7th IWA REGIONAL CONFERENCE

Yokohama, February, 2012

Critical Watermains Strategy

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Sydney WATER

Presentation Outline

- About Sydney Water
- Tariff Model
- Critical Water Main Strategy
- Future Investment

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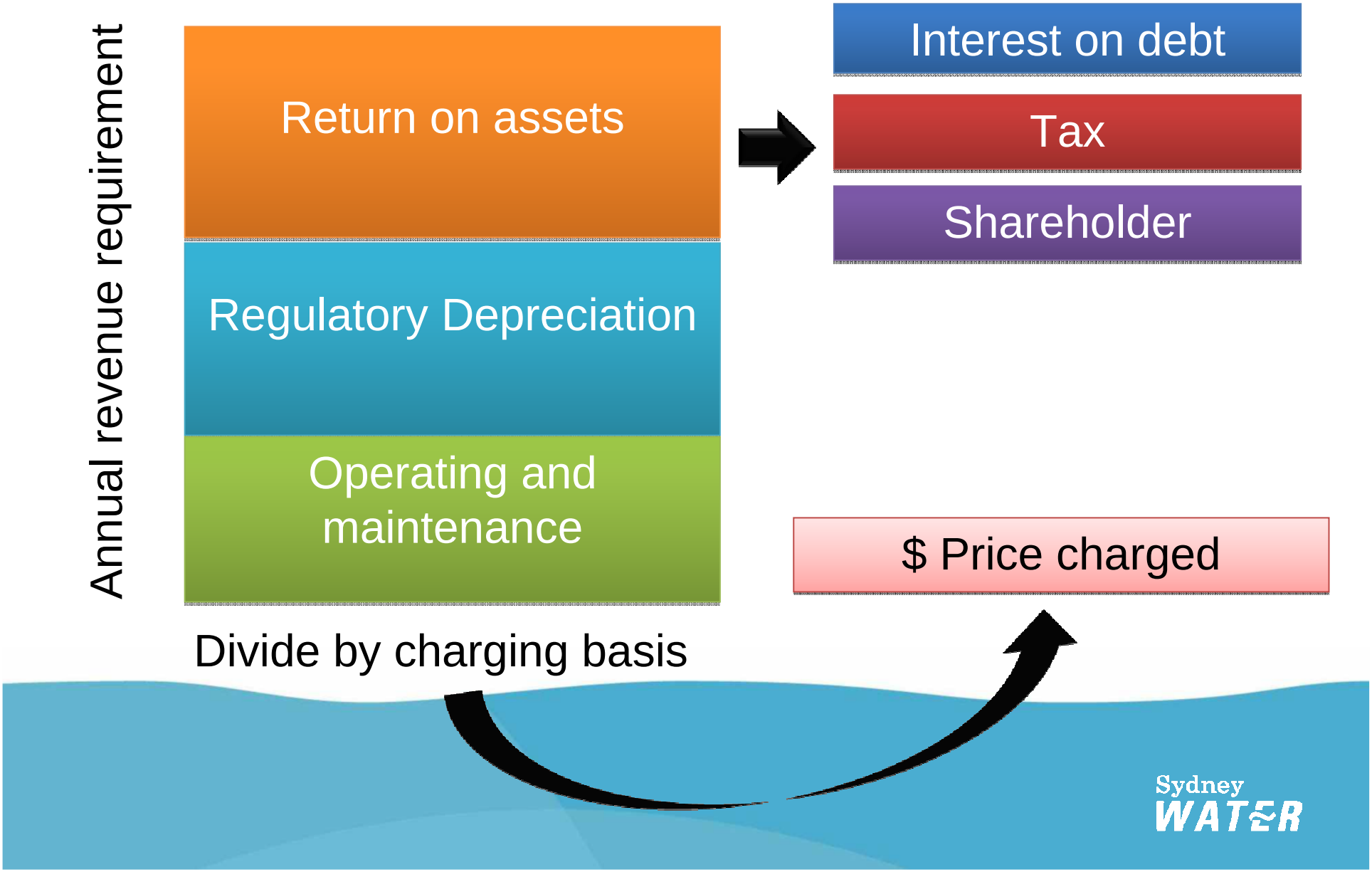
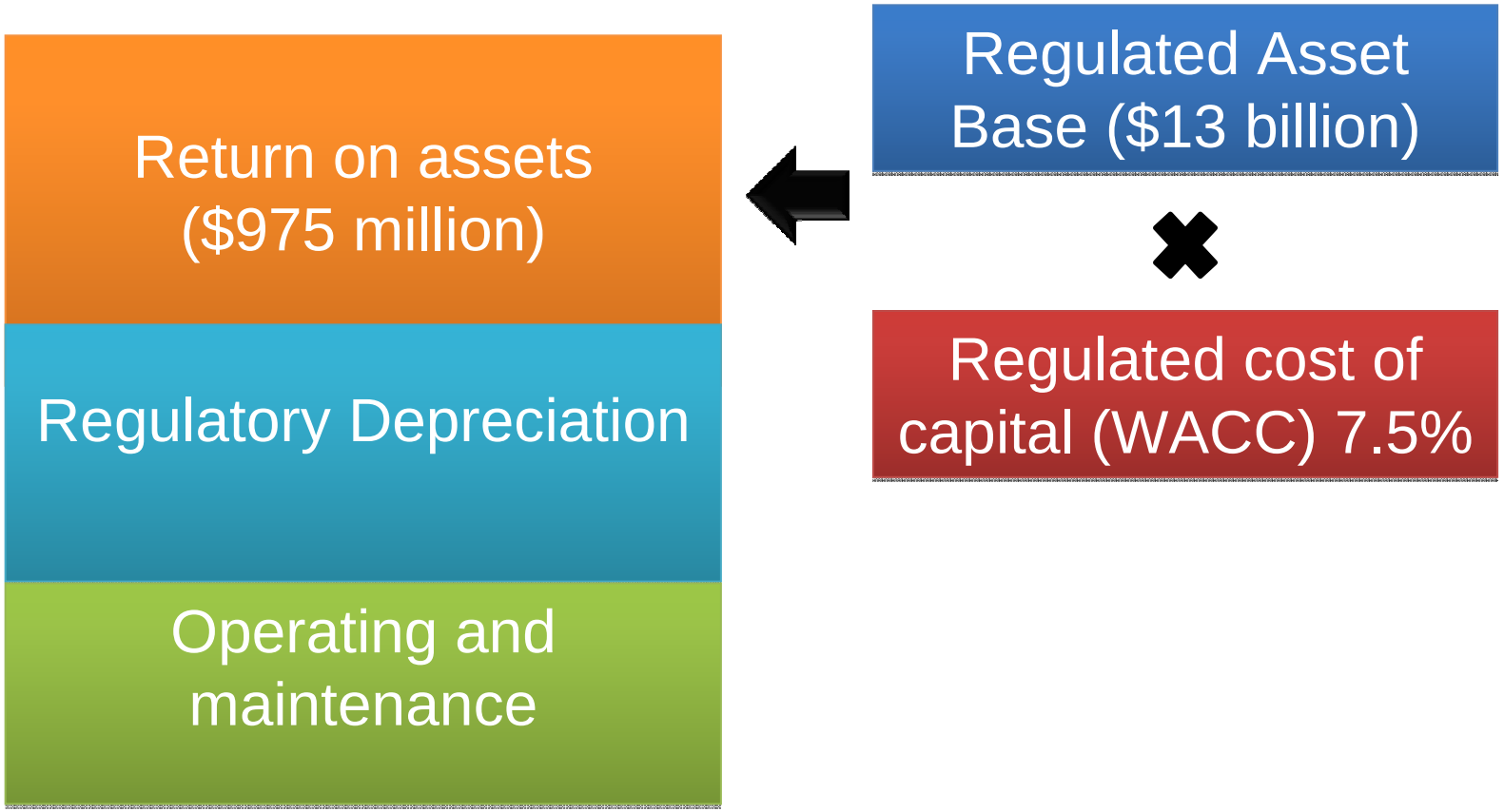
- Service Area 13,000km^2
- 4.2 million customers
- $2.7B annual revenue
- Assets - $40B (Replacement)
  $13B (Regulatory)
- 2700 staff
- 21,000km water mains
  1.4M m^3/day
- 4,800km critical mains
- 23,000km sewers

Tariff model (Building Block)



The Regulatory Asset Base



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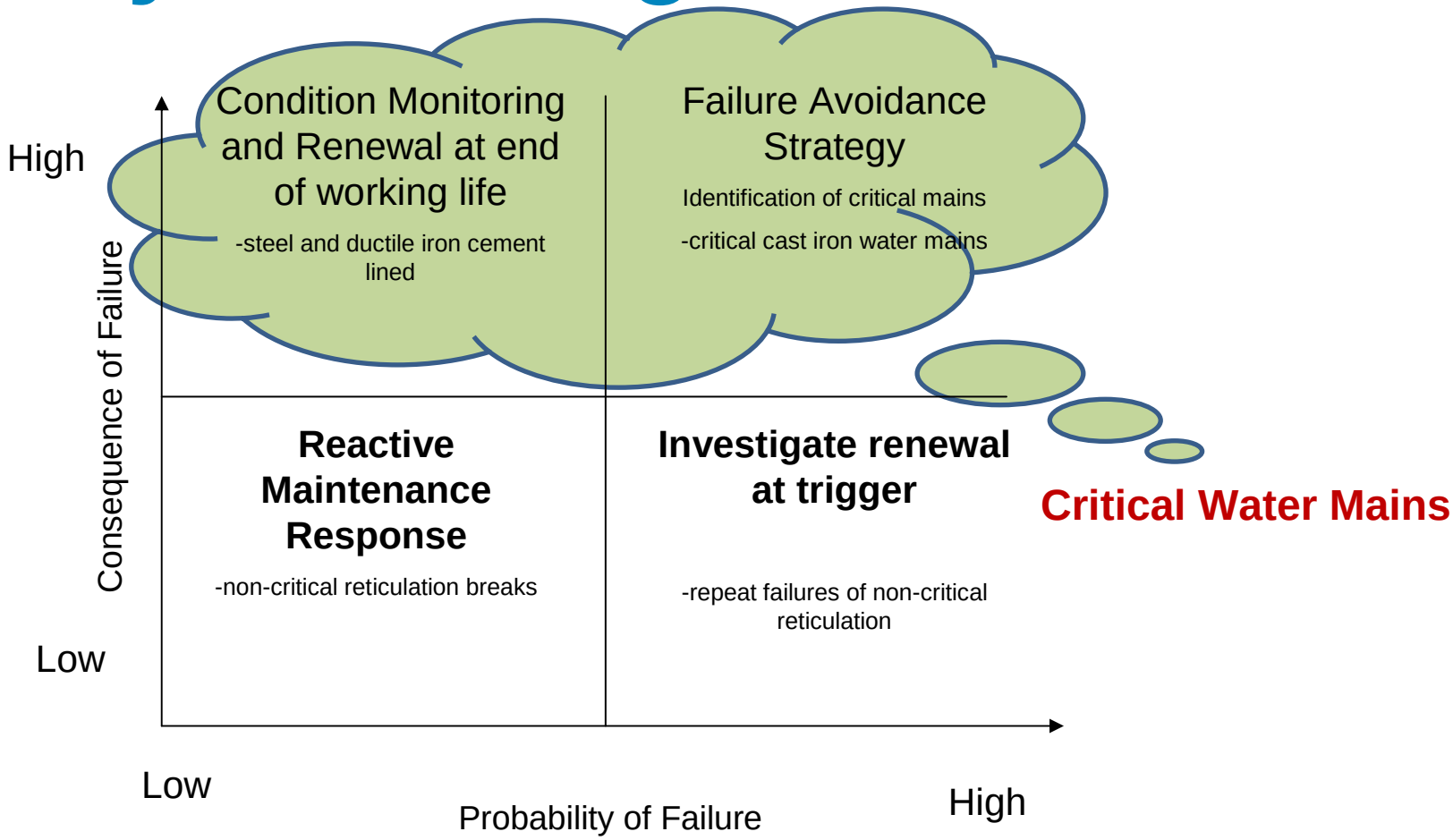
Tariff impacts of capital expenditure

- Assets only impact the tariff via the RAB
- Prudent capital expenditure is added to the RAB
- Depreciation is deducted from the RAB
- Ensure capital is recovered over its economic life
- Every $100M of new water investment = $4.85 on water tariff per year

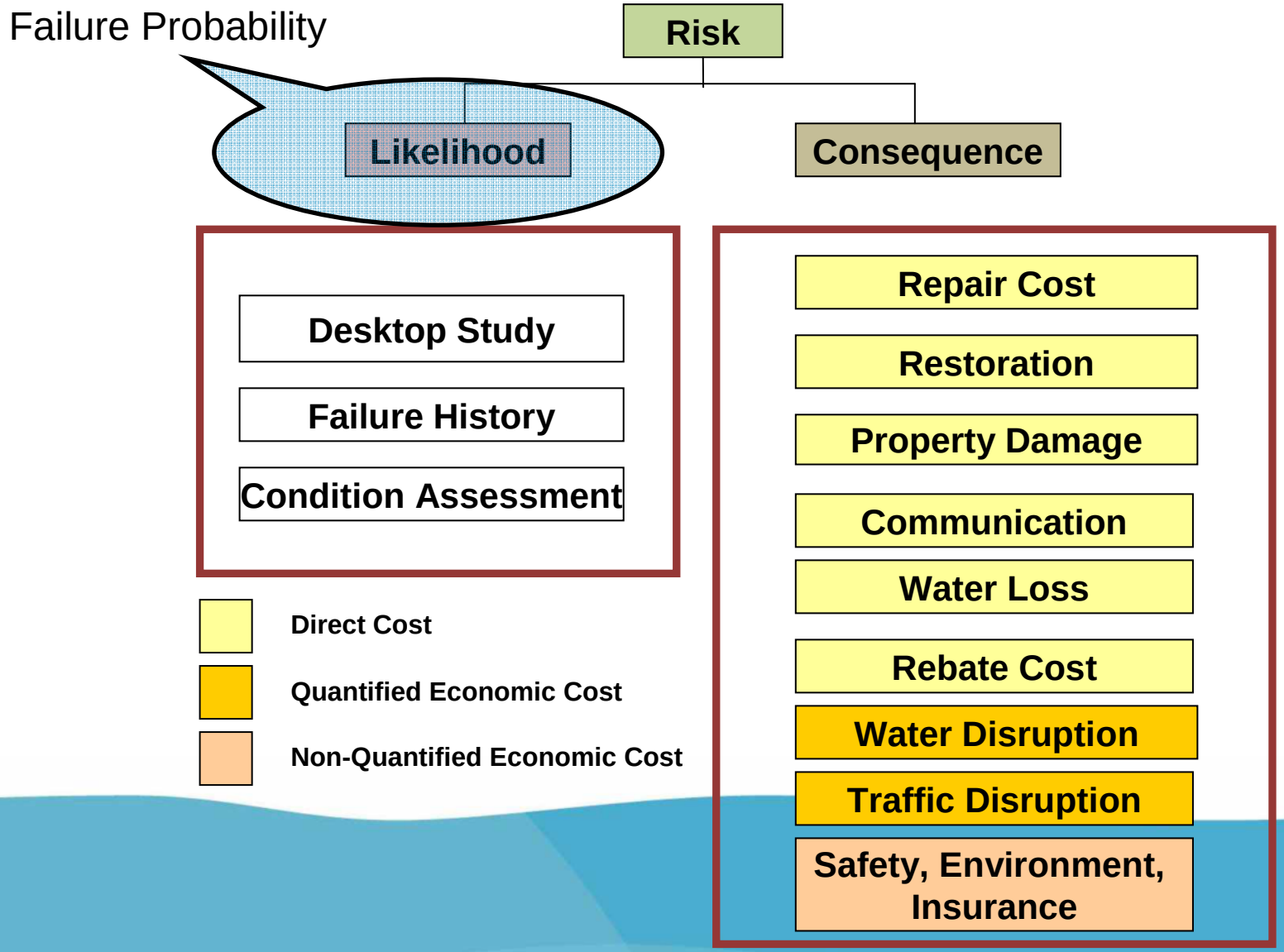
Test of Capital Prudence

- Determined by IPART via efficiency audit
- IPART engage Ofwat auditors from UK
- Based on:
  - asset plan for each asset class
  - condition and service risk assessments
  - renewal decision framework
  - economic business case for renewal expenditure

Life Cycle Management



Economic Model



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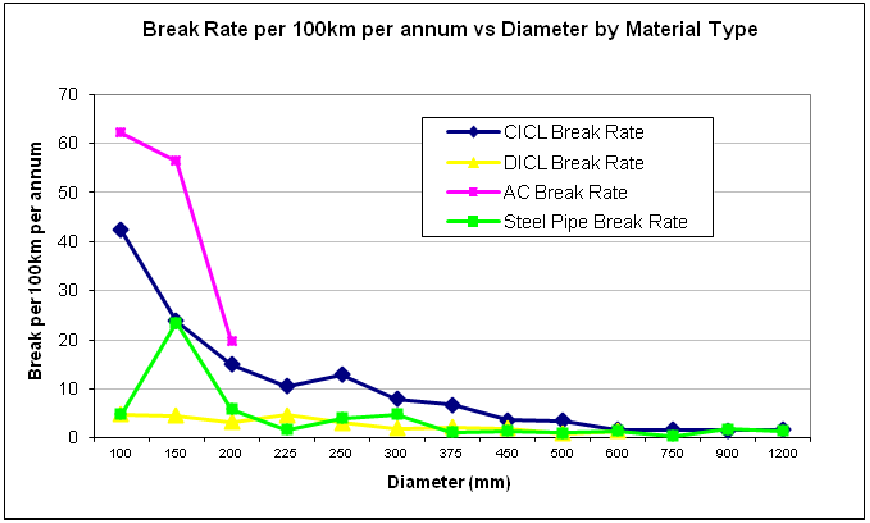
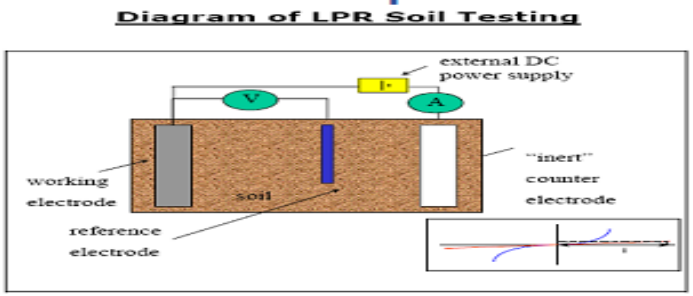
Understand Likelihood of Failure



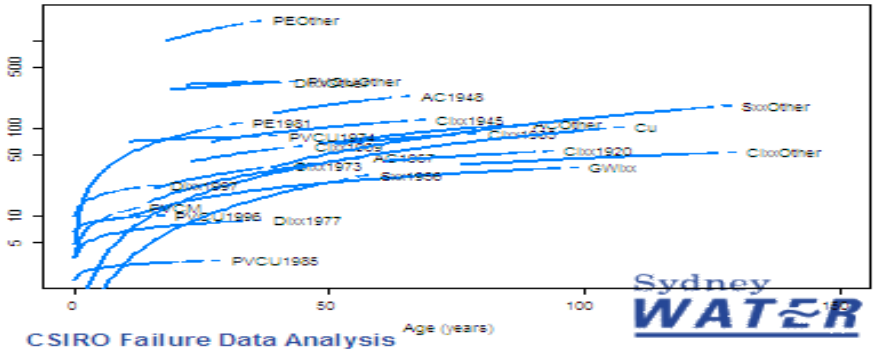
Condition Assessment Techniques

Intelligent Pigging



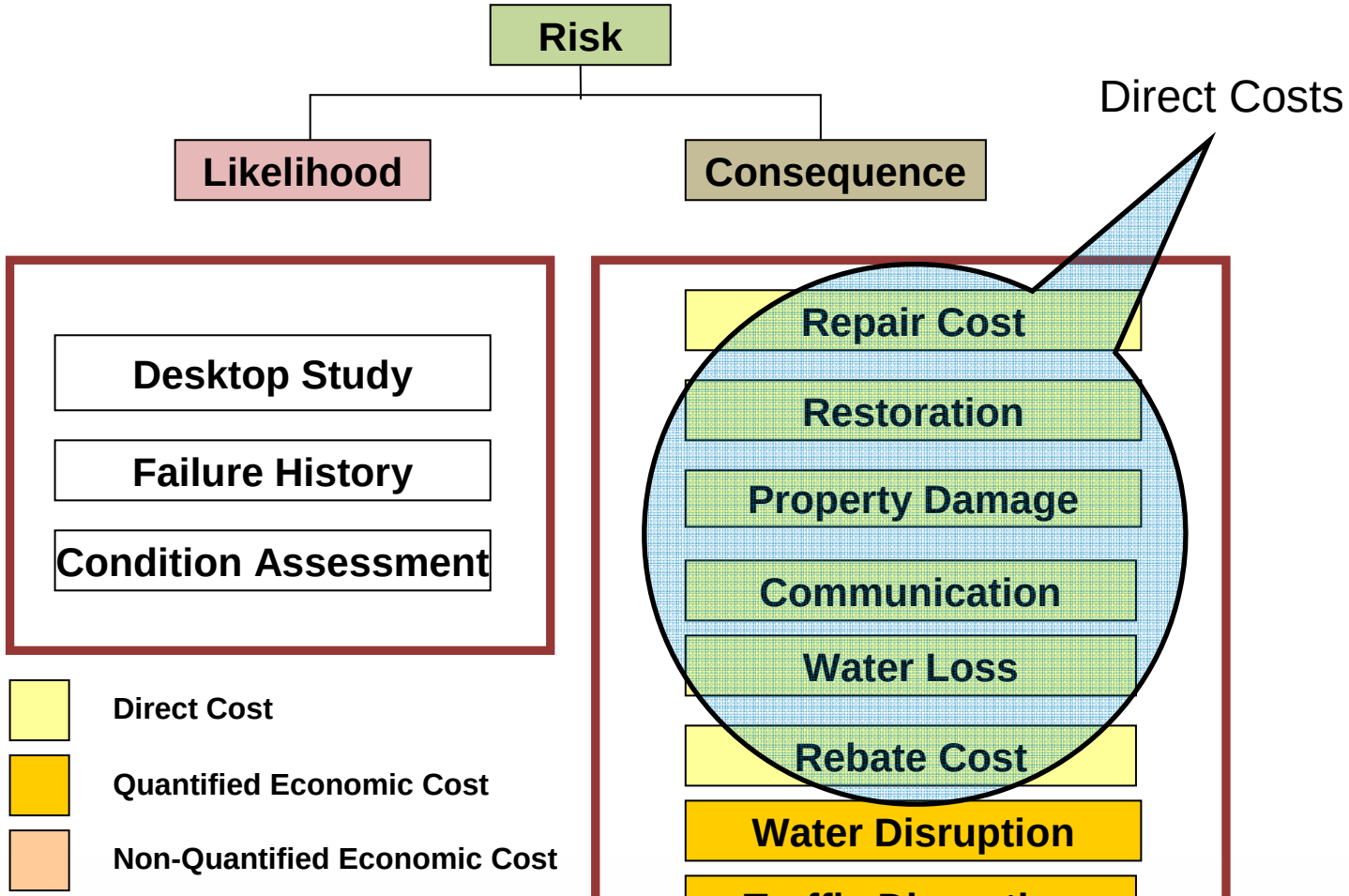
Linear Polarisation Resistance

Eddy Current



CSIRO Failure Data Analysis

Economic Model



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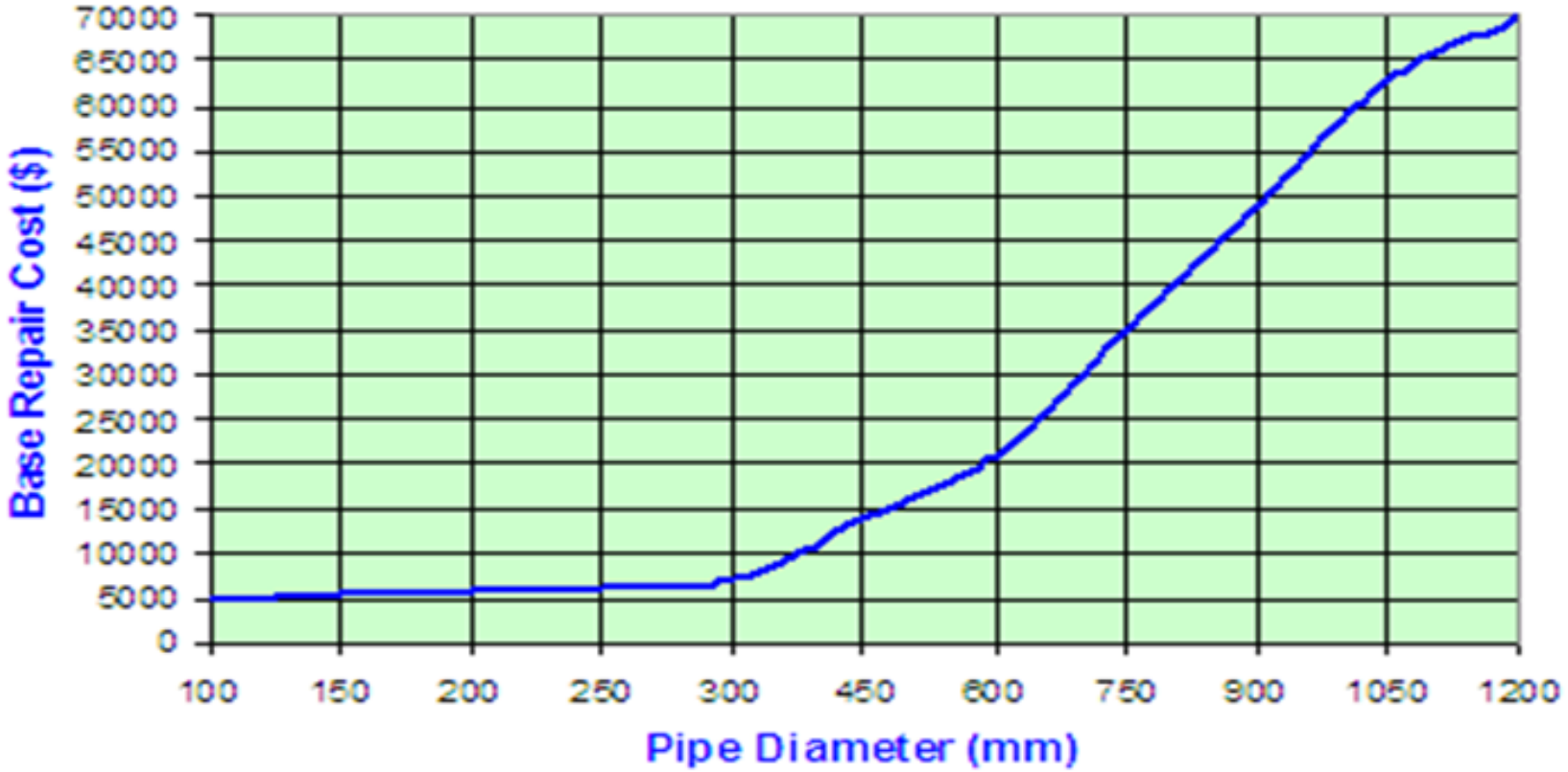
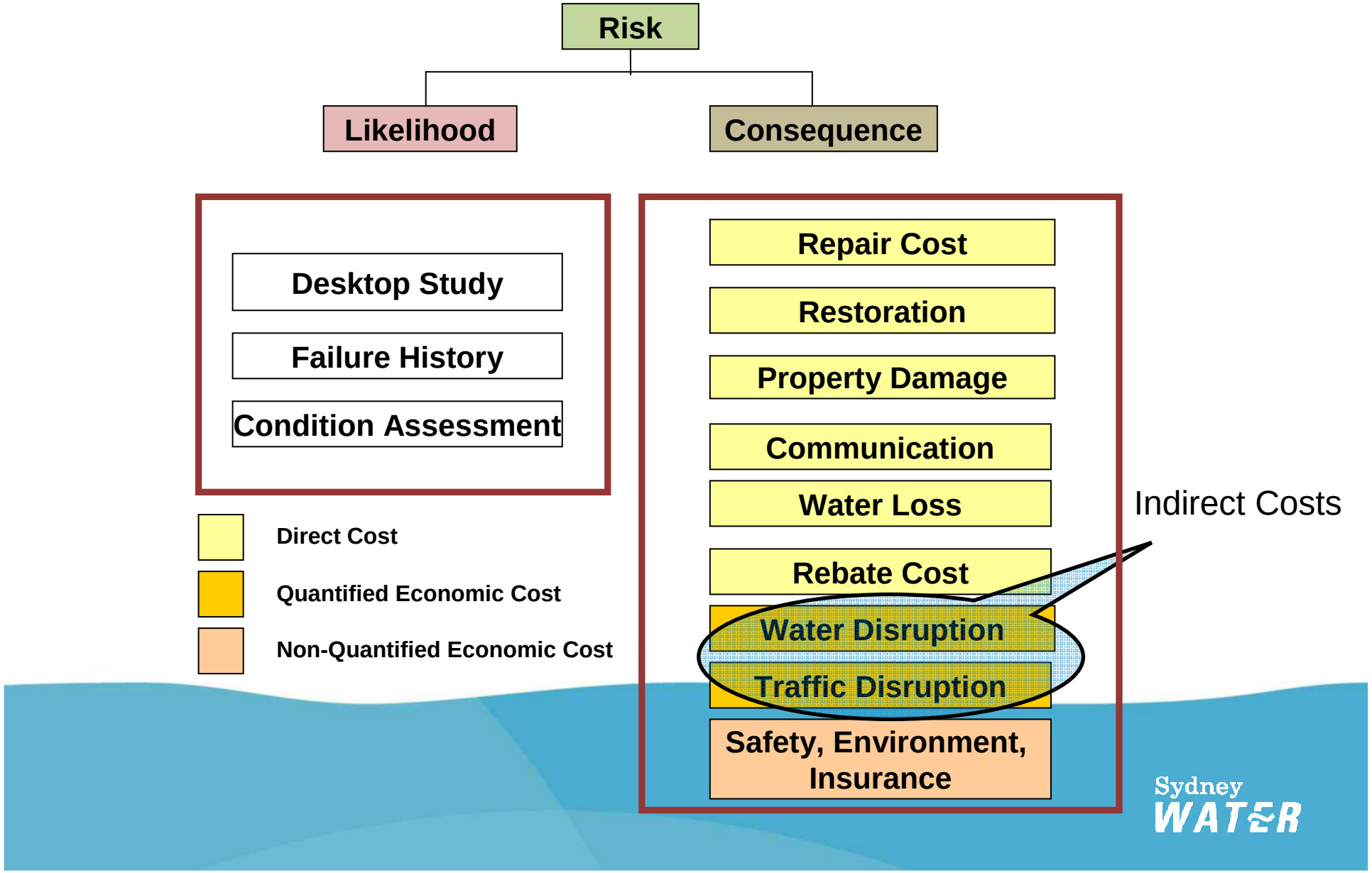
Water Main Repair Cost



Economic Model



Water Disruption Costs

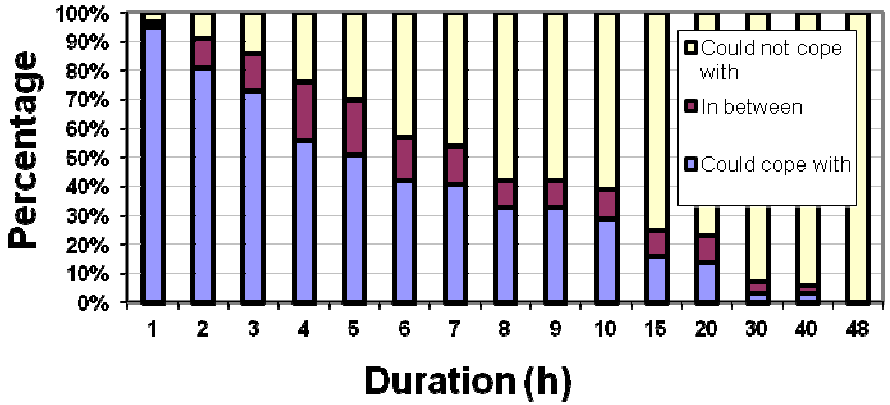
Cost to Customer

		Value	Source of Data
Purchase bottled water	12 litre	$6	Market survey
Travel to shops	30 minutes @ $18/hour	$9	RTA Economic Analysis Manual
Time of Customer	20 minutes @ $30/hr	$10	GSP data from ABS
Total Cost		$25	

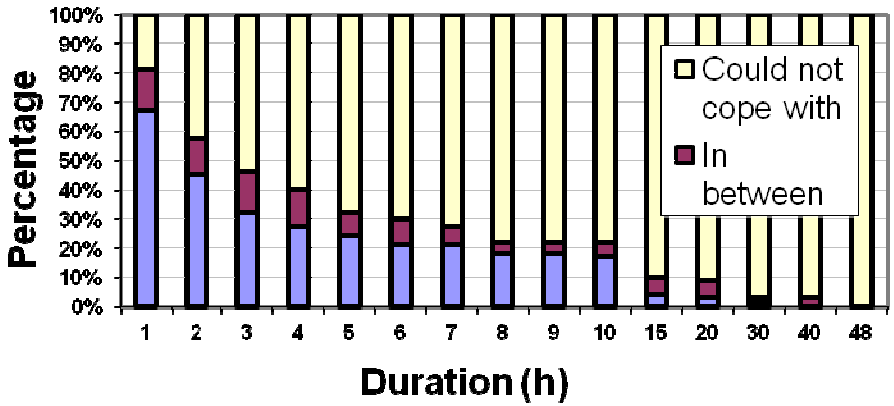
Note: It is assumed that 12 litres can last each customer 4 hrs; If the water disruption is longer than 4 hrs, the customers will repeat the same action;

Customer Impact

Residential Customer Acceptance for Unplanned interruption



Business Customer Acceptance for Unplanned interruption



Duration (hours)	1	2	3	4	5	6	7	8	9	10	15	20	30	40	48
Could not cope with (%)	1	2	8	19	29	34	43	50	57	64	66	68	72	75	82
Incremental (%)	1	1	6	11	10	5	9	7	7	7	2	2	4	3	7
Purchasing Cost ($)	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Cost incurred per hour ($)	25	25	150	275	275	150	375	450	450	325	425	500	475	400	600
Accumulated cost ($)	25	50	200	475	750	900	1275	1725	2175	2500	2925	3425	3900	4300	4900
Social Cost ($/Cust/hr)	0.3	0.5	2	5	8	9	13	17	22	25	29	34	39	43	49

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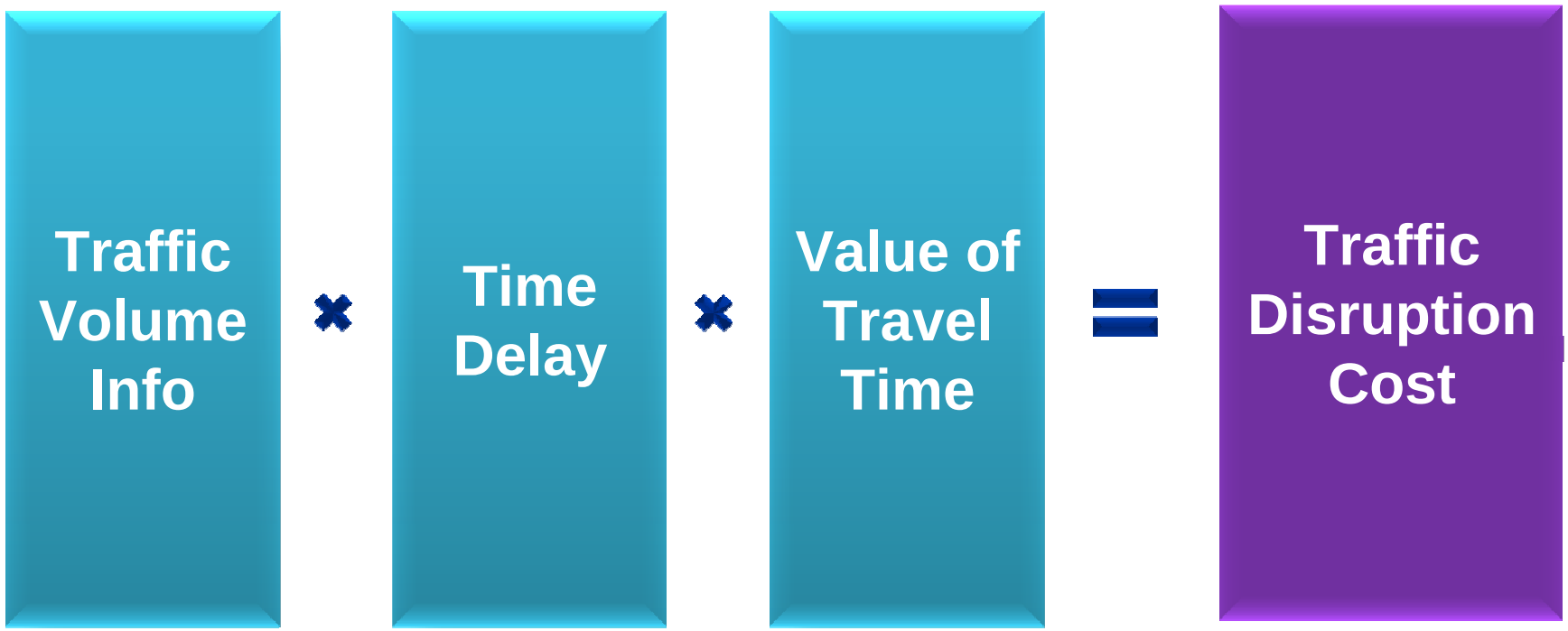
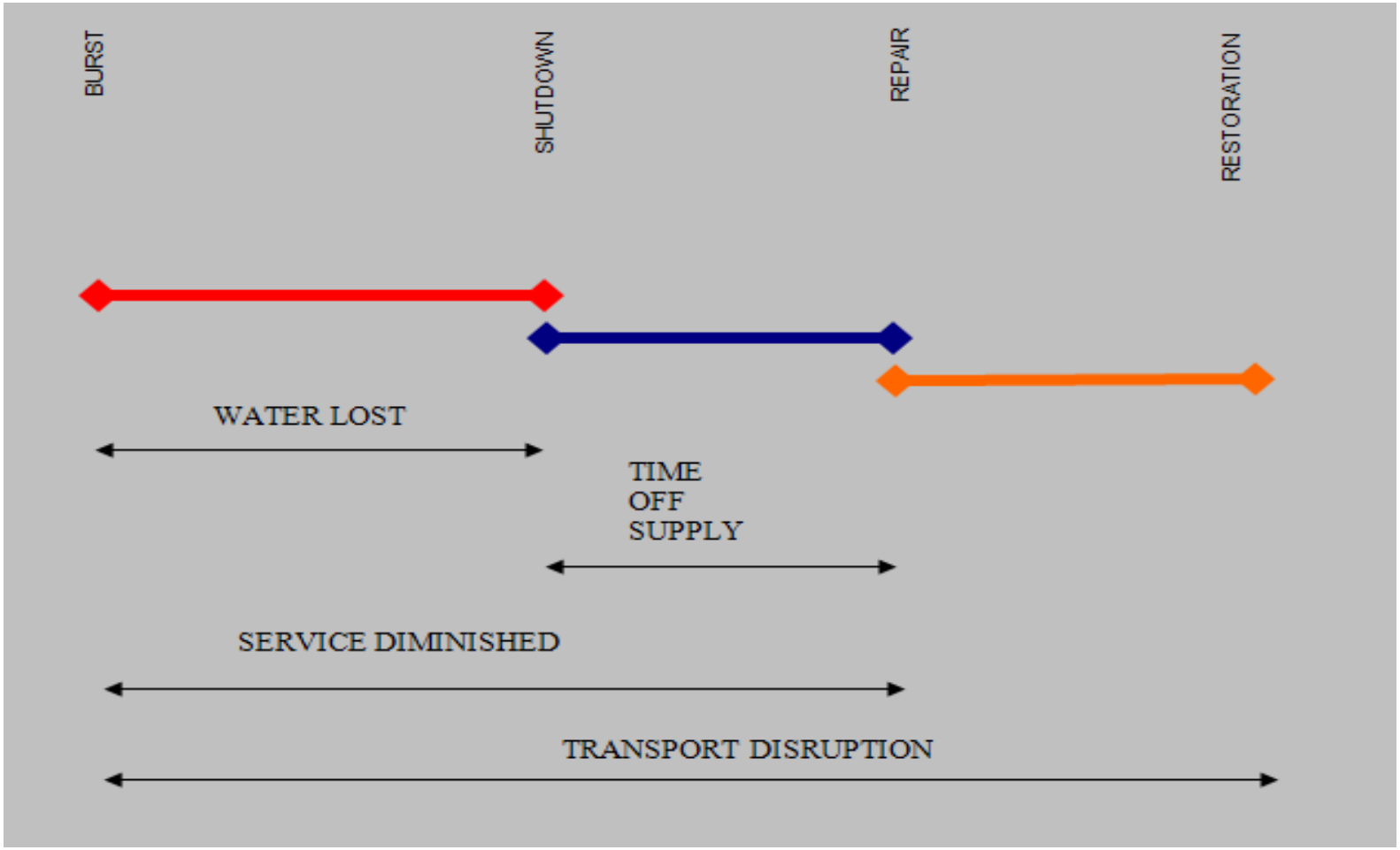
Traffic Disruption Costs

Based on RTA Economic Analysis Manual



Event Time



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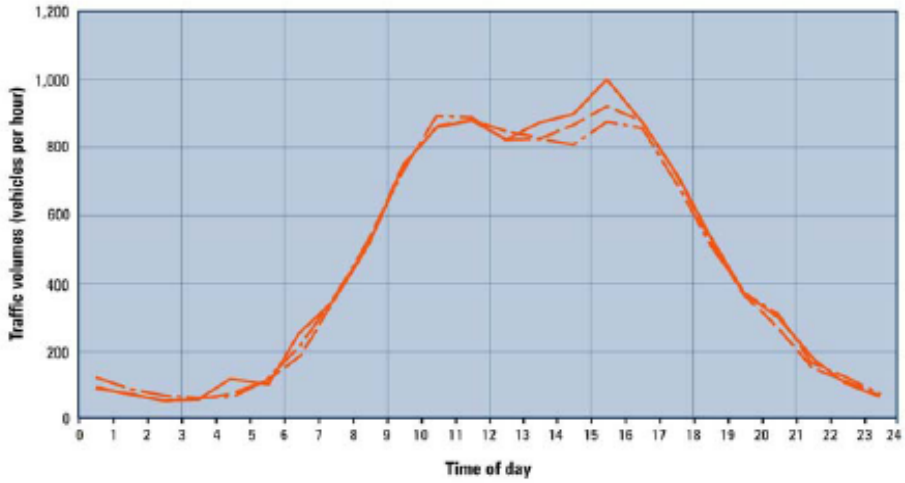
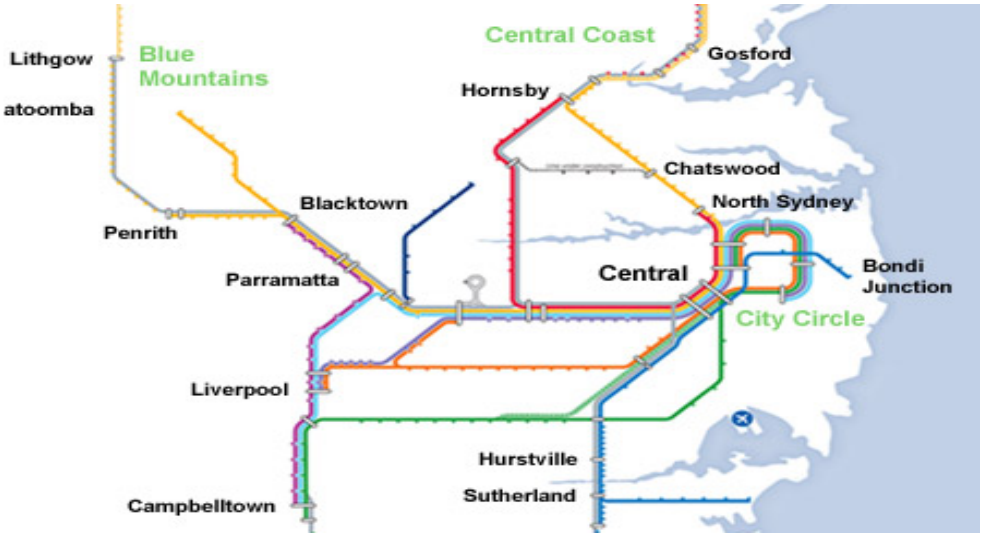
Estimating Time Lost by Passengers

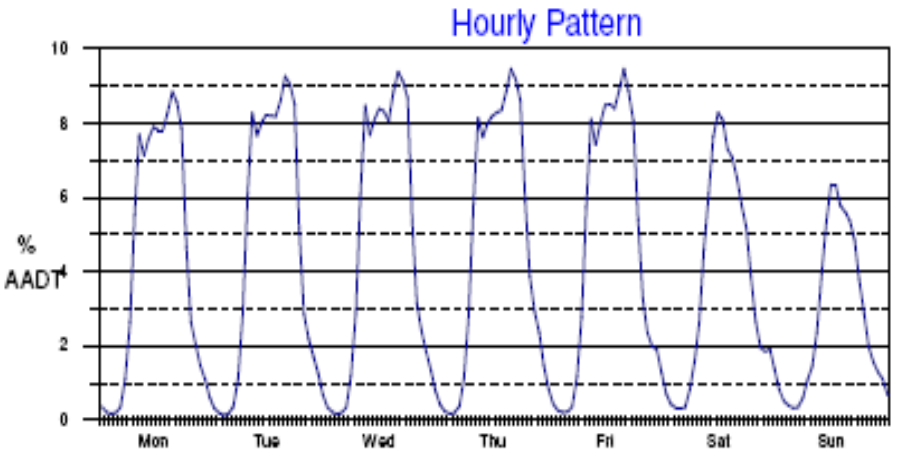
Road Network



Hourly Traffic Volume



Rail Network



Weekly Traffic Volume

Traffic Disruption Costs

(RTA Economic Analysis Manual)

Type	% on road	People/Veh.	Base Cost ($/hour/p)	Total Cost/veh/hr
Private	78.25%	1.64	$10.15	$17
Business	9.25%	1.35	$24.04	$32
Light Commercial	8.75%	1.30	$17.06	$22
Heavy Commercial	3.75%	1.00	$22.66	$23
Average				$19

Traffic Disruption Cost = $16,000 - $110,000 per hour

Estimated Road Traffic Volumes and Social Costs

Category	Vehicles Per Day	Vehicles Per Hour (Peaked: Day/12)	Cost per Hour
Minor Roads (2 Lanes)	10000	833	$15,682
Major Roads (4 Lanes)	25000	2083	$39,204
Highways / Freeways (6 Lanes)	70000	5833	$109,771

Rail Disruption Cost = $97,000 per hour

Railway Line Disruption Costs (Assumed that there is 4 Lines)

Average Trains Per Hour	People/Veh.	Cost ($/hour/p)	Total Cost/hr
16	600	$10.15	$97,440

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Bringing it together

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Risk Profile by Length of Critical Main

Consequence		Cost $M	4	3	2	1	Total
	5	above 5.00	0	0	14	3	**17**
	4	2.00 - 5.00	0	16	34	131	**181**
	3	0.75 - 2.00	21	25	105	678	**830**
	2	0.35 - 0.75	7	27	116	820	**970**
	1	0 - 0.35	71	200	528	1,958	**2,757**
			Probability of failure				**4,754**

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Future Investment in Critical Mains

to 2016

- $173 million in renewal
- $1.5 million per annum condition assessment
- $6 million in contingency and resilience planning
- $16 million (Cash and in-kind) Industry/University research project

to 2042

- $2 billion in renewals

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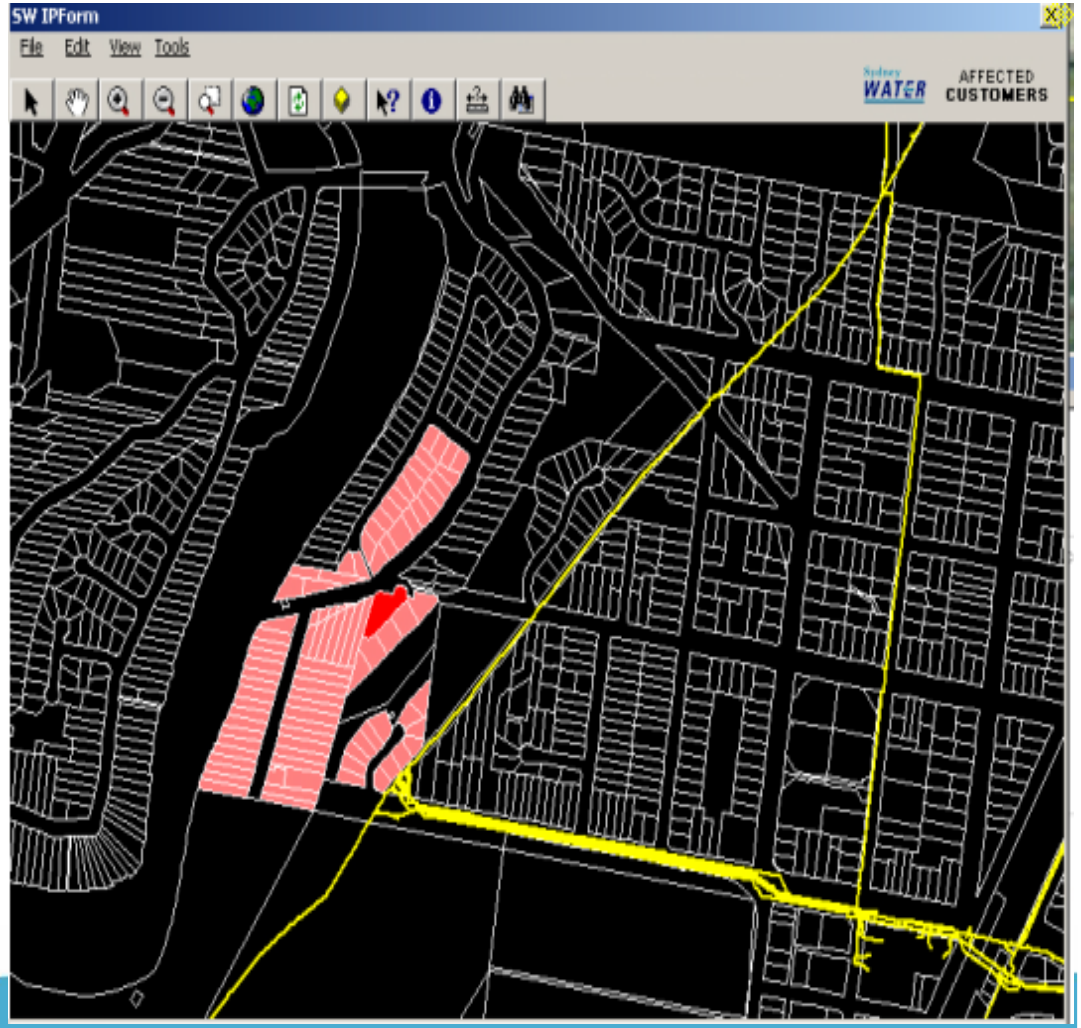
System Resilience

- Simulate network failure
- Assess customer impacts
- Plan alternate supply options relative to cost of failure



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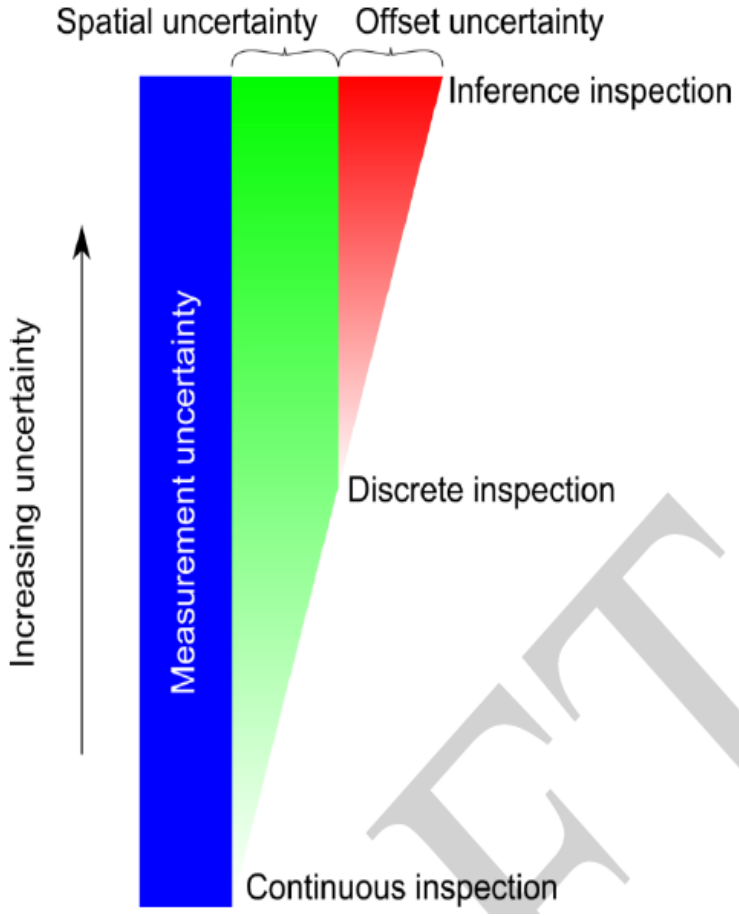
Questions?

Condition Assessment Technique

- Linear Polarisation Resistivity (LPR) coupled with Mainscan (electro magnetic) and ultrasonic
- Resistance across soil sample (Corrosion Potential)
- Results & asset details entered into Analysis Algorithms
- Reported in terms of Probability of failure for various timeframes

Limitations of LPR Technique

- Inference method vs continuous
- Proximity of soil sample to pipe
- Sydney Water asset data accuracy
- Accuracy of prediction algorithm



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Condition Assessment

- 4 year condition assessment program developed from 2008 to 2012 with $1 million per annum of 50km
- 300km of critical water mains have been assessed through LPR coupled with Mainscan and eltromagnetic tools
- The condition assessment program is going to be increased to $1.5 million per annum from 2012 t o2016
- Quantified risk model is used to prioritise the condition assessment program

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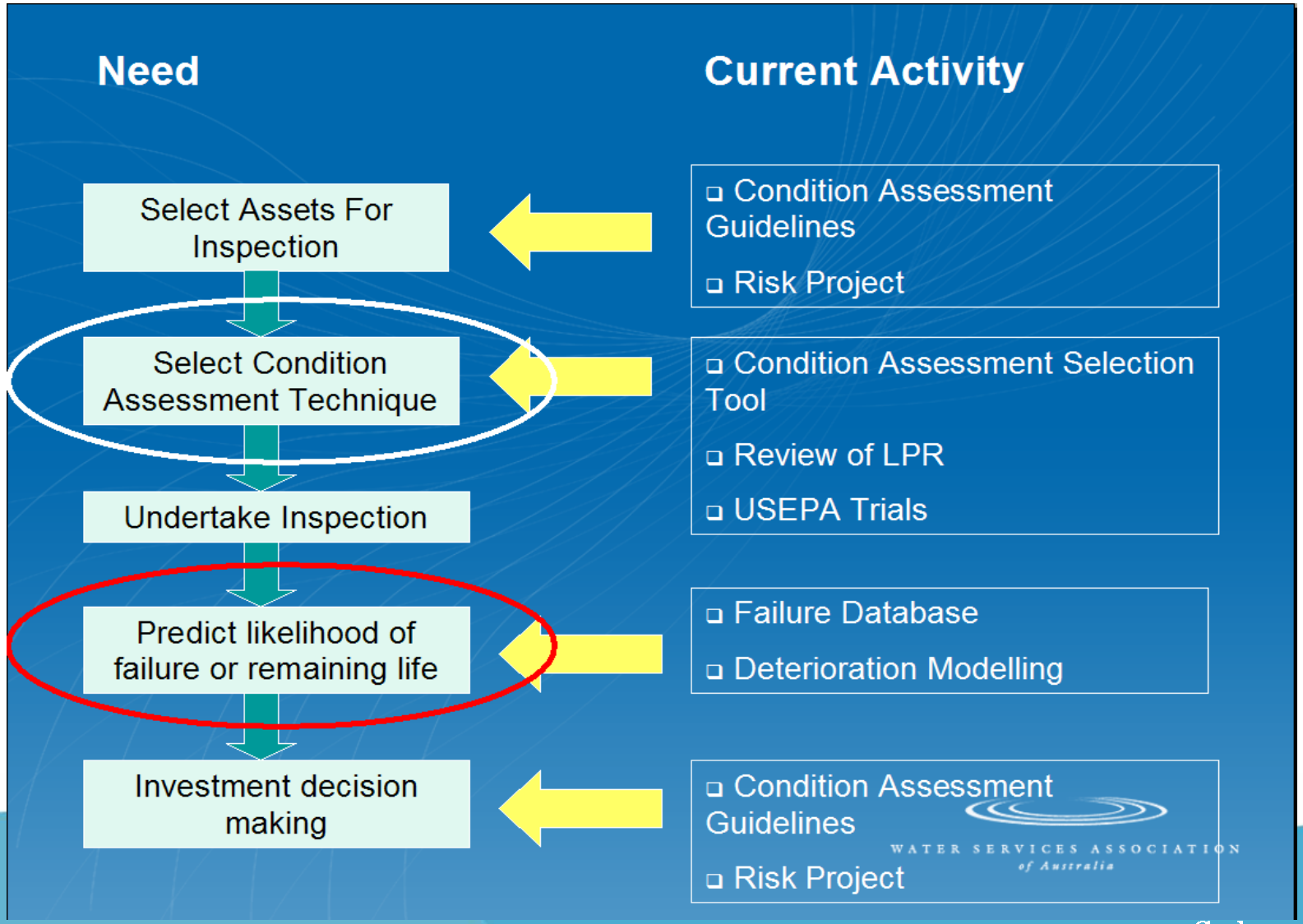
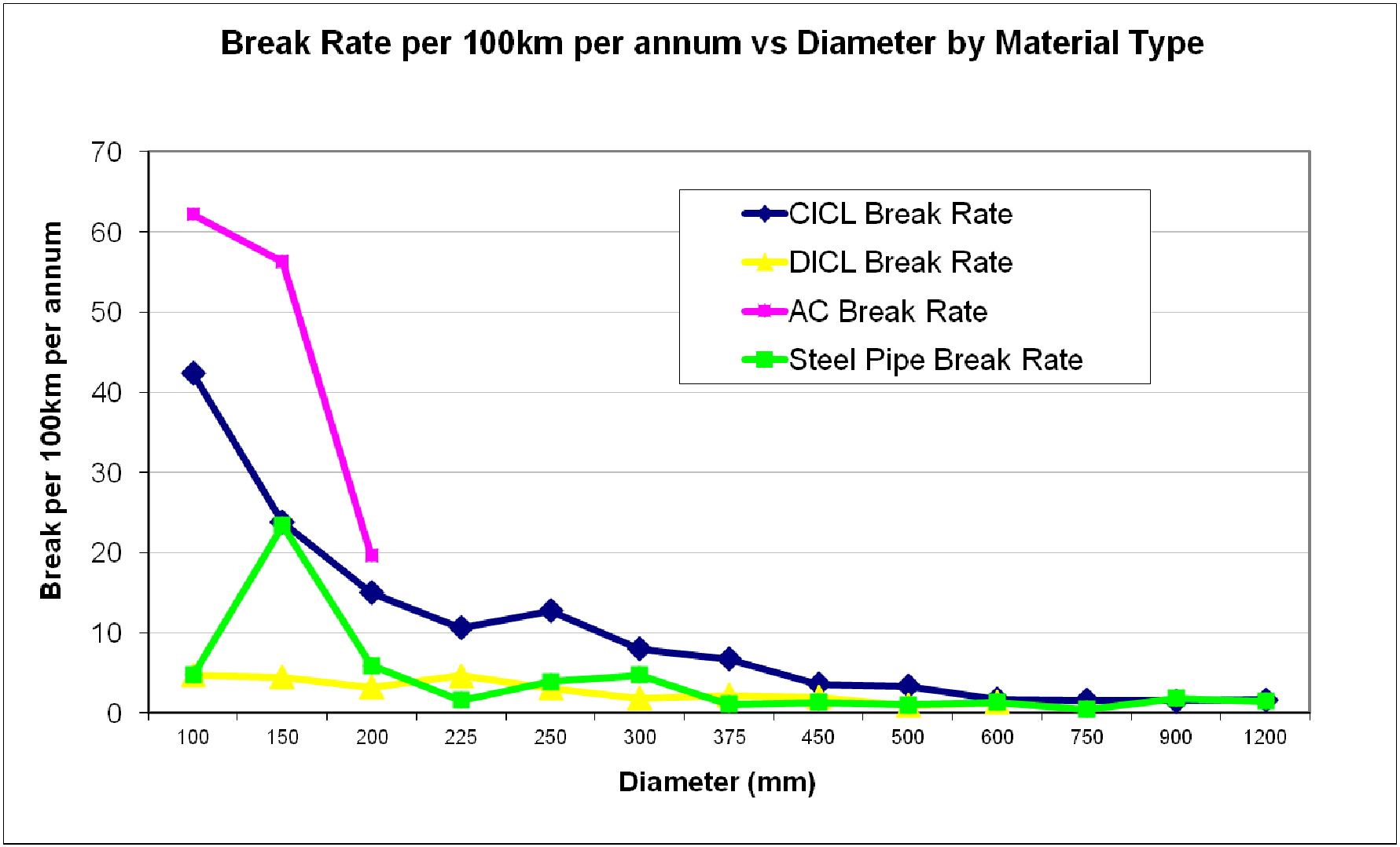
Research & Development



Likelihood of Failure



Failure Modes

Canterbury Rd 750mm Steel Main

Pittwater Rd, April 2007

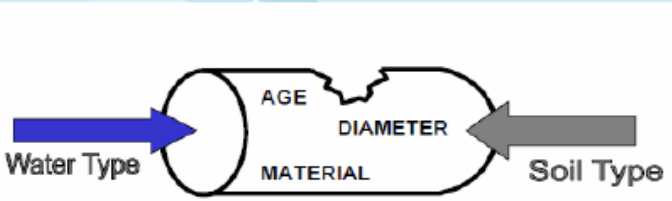
Caringbah Break Feb 2007

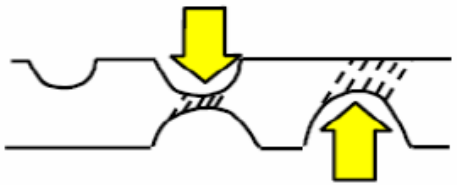
Better Definition of Failure ?

1. Stress at any location of the pipe reaches its ultimate strength for brittle material such as Cast Iron

2. 100% perforation of wall thickness for ductile material such as Steel and Ductile Iron

3. Pipe collapse

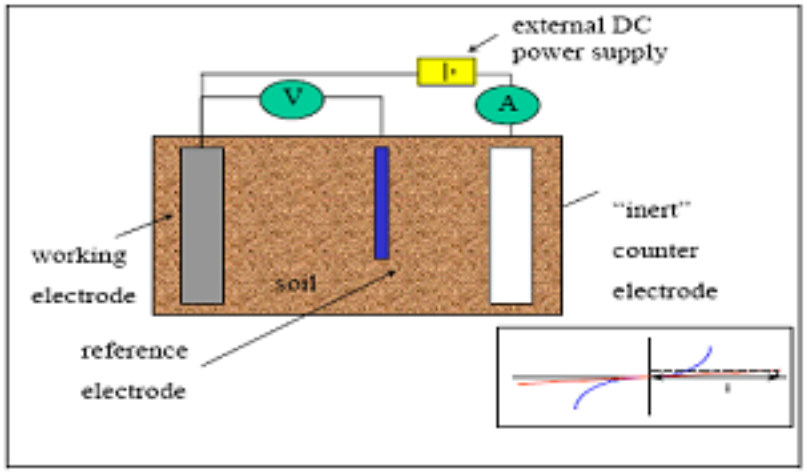




Condition Assessment Techniques

Intelligent Pigging

Diagram of LPR Soil Testing



Linear Polarisation Resistance

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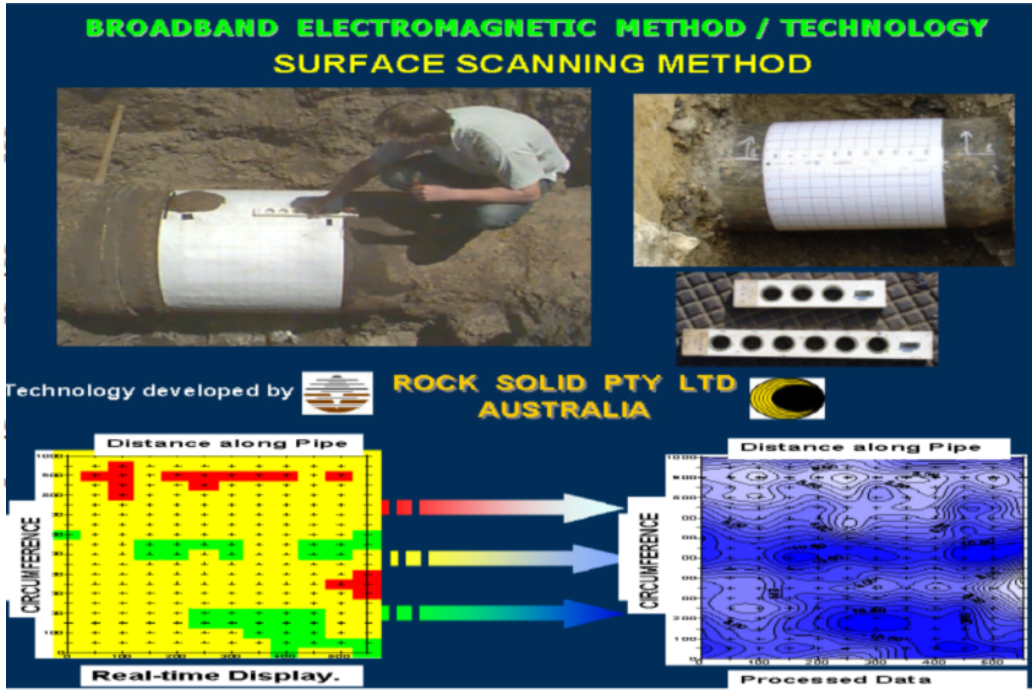
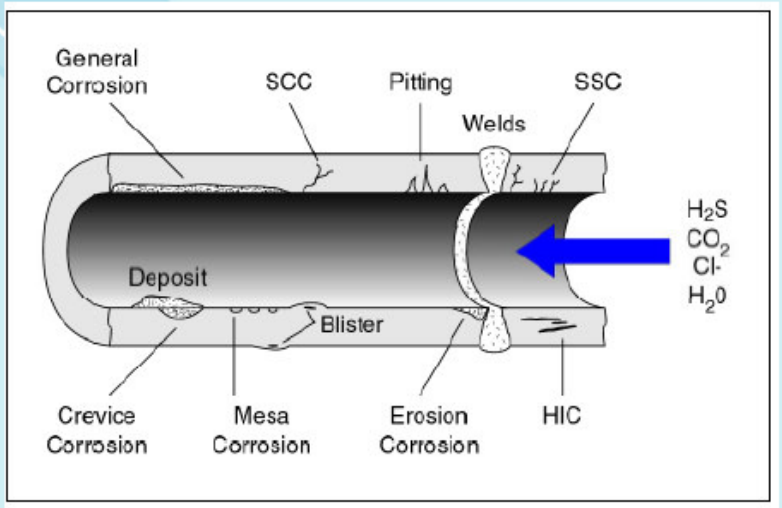


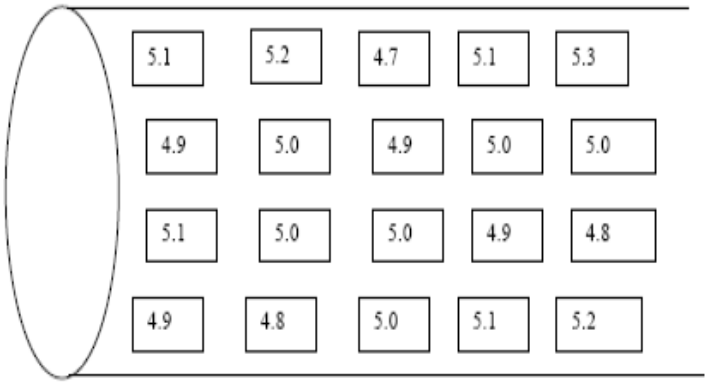
A Process to Analyze Condition Assessment Results

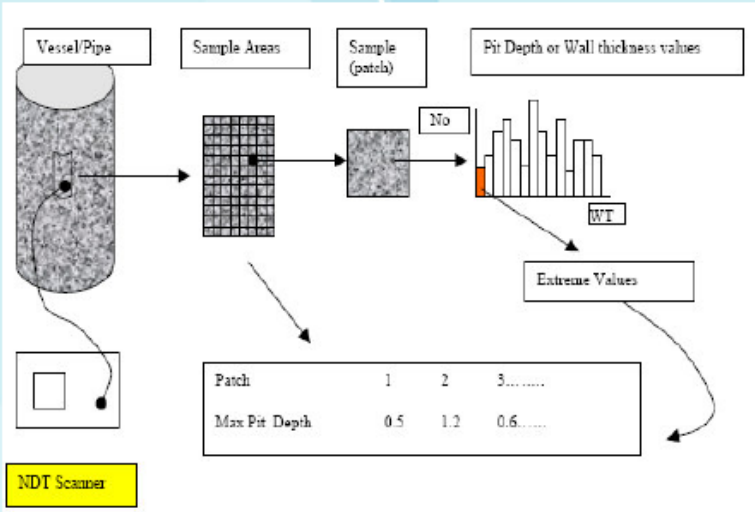
HSE Health & Safety Executive

Guidelines for use of statistics for analysis of sample inspection of corrosion

TWI Limited
Granta Park
Great Abington
Cambridge
CB1 6AL
United Kingdom







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