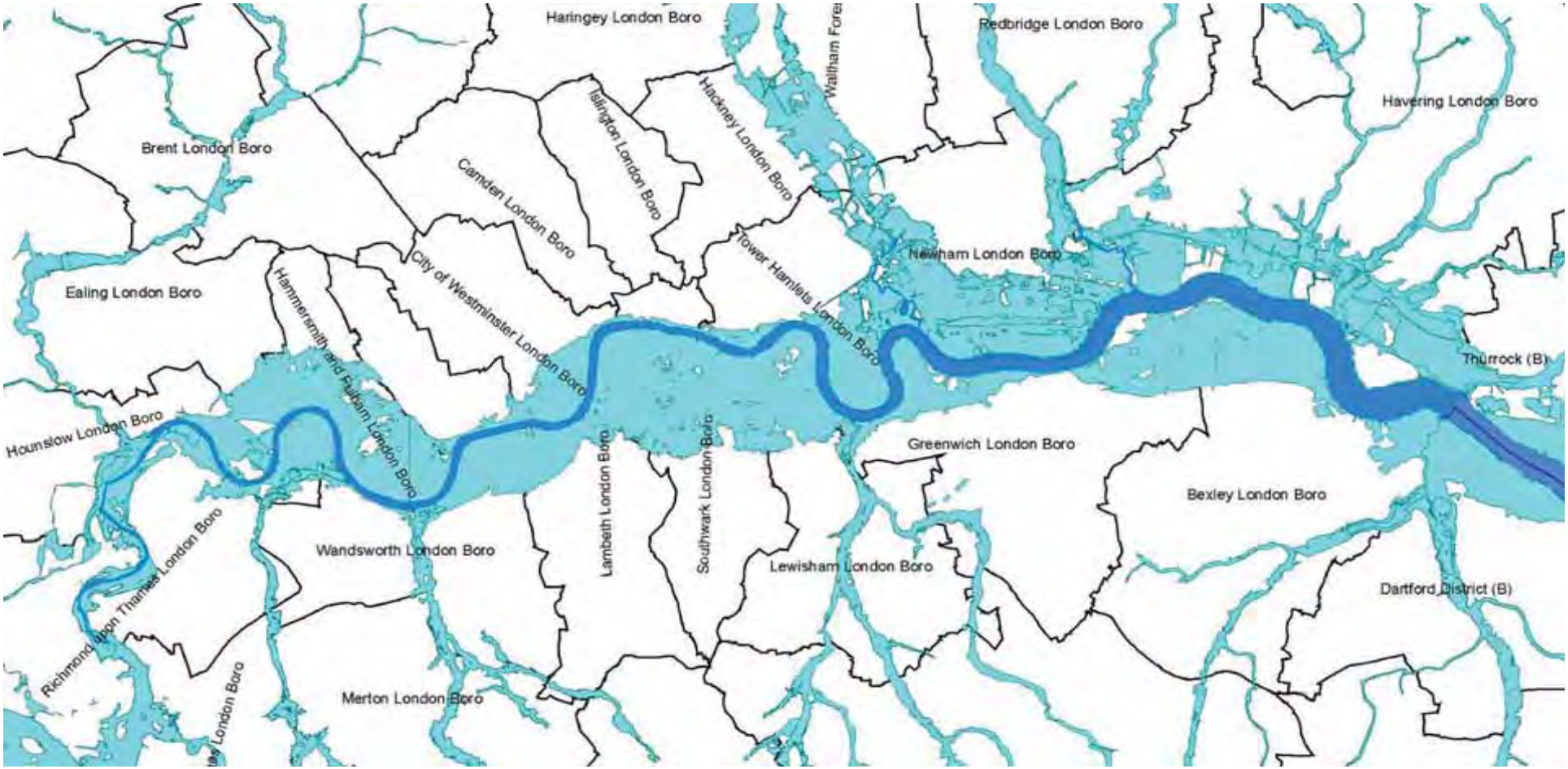
200 DEATH-ROLL IS FEARED AS SEA-FLOOD HORROR STRIKES BRITAIN

Two to whom death came in a night of terror...



Environment Agency

Flood risk in London today



Environment Agency

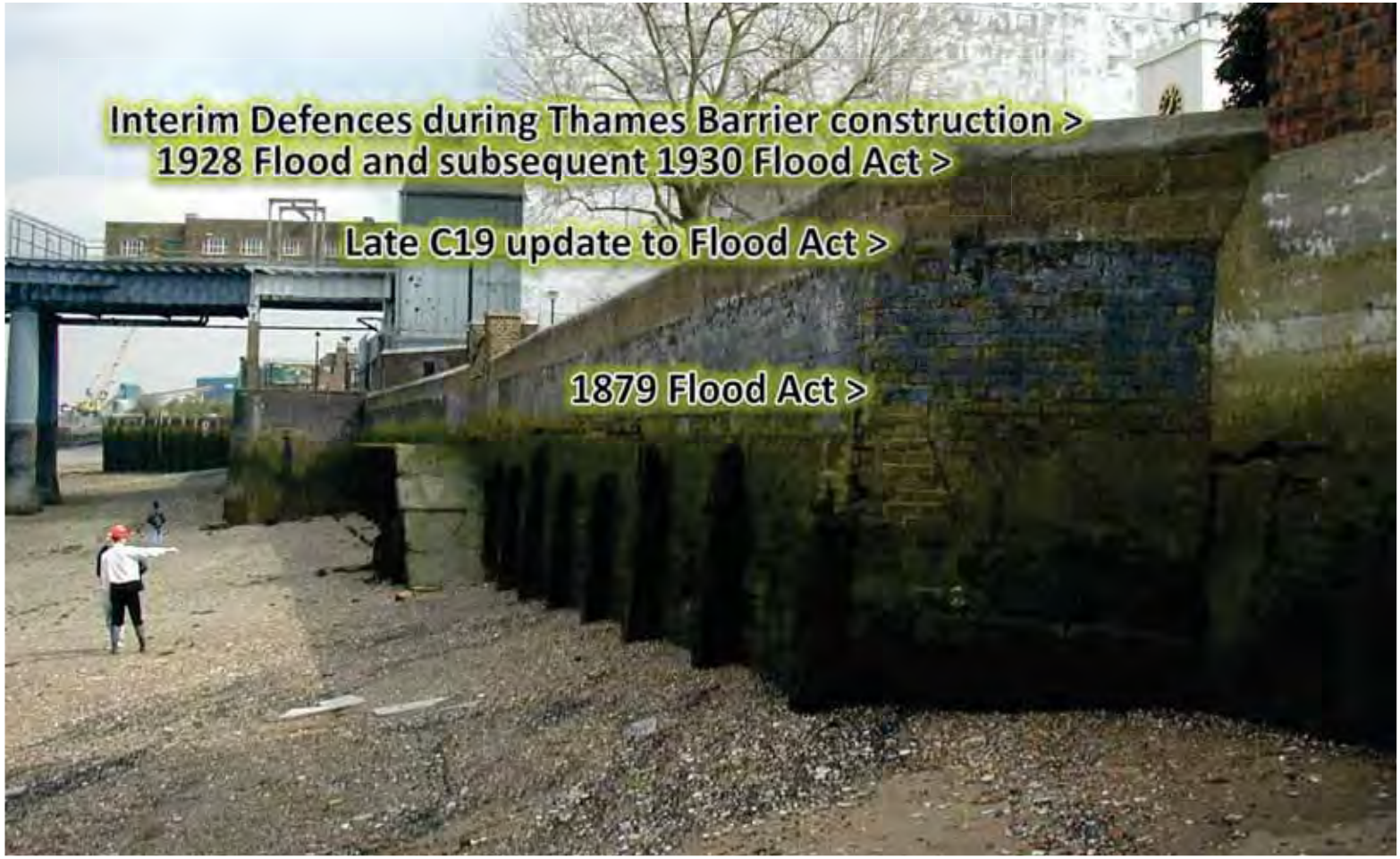
DEVELOPING DEFENCES

What were the options?

- Do nothing
- Relocate London to a safer site
- Raise the heights of walls both sides of the Thames
- Build barriers to keep dangerously high tides out of the city

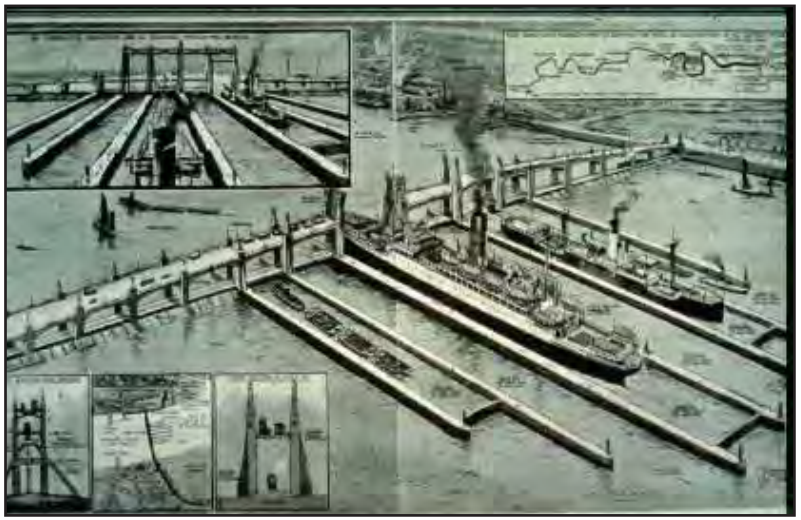
Environment Agency

What were the options?



Designing the Barrier

- Many designs submitted
- Charlton chosen because of the straight, deep, wide stretch of river
- Not too wide to be cost prohibitive

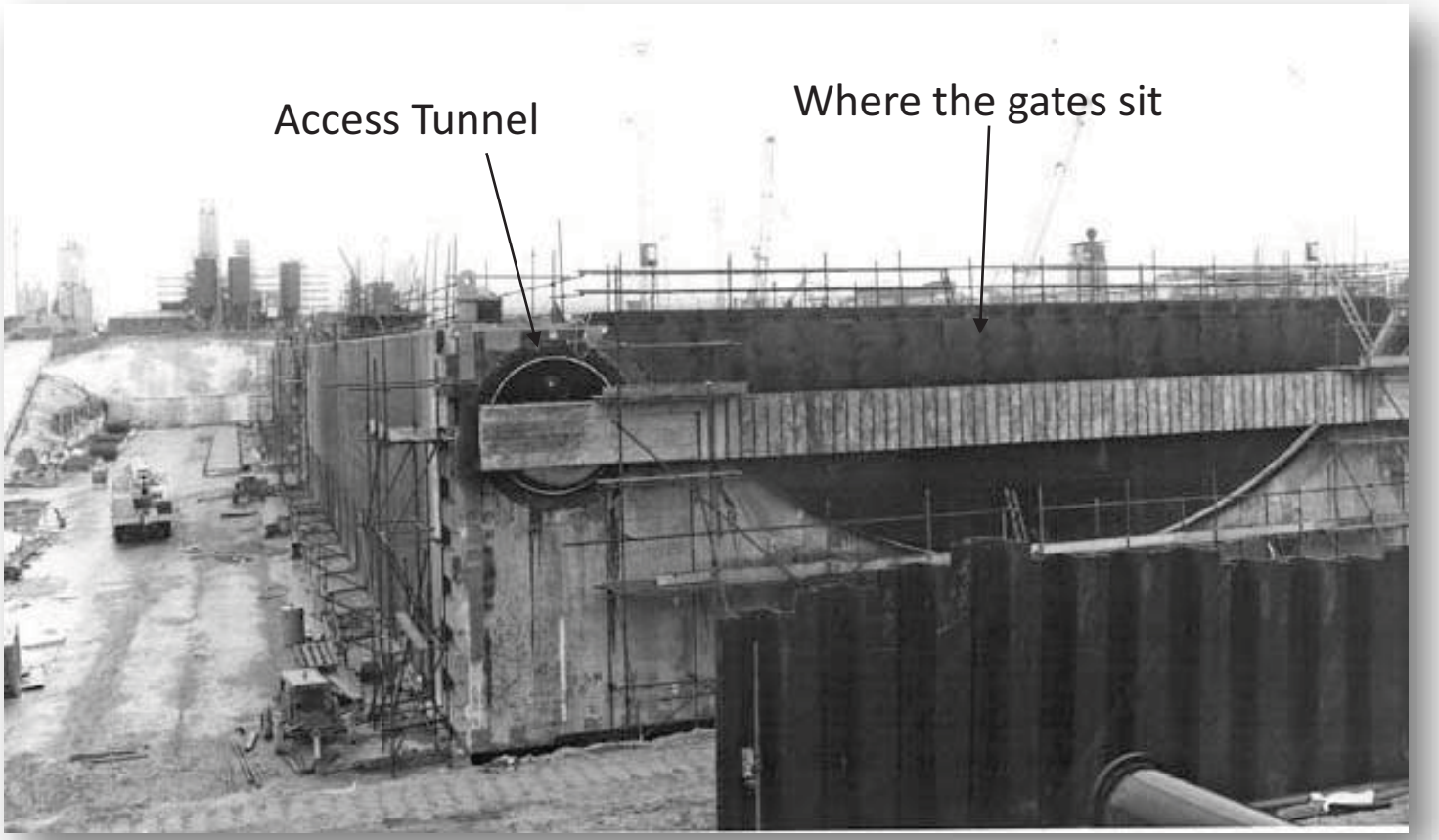


Core objectives of the Thames Barrier

1. To prevent tidal flooding to people and property in London
2. To have total reliability in operation
3. To cause minimum impact on navigation

Environment Agency

Constructing the Thames Barrier



One of the six concrete gate cills, that were formed on the North Bank, before being floated out and sunk between two of the Piers

Environment Agency

THAMES TIDAL DEFENCES

What the Thames Tidal Defences protect

- 45 square miles of London
- Over 375,000 properties at risk
- Over £200 billion capital values of assets
- 25 mainline & 54 Underground / DLR stations
- 226 schools,13 hospitals, 15 fire & 15 police stations
- 1.25 million people live/work below average high tide
- City Airport
- Internationally important cultural heritage and environmental sites

(estimated figures)

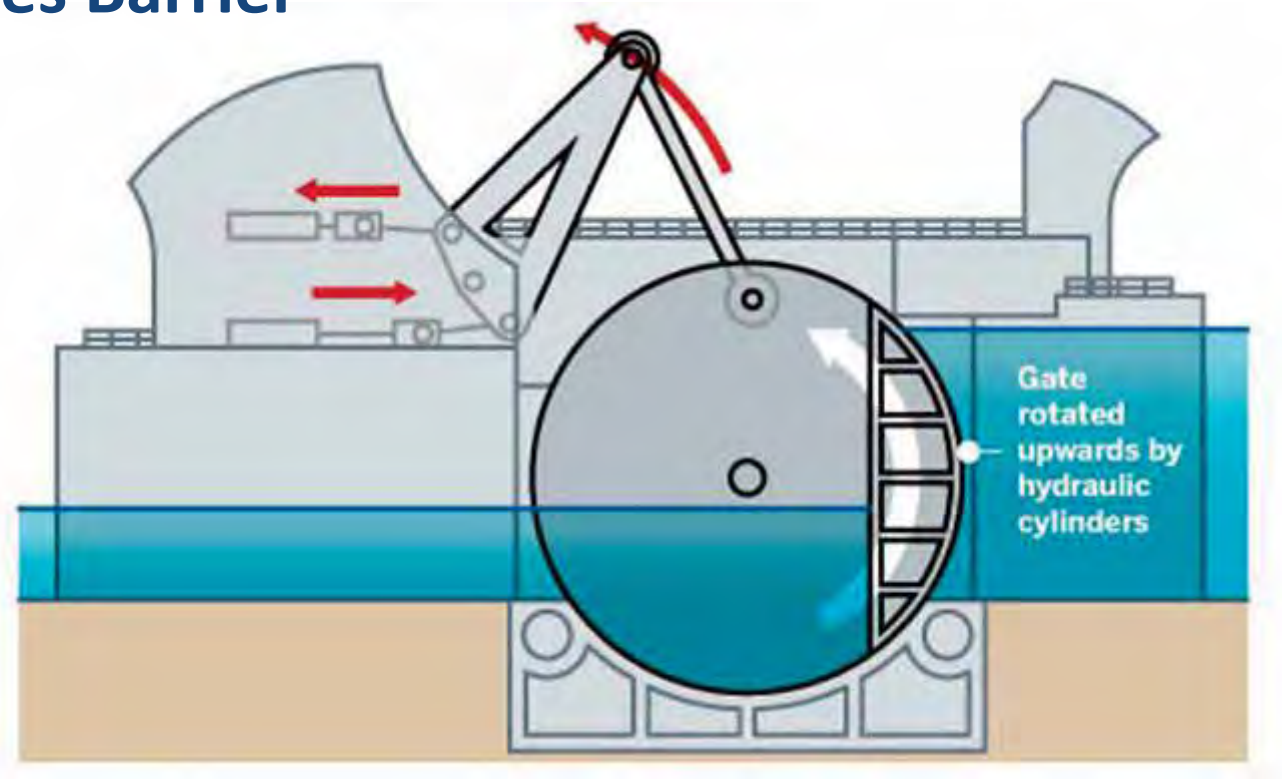
Thames Tidal Defences

Thames Barrier

Environment Agency

Thames Tidal Defences

Thames Barrier



Thames Tidal Defences

Dartford Creek Barrier

Barking Barrier

Environment Agency

Thames Tidal Defences

The Royal Docks

Environment Agency

Thames Tidal Defences

Earth embankments

Steel sheet

Stone revetments

Masonry gravity walls

Flood gates

Concrete gravity walls

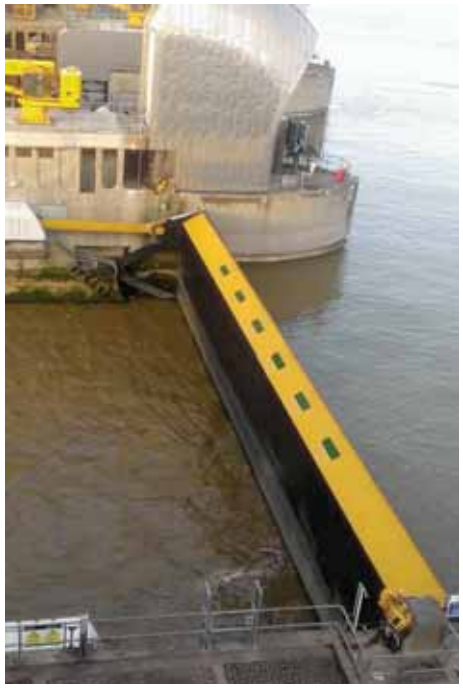
Wooden piles

Environment Agency

BARRIER OPERATION

2013/14 – Our busiest Winter

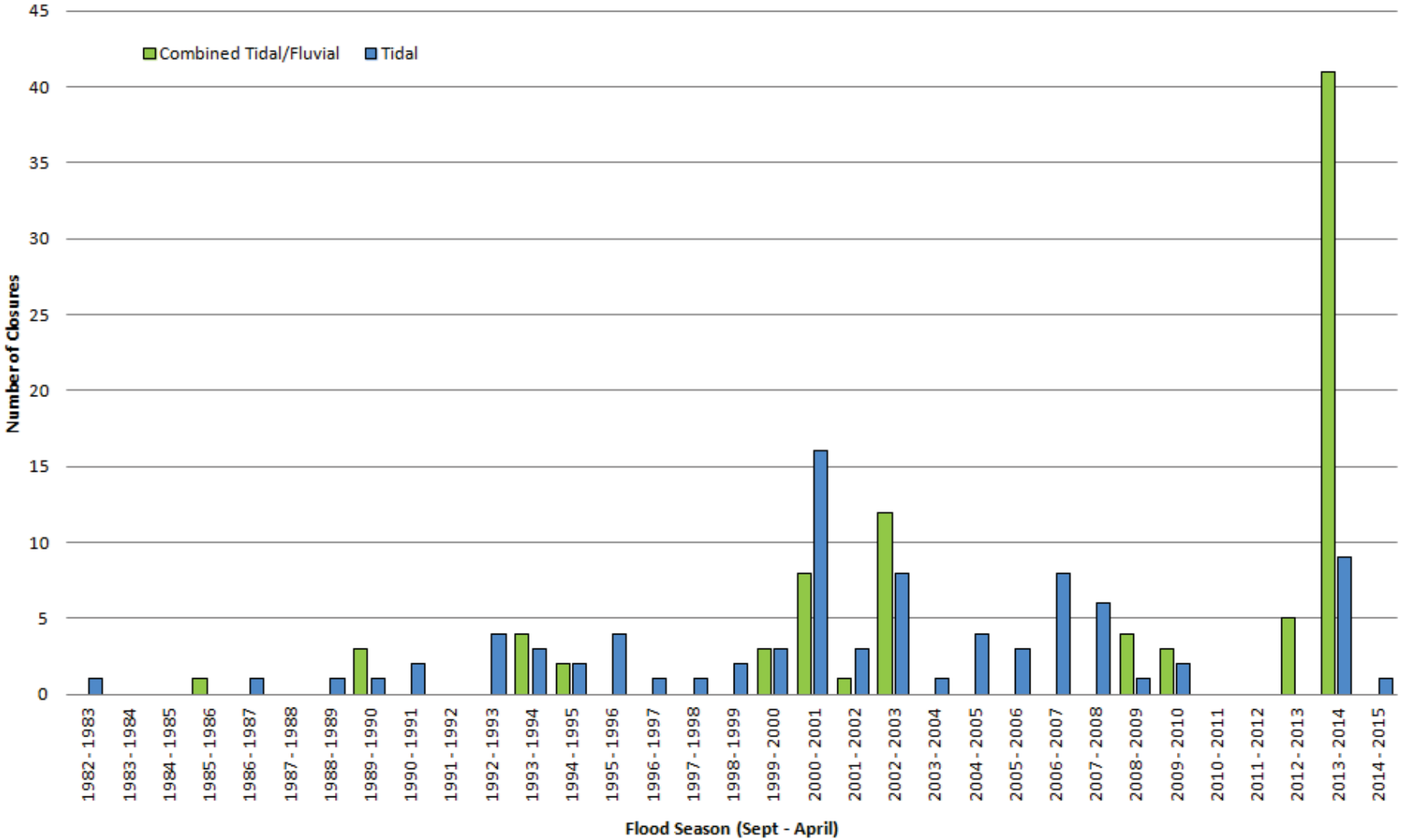
- 50 Closures in 13 weeks
- Closed on 13 and 20 consecutive tides
- Highest tide since construction
- Highest fluvial flow since 1974



Environment Agency

Thames Barrier Flood Defence Closures by Flood Season

Last updated 27th March 2015



HISTORIC CHALLENGES

The Sand Kite Dredger – Oct 1997

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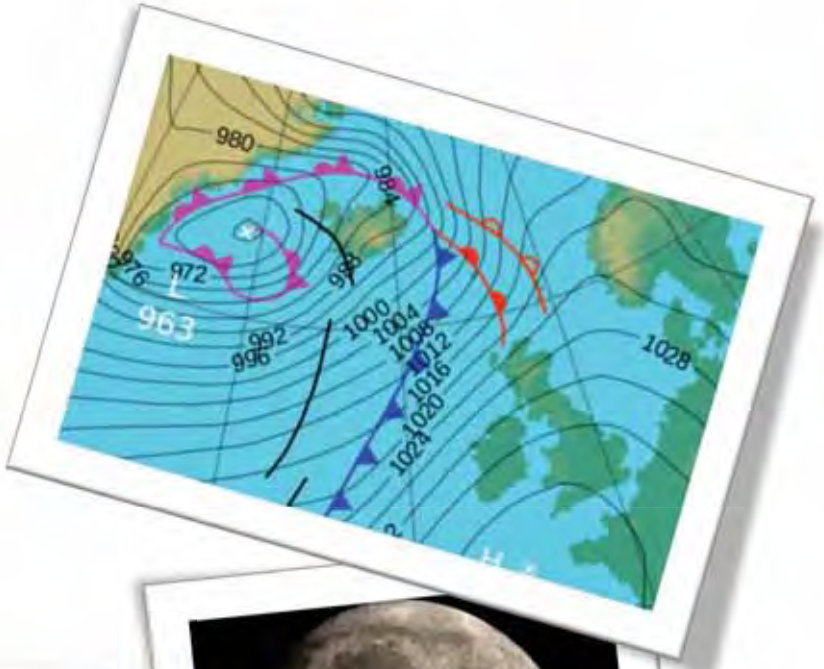
TIDAL FORECASTING

Forecast attributes

- Astronomical tides
- Surge activity
- Fluvial river flow



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National Flood Forecasting System (NFFS)

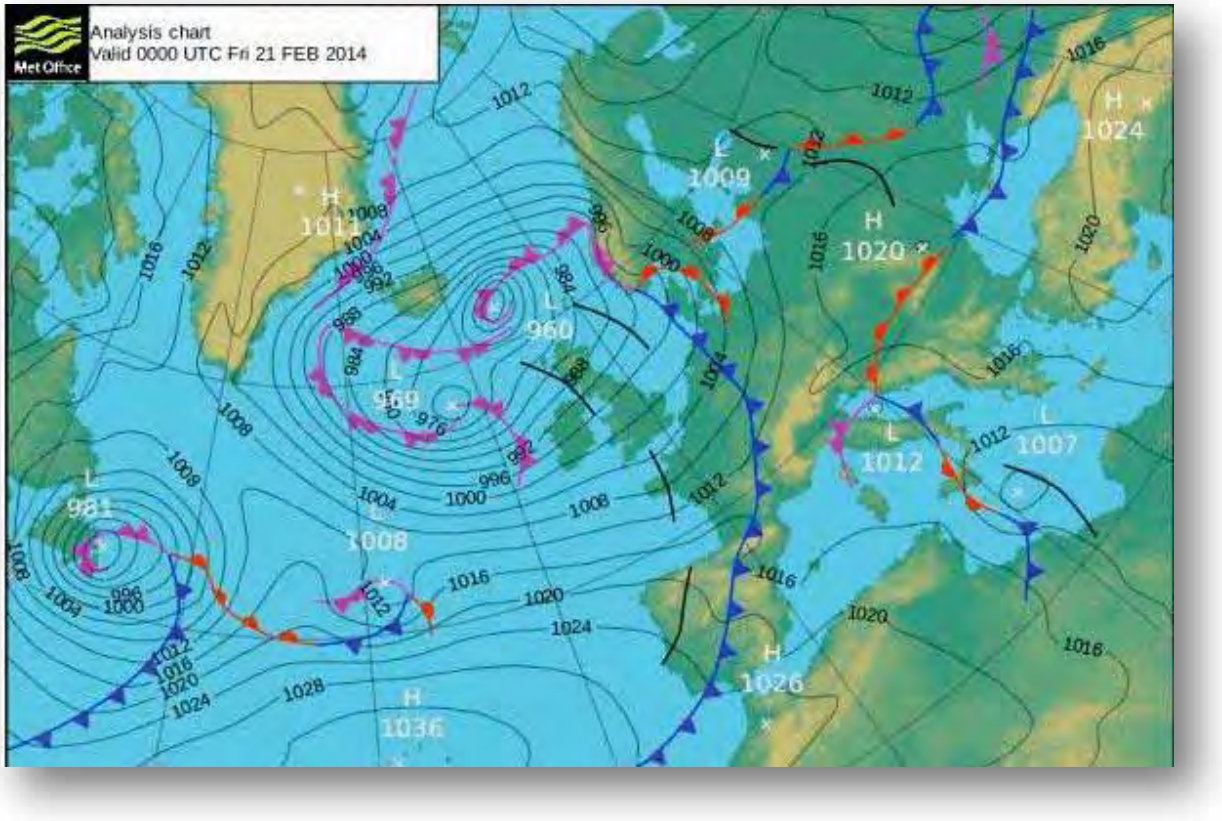
INPUT:

- Forecast astronomical tides (NOC)
- Coastal data (MET Office)
- Telemetry network (fluvial and tidal)

OUTPUT:

- Surge ensemble forecasts (24 members)
- Total water level forecasts

6-10 days: Tidal outlook



- Indication of pressure systems conducive to result in an East Coast Surge
- Broader models and meteorological forecasts available

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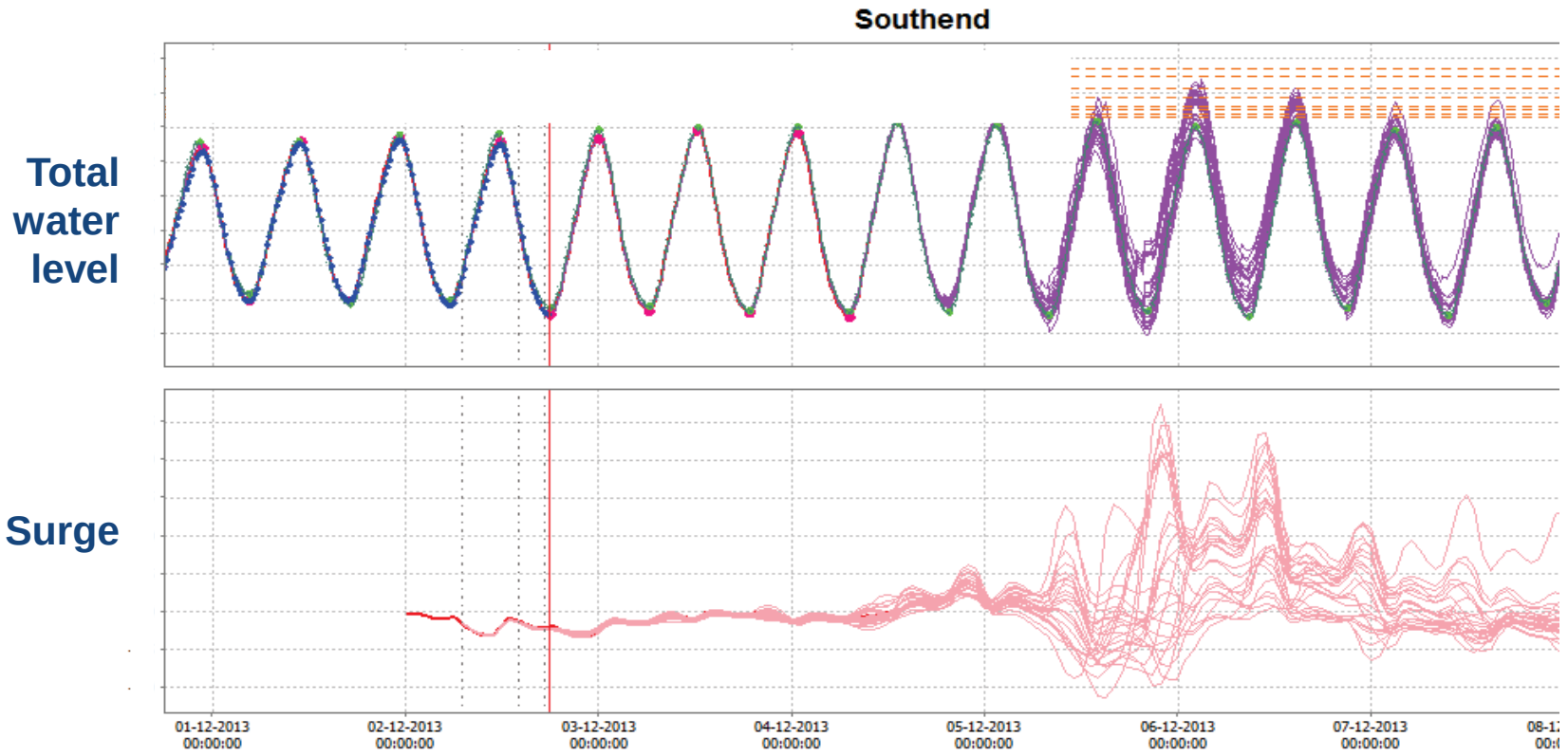
3-5 days: Probabilistic forecasts



- Represent uncertainty
- Longer lead times
- Can provide best, worst case and most likely scenarios

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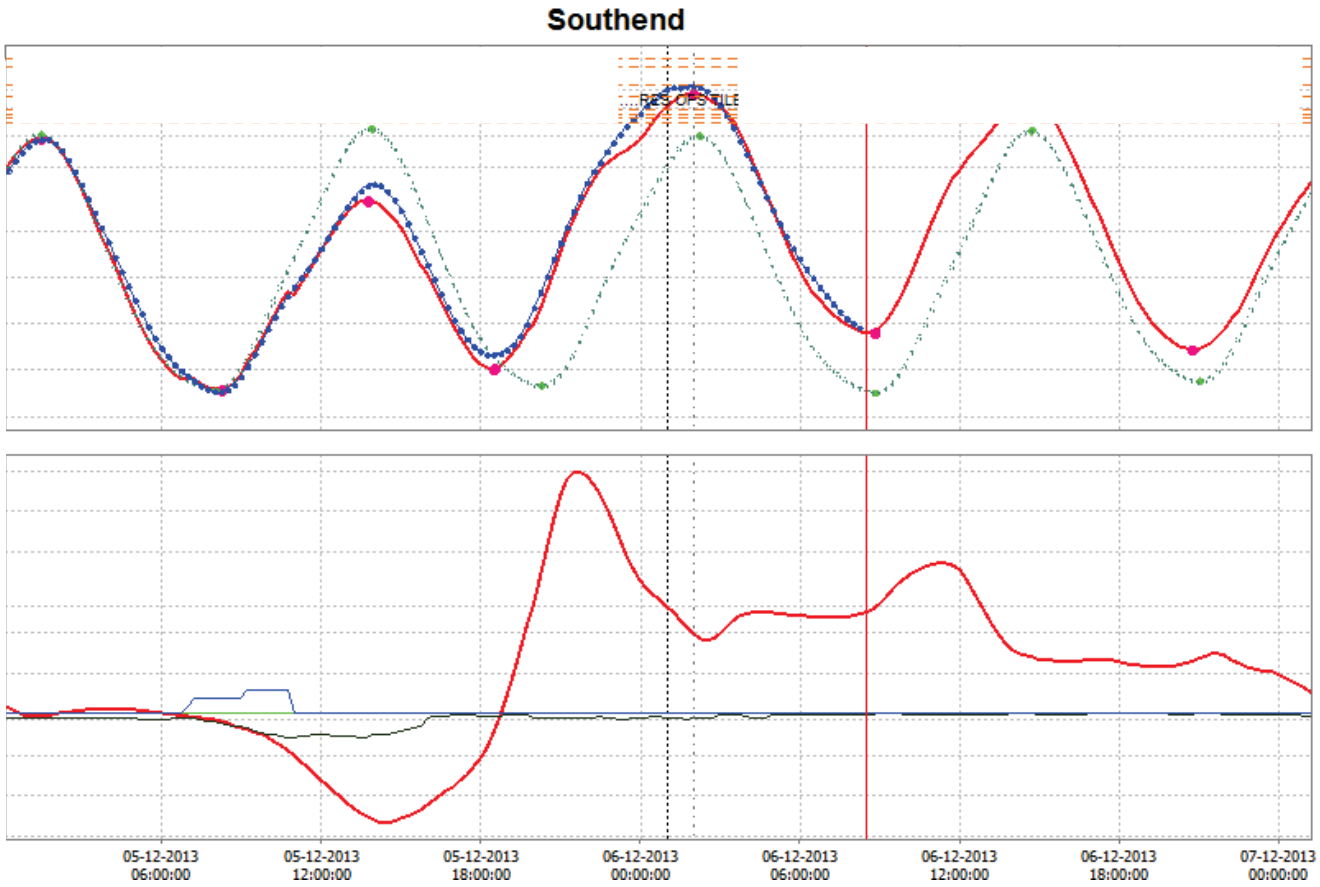
1-2 days: Deterministic forecasts



- Enhanced certainty
- Shorter lead times

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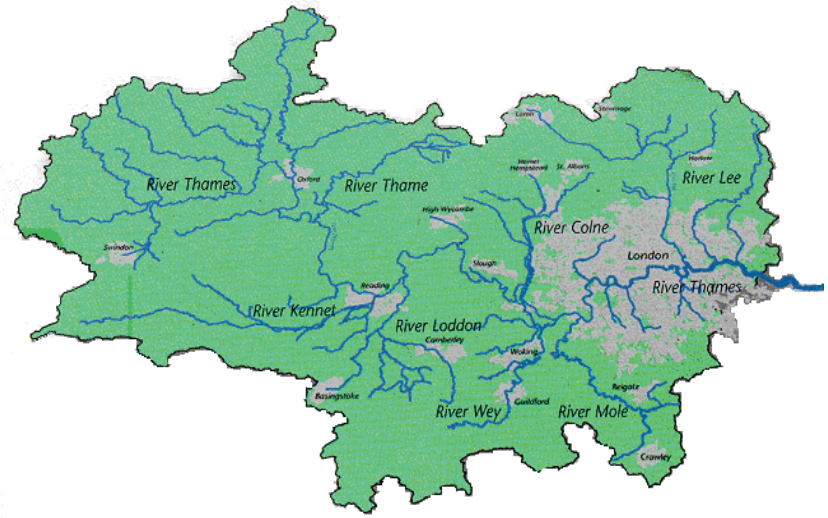
December 2013 East Coast Surge – A real life scenario

- Two Thames Barrier and associated gate closures
- 4.10m tide at Southend
  (we protect to over a metre more)
- Surge peak did not coincide with high tide
- A peak surge 2 hours later – coinciding with peak of astro tide – would have seen a potentially different outcome

And then it started to rain...

- Rain started falling on 13th December across the Thames catchment
- 446mm rainfall recorded over the next 2.5 months (Largest total since records began in 1883)
- Flow over Teddington Weir was enough to fill 980,000 Olympic swimming pools or 892 O_2 arenas



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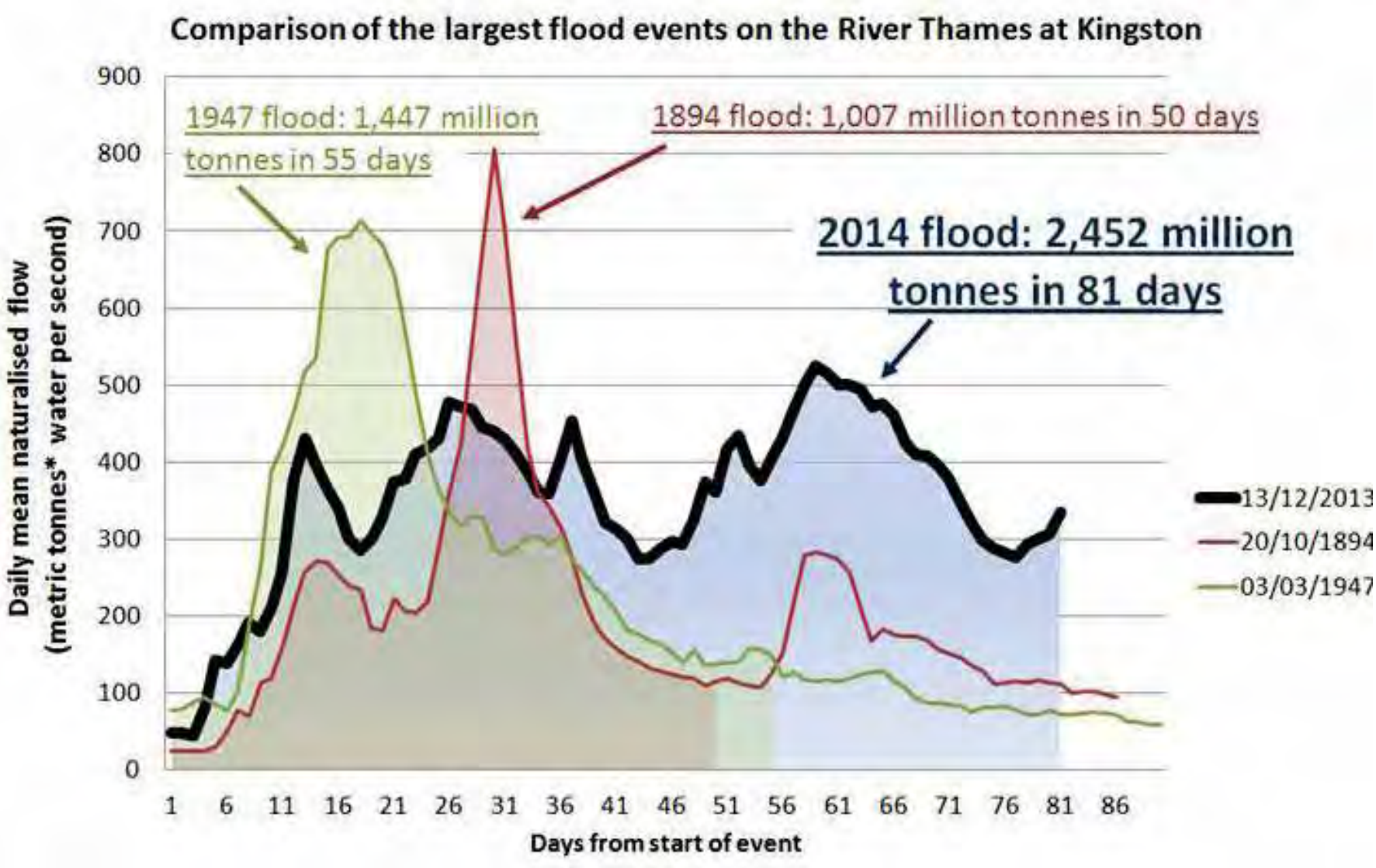
Comparison of the largest flood events on the River Thames at Kingston
Daily mean naturalised flow (metric tonnes* water per second)
900
800
700
600
500
400
300
200
100
0
1947 flood: 1,447 million tonnes in 55 days
1894 flood: 1,007 million tonnes in 50 days
2014 flood: 2,452 million tonnes in 81 days
13/12/2013
20/10/1894
03/03/1947
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86
Days from start of event

Flows over Teddington Weir

Abnormally low Winter flow of 4 cumecs

Expected Winter flow of 40 cumecs

Record Winter flows in February 2014 of 500 cumecs

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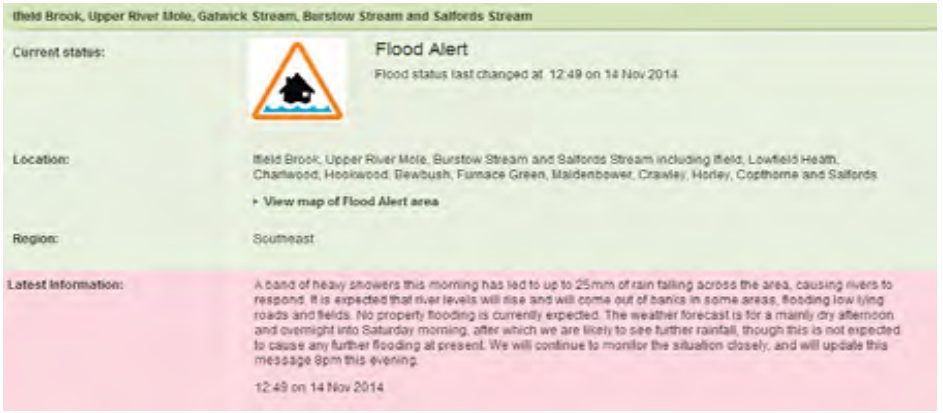
FLOOD WARNING SERVICE

Flood Alerts and Warnings

- Targeted warnings by phone, text, fax, e-mail and pager
- Free service
- Online registration
- Issued by our 24/7/365 duty officers

Floodline
0845 988 1188
FOR ADVANCE FLOOD WARNINGS



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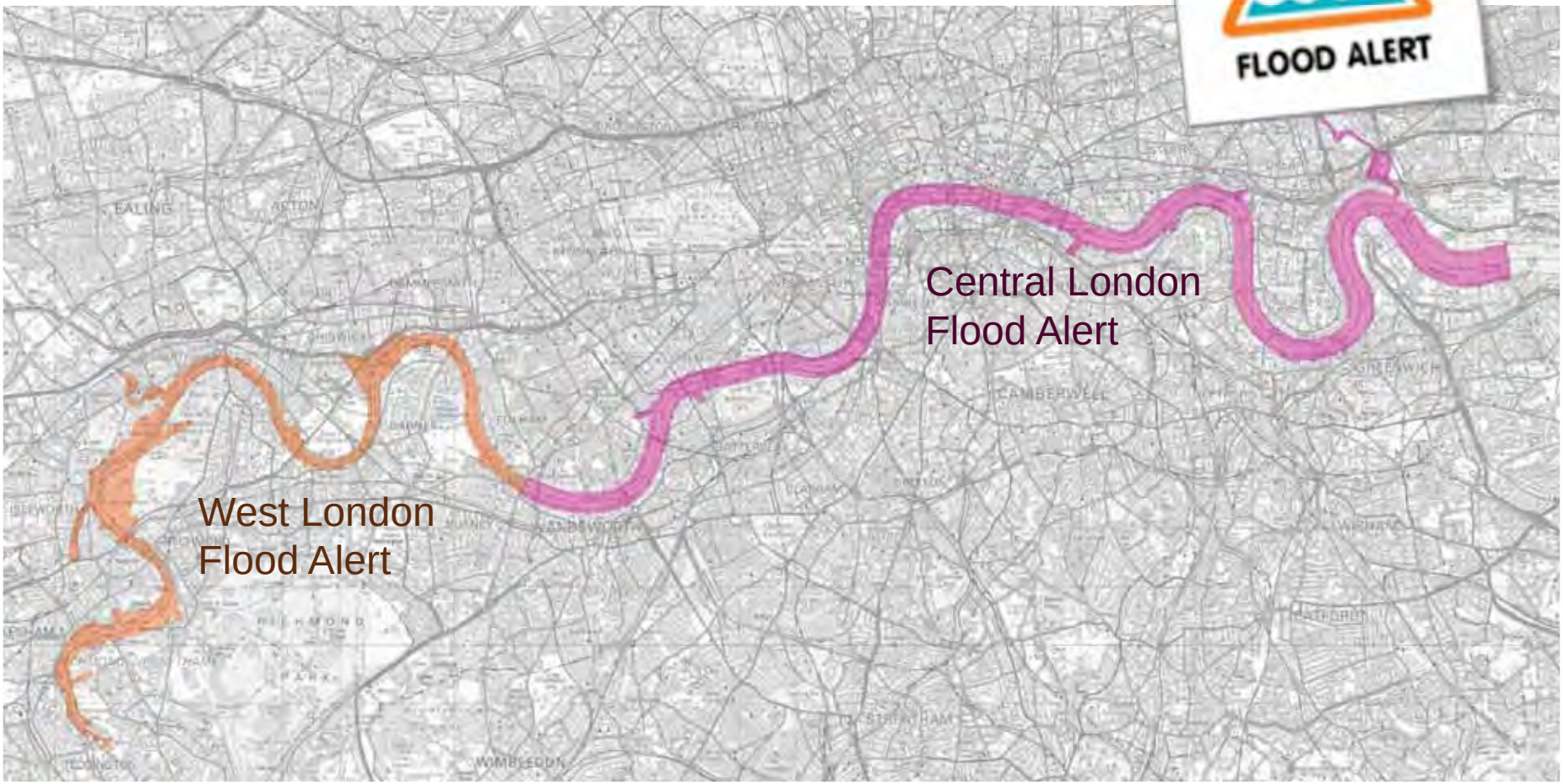
CURRENT CHALLENGES – UNDEFENDED AREAS

Flood Alert areas



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West London

Chiswick Mall

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West London

Strand on the Green

Richmond riverside

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Central and East London

An unusually high tide today saw the River Thames burst its banks in several spots across London.

In Greenwich, raised water levels swamped waterfront walkways that are normally metres above the river, and in central London waves licked Bankside outside the Tate Modern.

Normally dry parkland in Richmond was also submerged under water.

It comes after flooding in south west London caused by yesterday's high tide left cars underneath several feet of water.

Swamped: The Thames swells outside the Royal Naval College in Greenwich (Picture:

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LOOKING AHEAD

The Future?

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TE2100 Plan & TEAM2100

This programme is already looking at:

- Improvements to existing flood defences
- Ensuring effective floodplain management
- Possible new barrier to be operational by 2070


THANK YOU