



Economic Level of Service for Sewer Blockages

WaPUG: Paper 14 - Operational Issues

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Project Objectives

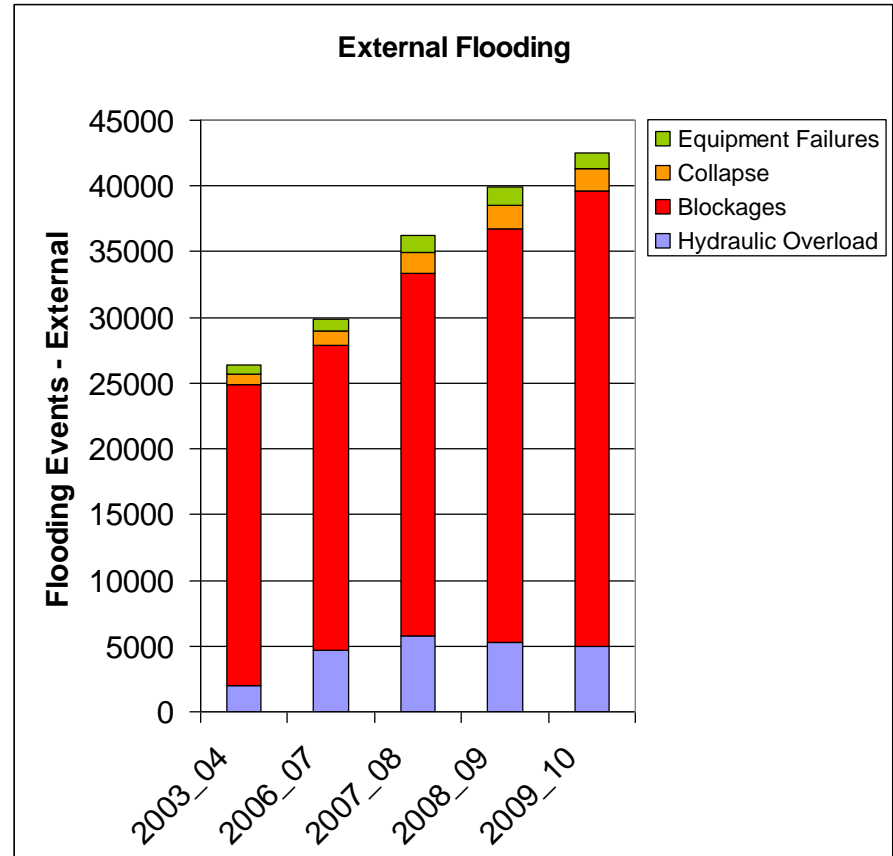
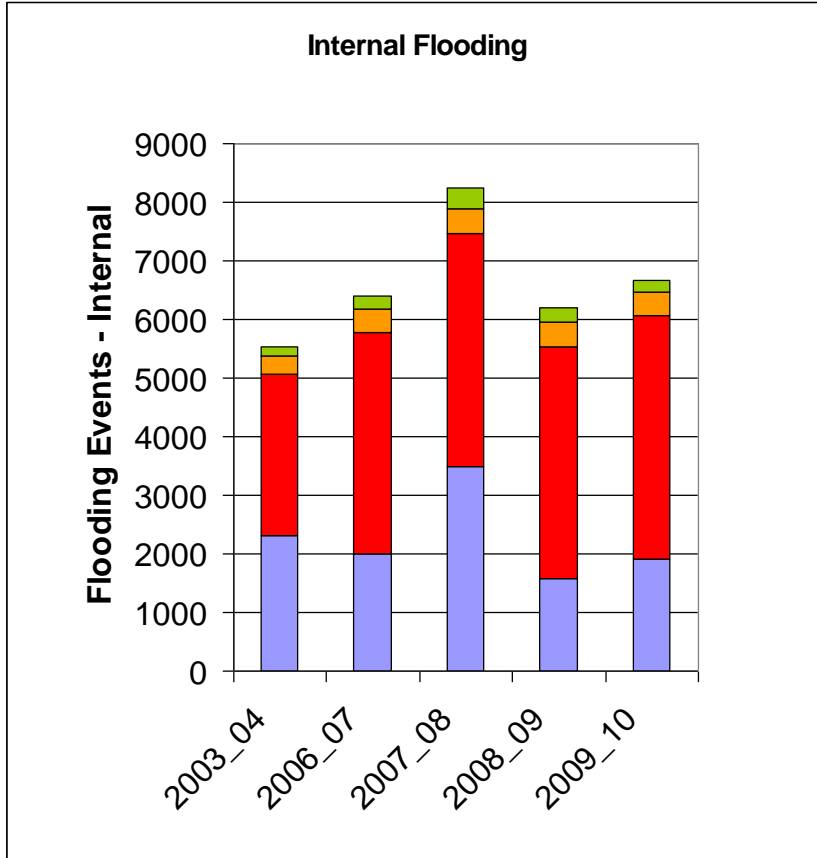
- Provide the ability to identify the **Economic Level of Service (ELS)** for sewer blockages
- Deliver guidance on the **‘quick wins’** for blockage maintenance options.
- Provide guidance and financial evaluation on **emerging techniques** and hence best management practice (BMP) to improve performance for the future.
- Understand how blockage management directly **impacts service** to customers & water company financial performance.

Project Drivers

- National costs of managing sewer blockages (England and Wales) are currently:
 - £86 million per year to sewerage undertakers
 - £540 million per year to all stakeholders
- There were 154,700 blockages in 2008; a rate of about 0.5 /km. This varied across the industry between 0.24 and 0.89 /km/yr.
- Blockage numbers likely to increase between 150% and 300% with transfer of private sewers.
- 15 years of blockage data indicate 30% of blockages are repeats. This reduces to 10% from analysis of one years data.
- Currently 75% of blockage management expenditure is reactive and only 25% proactive.



Project Drivers - Flood Impacts

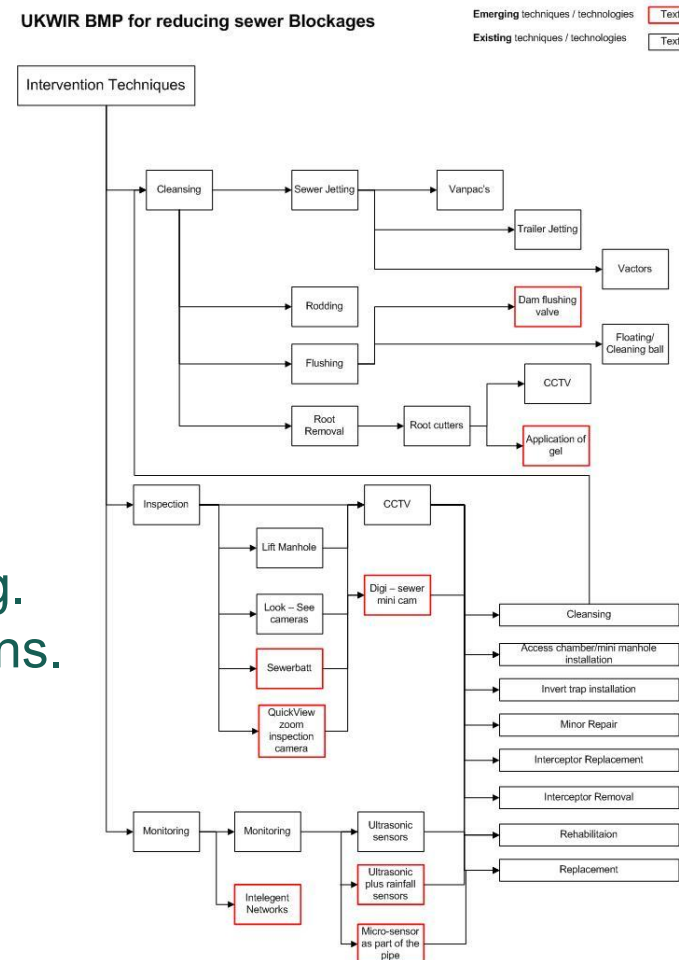


Review of current best practice & emerging techniques

Current Maintenance Activities

- Reactive
 - No two companies are the same, but common principles.
 - Call handling
 - Data
 - Field Response
- Proactive
 - Historic cleansing programmes
 - Predictive analytics maintenance targeting.
 - CCTV / look-see camera's for investigations.
 - Monitoring; high cost & limited coverage
 - Source control

UKWIR BMP for reducing sewer Blockages



Review of current best practice & emerging techniques

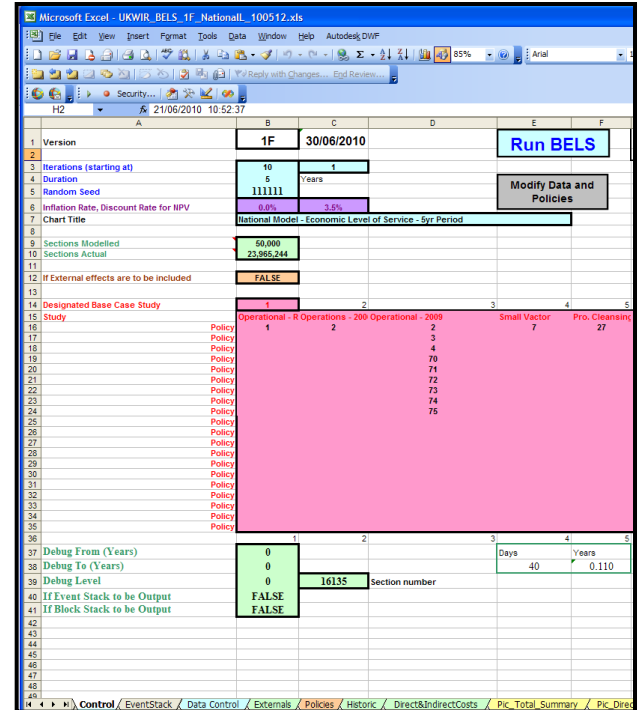
Future Maintenance Activities

- Call handling
- Field Response
- Data
- Proactive
 - Predictive performance models
 - Monitoring
 - Flushing chambers
 - Dosing
 - Source Control



Blockage Economic Level of Service (BELS) Model

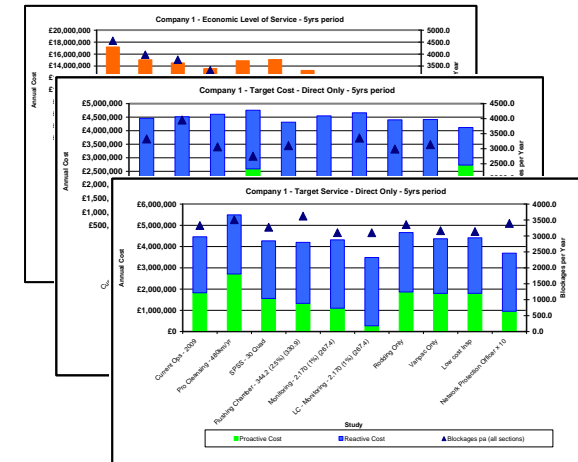
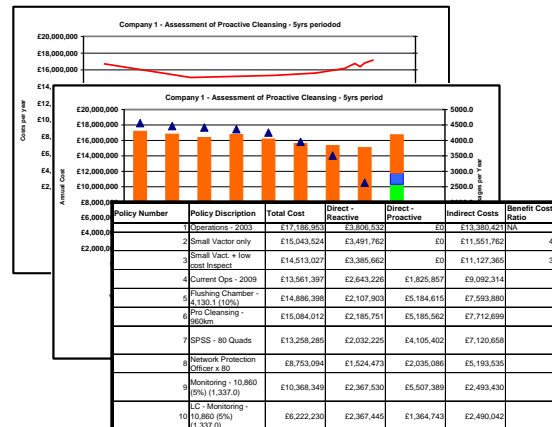
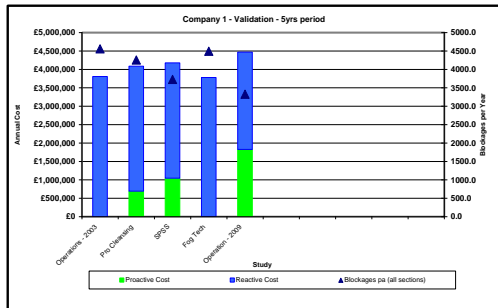
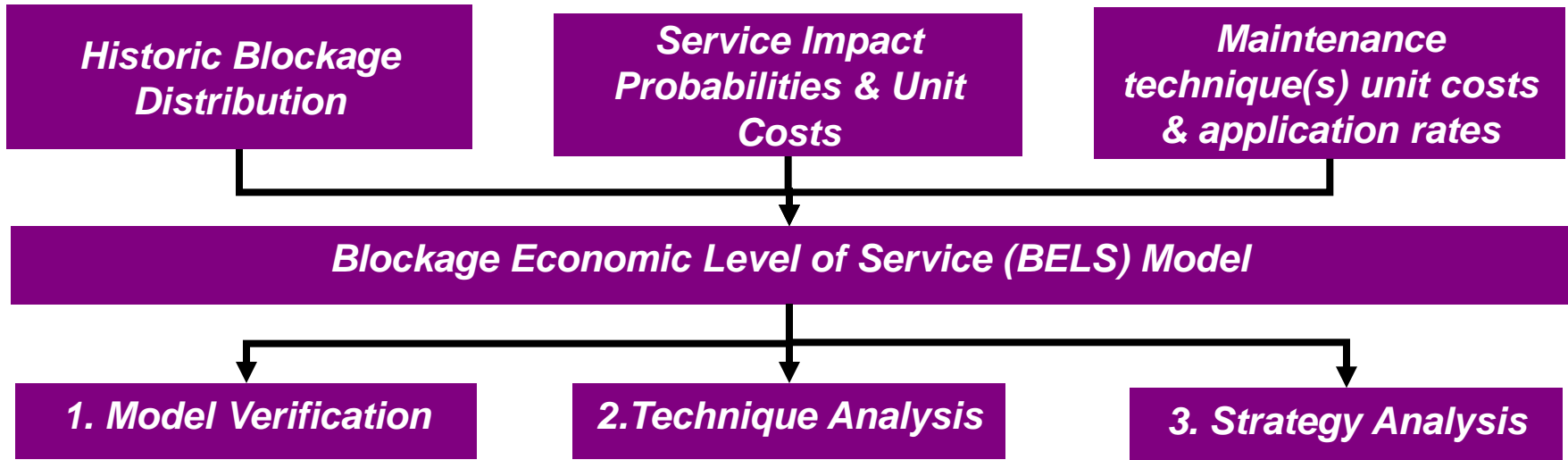
- BELS considers cost benefit based on:
 - Direct company costs – least cost strategy.
 - Costs to all stakeholders – economic level of service.
- BELS can consider **Techniques** that consider an individual method for manage blockages or **Strategies** that consider a combination of elements of reactive and proactive techniques.
- BELS compares the costs and benefits of different techniques and strategies; reactive & proactive cleansing, inspections, education, network protection officers, monitoring, flushing chambers.
- BELS Monte Carlo simulation engine allows uncertainty to be accounted for and measured.



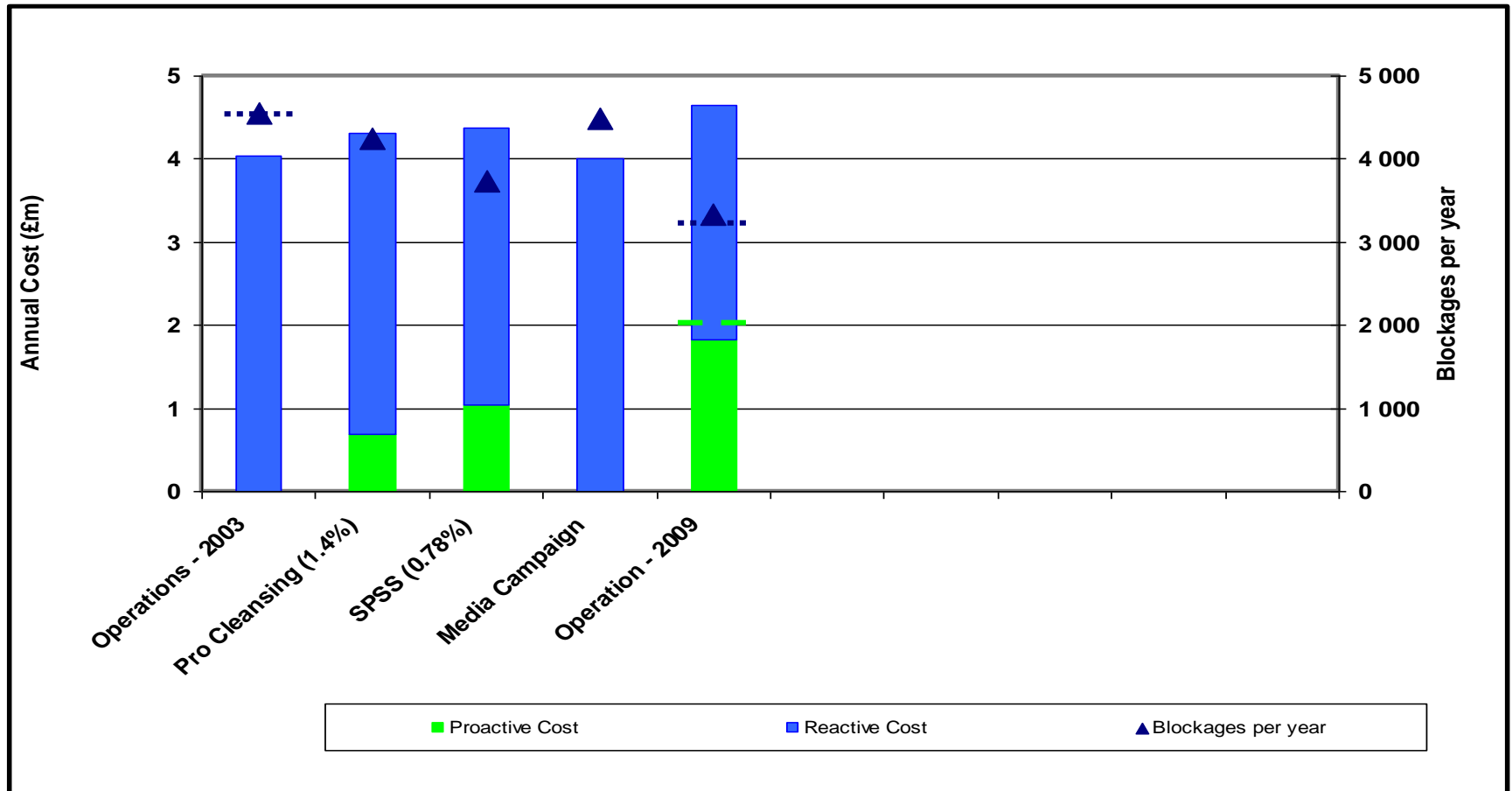
Row	Column A	Column B	Column C	Column D	Column E	Column F
1	Version	1F	30/06/2010			Run BELS
2						
3	Iterations (starting at)	10	1			
4	Duration	5	Years			Modify Data and Policies
5	Random Seed	111111				
6	Inflation Rate, Discount Rate for NPV	4.0%	3.5%			
7	Chart Title	National Model - Economic Level of Service - 5yr Period				
8						
9	Sections Modelled	50,000				
10	Sections Actual	23,965,244				
11						
12	If External effects are to be included	FALSE				
13						
14	Designated Base Case Study	1	2	3	4	5
15	Study	Operational - R	Operational - 209	Operational - 209S	Small Vector	Pro. Cleansing
16	Policy	1	2	3	7	27
17	Policy					
18	Policy					
19	Policy					
20	Policy					
21	Policy					
22	Policy					
23	Policy					
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27	Policy					
28	Policy					
29	Policy					
30	Policy					
31	Policy					
32	Policy					
33	Policy					
34	Policy					
35	Policy					
36						
37	Debug From (Years)	0			Days	Years
38	Debug To (Years)	0			40	0.110
39	Debug Level	0	16135	Section number		
40	If Event Stack to be Output	FALSE				
41	If Block Stack to be Output	FALSE				
42						
43						
44						
45						
46						
47						
48						
49						
50						

F	G	H	I	J	K	L	M	N	O	P
Update Reactive Totals		Unit cost or cost per metre				Typical Length of application	Percentage of Sites Targeted	Gain for 100% usage		
					Unit, 0 = £/unit 1 = £/metre					
		Min	Max	Conf			Min	Max	Conf	
Rodding	FR_I_C_M_R	£174	£174	9	0		15.00%	10.0%	50.0%	8
Plunger	FR_I_C_M_P	£122.00	£122.00	9	0		5.00%	10.0%	50.0%	8
Vanpack	FR_I_C_M_VP	£225	£225	9	0		35.00%	60.0%	85.0%	8
Trailer Jetting	FR_I_C_M_TJ	£225	£225	9	0		30.00%	60.0%	90.0%	8
Vactor	FR_I_C_M_V	£671	£671	9	0		5.00%	80.0%	95.0%	8
Flushing	FR_I_C_M_F	£0	£0	0	0			0.0%	0.0%	0
Root Cutting	FR_I_C_M_RC	£3	£4	8	1	50	10.00%	90.0%	100.0%	8
Root Cutting & Gel	FR_I_C_M_RCG	£0.00	£0.00	0	0			0.0%	0.0%	0
Upstream	FR_I_C_A_U	£0.00	£0.00	0	0		50.00%	0.0%	0.0%	5
Downstream	FR_I_C_A_D	£0.00	£0.00	0	0		50.00%	-5.0%	0.0%	5
Material Removed	FR_I_C_BM_R	£20.00	£40.00	5	0		5.00%	0%	0%	5
Washed Downstream	FR_I_C_BM_W	£0.00	£0.00	0	0		95.00%	-20%	-5%	5
Pamphlet	FR_I_SC_E_P	£0.10	£0.20	5	0		100.00%	3.0%	6.0%	5
Mapping not required	FR_I_MA_NR	£0.00	£0.00	0	0			0.0%	0.0%	0
Mapping not completed	FR_I_MA_NC	£0.00	£0.00	0	0			0.0%	0.0%	0
Mapping redline	FR_I_MA_RAL	£5.00	£15.00	7	0		10.00%	5.0%	7.0%	5
Detailed surveys	FR_I_MA_DS	£0.00	£0.00	0	0			0.0%	0.0%	0
No investigation	FR_RCI_M_N	£0.00	£0.00	0	0			0.0%	0.0%	0
No prior inspection	FR_RCI_M_IBI_N	£0.00	£0.00	0	0			0.0%	0.0%	0
Prior Look see	FR_RCI_M_IBI_T_LS	£0.0	£0.0	0	0			0%	0%	0
Prior CCTV	FR_RCI_M_IBI_T_CC	£0.0	£0.0	0	0			0%	0%	0
Prior inspect manhole	FR_RCI_M_IBI_T_MH	£0.0	£0.0	8	0	0.0		0%	0%	5
Other Prior	FR_RCI_M_IBI_T_O	£0.0	£0.0	0	0			0%	0%	0
No post inspection	FR_RCI_M_IAI_N	£0.00	£0.00	0	0			0.0%	0.0%	0
Post Look see	FR_RCI_M_IAI_T_LS	£30.0	£60.0	0	1	1	4.00%	20%	30%	5
Post CCTV	FR_RCI_M_IAI_T_CC	£2.0	£4.5	0	1	38	3.00%	20%	30%	5
Post inspect manhole	FR_RCI_M_IAI_T_MH	£0	£0	0	0			0%	0%	0
Other Post	FR_RCI_M_IAI_T_O	£0.0	£0.0	0	0	0		0%	0%	0
Interceptor removal	FR_RM_MR_IR	£480	£1,500	3	0		3.00%	25%	100%	3
Section relining	FR_RM_MR_sRel	£60	£80	7	1	10	5.00%	95%	100%	8
Section replacement	FR_RM_MR_sRep	£500	£3,000	5	1	1	5.00%	95%	100%	8
New rodding chamber	FR_RM_IA_RC	£0	£0	0	0			0%	0%	0
Install Manhole	FR_RM_IA_MH	£2,000	£3,000	8	0		1.00%	5%	10%	0
Pipe relining	FR_RM_PR_PRel	£70	£80	7	1	38	1.00%	95%	100%	8
Pipe replacement	FR_RM_PR_PRep	£150	£250	7	1	38	0.60%	95%	100%	8

Blockage Economic Level of Service (BELS) Model - Process

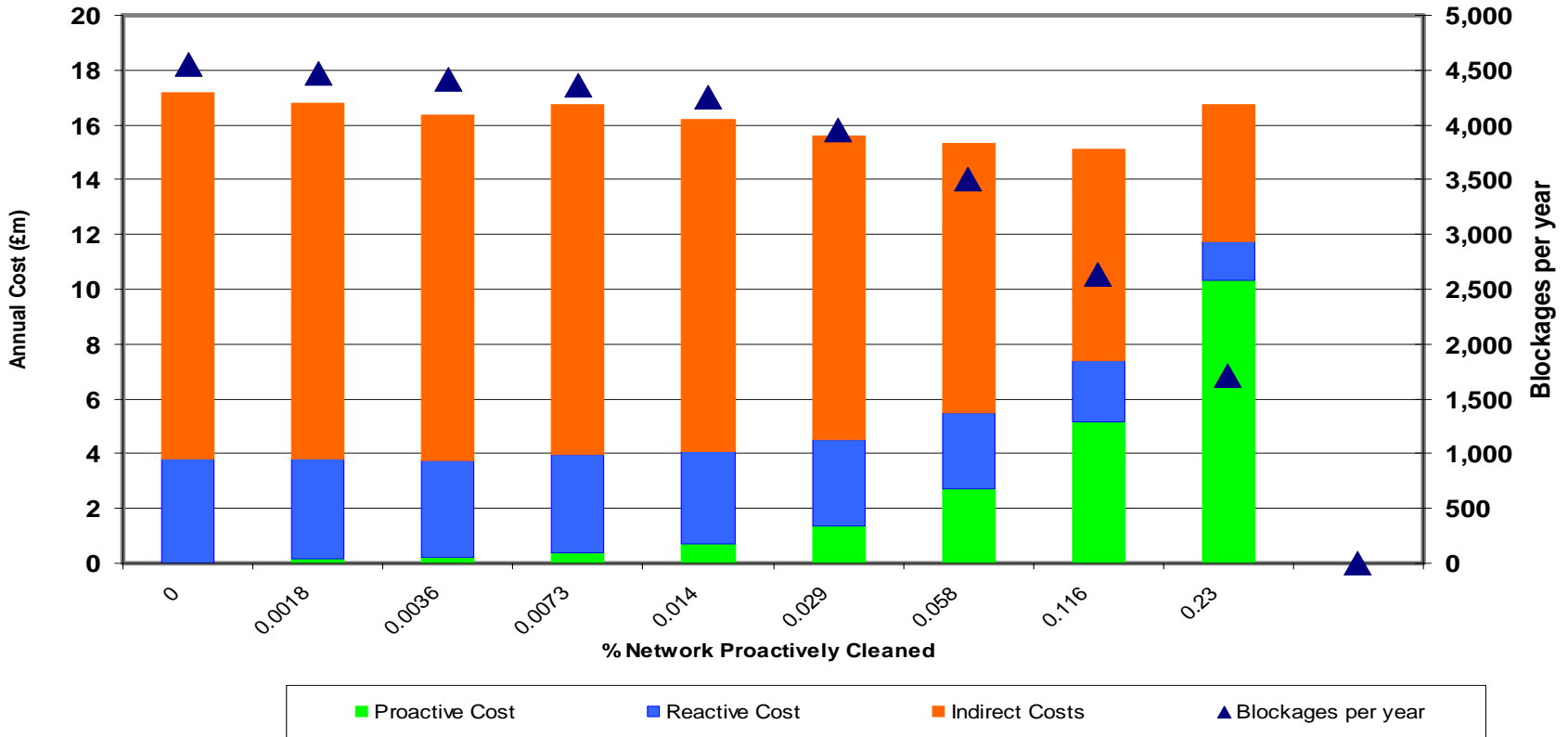


BELS – Model Verification



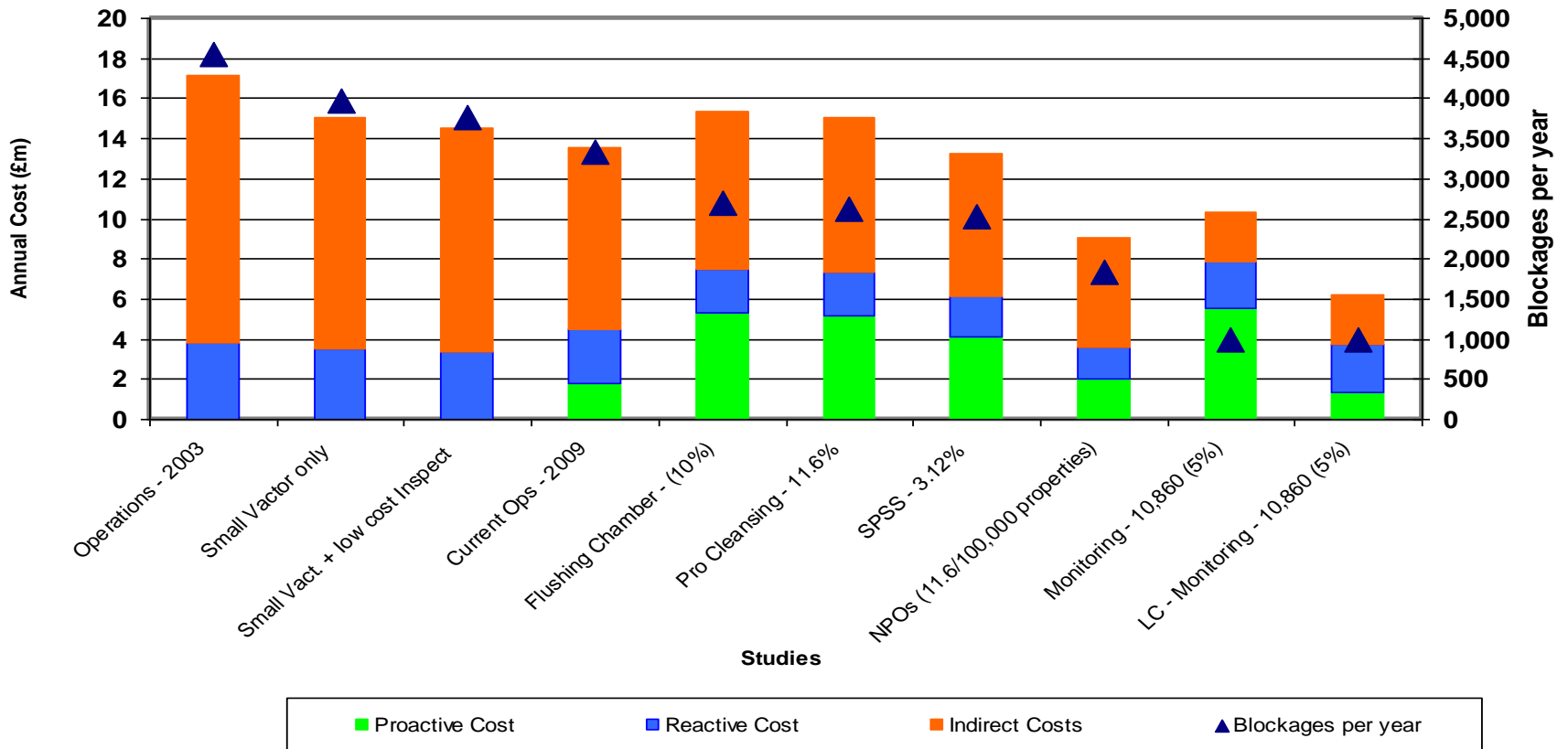
BELS – Technique Analysis

Company 1 - Proactive Cleansing



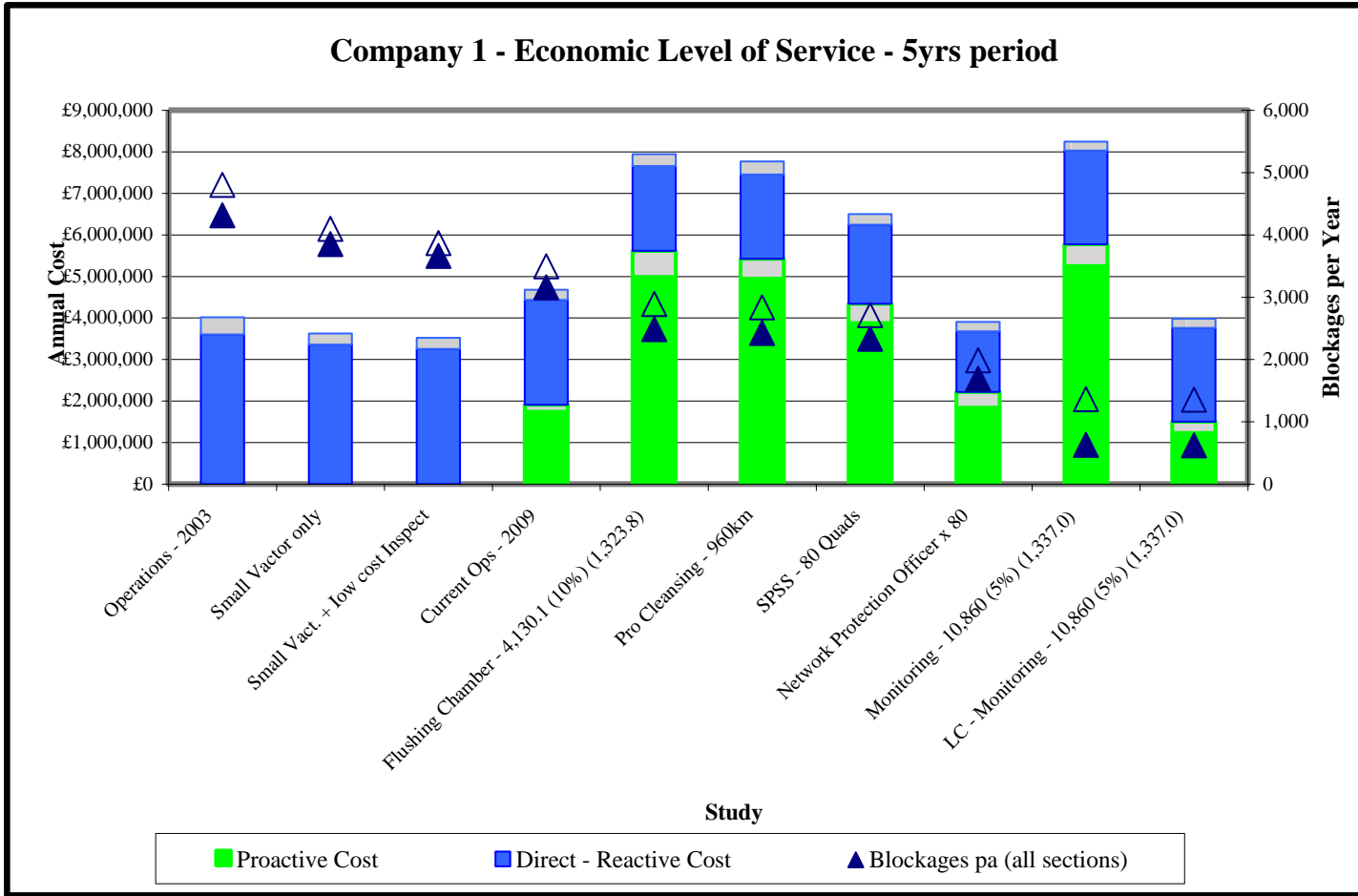
BELS – Strategy Analysis – Economic Level of Service

Company 1 - Overview of all polices

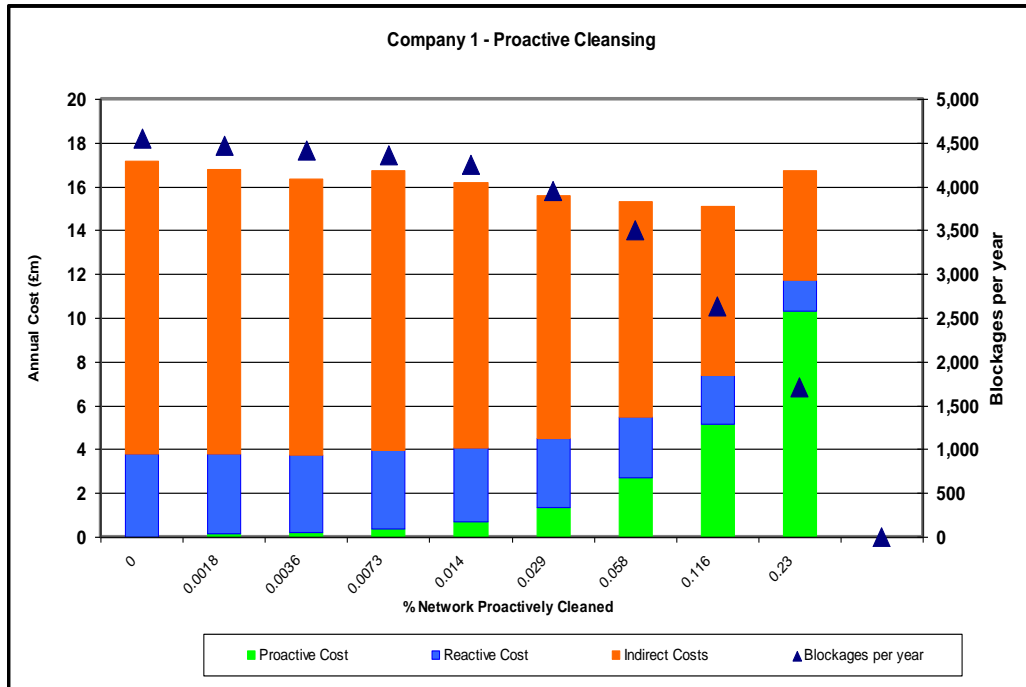


BELS – Strategy Analysis – Economic Level of Service

Company 1 - Economic Level of Service - 5yrs period



Assessment of Current & Emerging Techniques – Proactive Cleansing



Intervention	Blockage / Section Cost		Effectiveness	
	Min	Max	Min	Max
Reactive	£459	£527	53%	59%
Proactive	£69	£77	70%	78%
Targeting	NA	NA	90%	100%
Vactor	£24	£48	80%	95%

Conclusions

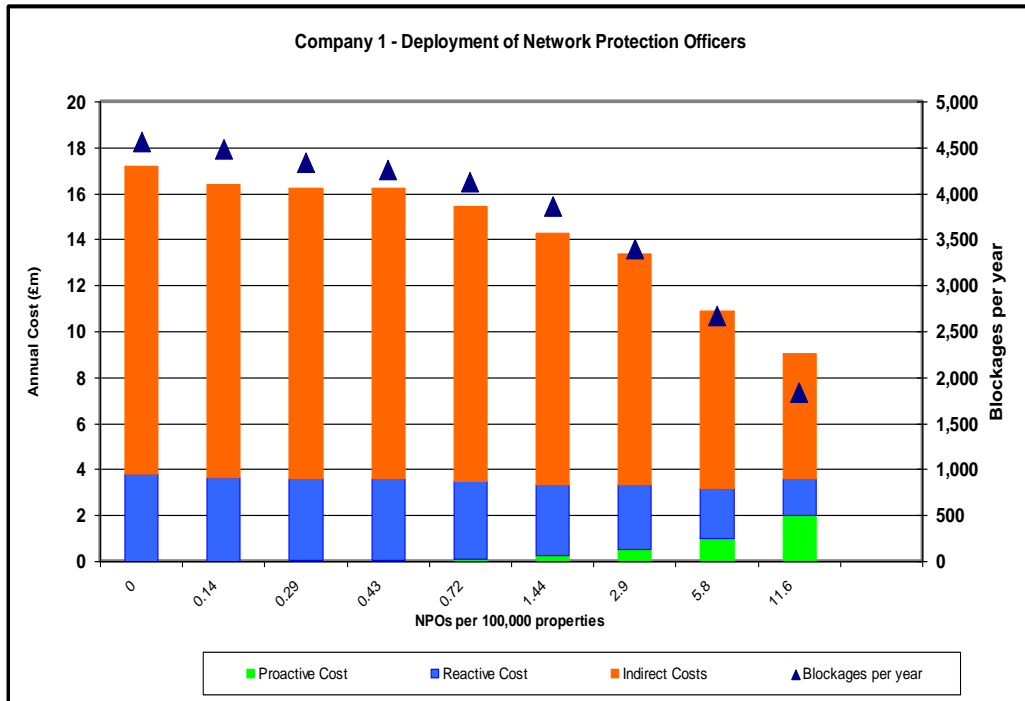
Need to ensure benefit from cleansing operations by:

Collection of data to optimise the frequency

Use real time monitoring

Low cost survey technology to confirm silt build prior to cleansing.

Assessment of Current & Emerging Techniques – Network Protection Officers

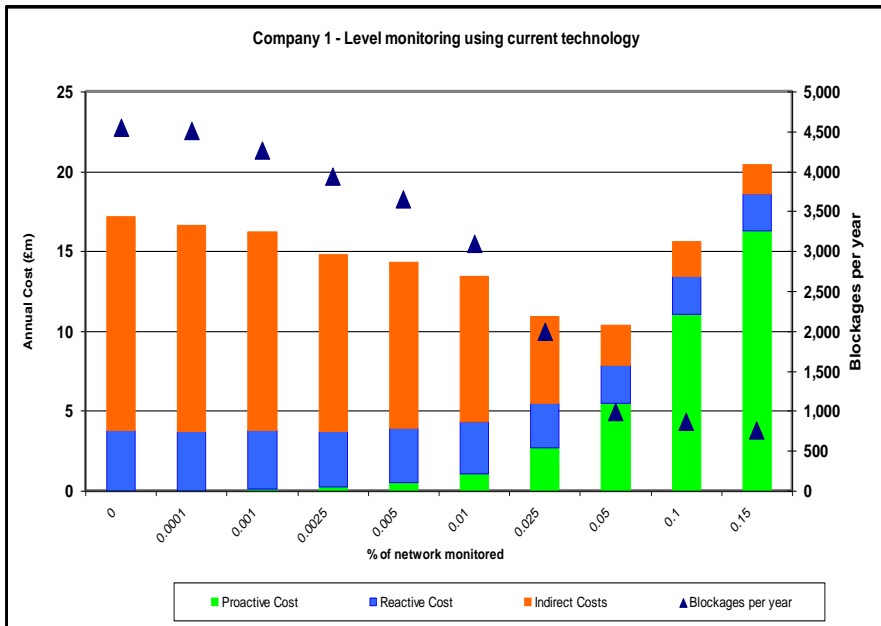


Intervention	Blockage Cost		Effectiveness	
	Min	Max	Min	Max
Reactive	£459	£527	53%	59%
Proactive	£28	£36	52%	56%
Inspection officer	£15	£20	50%	60%
Fat traps	£200	£500	80%	95%

Conclusions

Productivity of network protection office needs to be confirmed.
 Opportunity to link with other customer service functions and SIM requirements.

Assessment of Current & Emerging Techniques – Level Monitoring



Intervention	Blockage / Section Cost		Effectiveness	
	Min	Max	Min	Max
Reactive	£459	£527	53%	59%
Proactive	£0	£0	0%	0%
Setup	£1.2k/m	£1.5k/m	NA	NA
Annual	£200/m	£300/m	80%	100%
Section per application	5.2 or 62m			

Conclusions

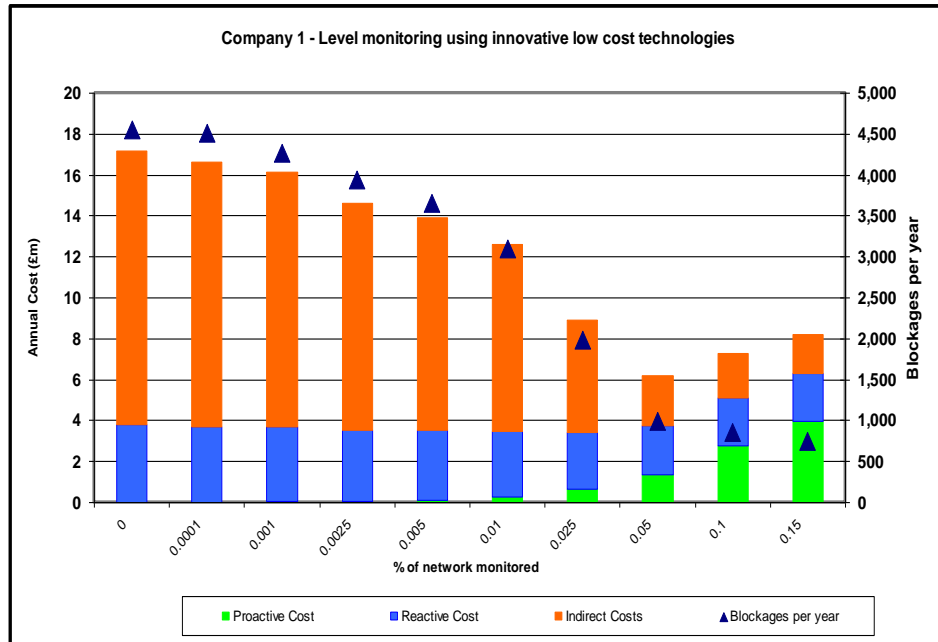
Confirm typical coverage.

Business case for mass coverage will require use of total costs in BCR.

Significant service gains to be achieved.

Telemetry likely to be an issue for large scale deployment.

Assessment of Current & Emerging Techniques – Low Cost Level Monitoring

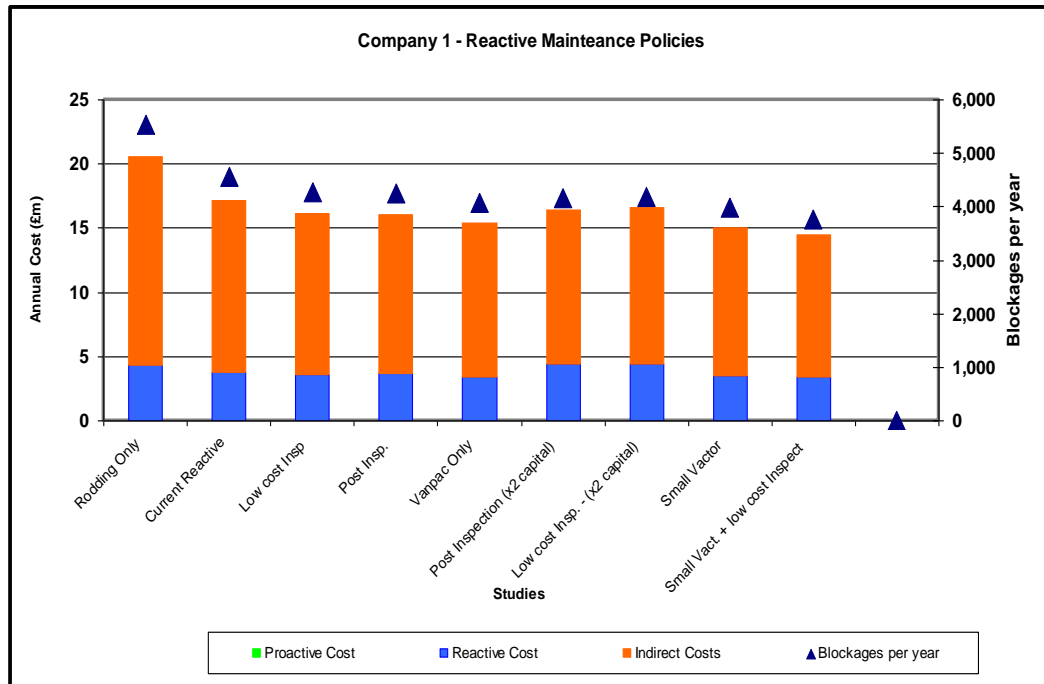


Intervention	Blockage / Section Cost		Effectiveness	
	Min	Max	Min	Max
Reactive	£459	£527	53%	59%
Proactive	£0	£0	0%	0%
Setup	£250/mon.	£400/mon.	NA	NA
Annual	£40/m on.	£100/mon.	80%	100%
Section per application	5.2 or 62m			

Conclusions

Low cost level monitors are being used on a number of pilot studies. Number of pipes / properties monitored by each monitor is a key variable.

Assessment of Current & Emerging Techniques – Reactive Maintenance



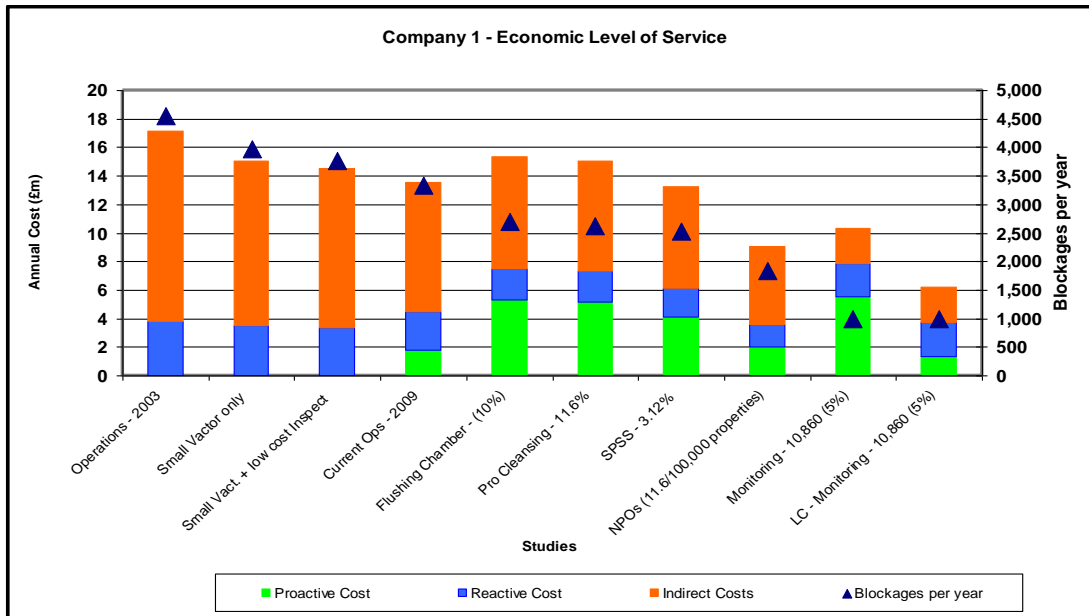
Intervention	Blockage Cost		Effectiveness	
	Min	Max	Min	Max
Reactive	£459	£527	53%	59%
Roding	£56	£100	10%	50%
Vanpac	£56	£100	60%	85%
Small Vact.	£210	£280	80%	95%
Material removal	£7.5	£8.75	2%	10%
Inspection	£50	£100	20%	30%
LC Inspection	£5	£10	20%	30%

Conclusions

Rods should not be used to remove blockages.

Actual benefits from small vactors and low cost inspection devices needs to be quantified.

Economic Level of Service – Company 1

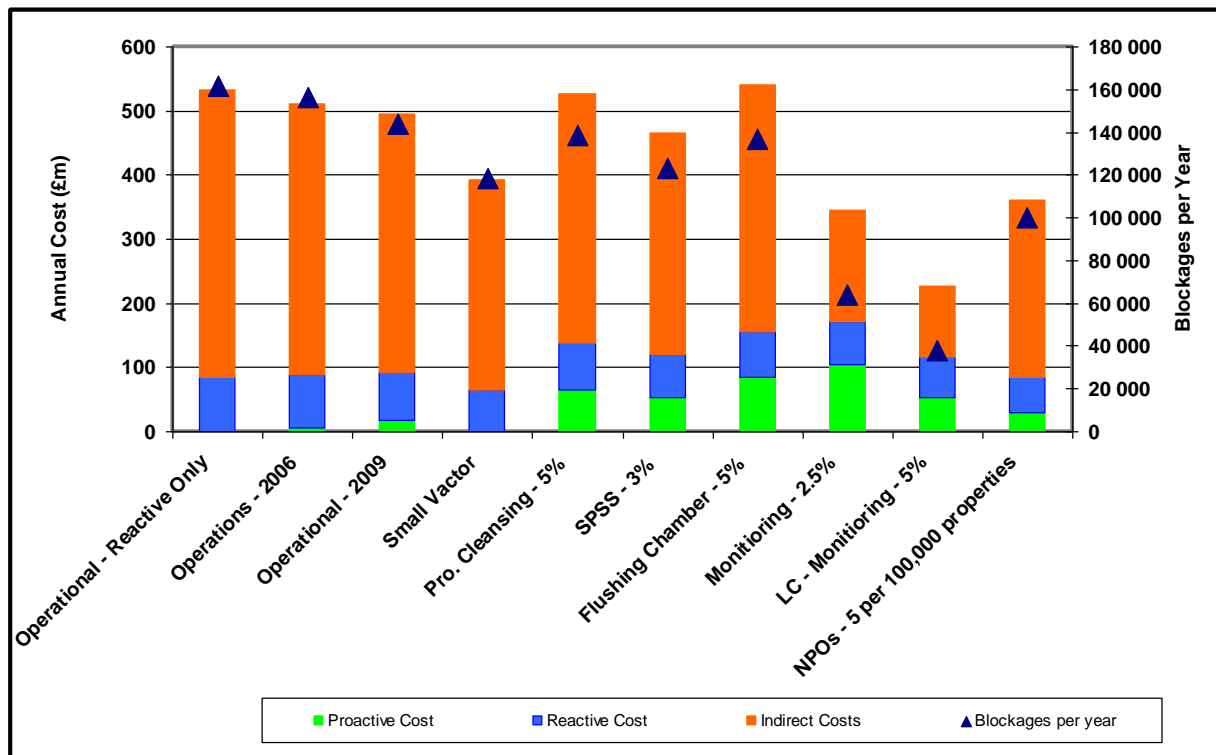


Results

- Significant proactive programme already and benefits have been modelled.
- Operating above least cost level for direct costs.
- Benefits to optimising proactive cleansing programme.
- Direct costs reduced from fix first time strategy.
- Extend use of network protection officers.
- Investigate true benefits from level monitoring.

Policy	1	2	3	4	5	6	7	8	9	10
BCR	NA	7	6	5.5	0.5	0.6	1.7	39	2	147

Economic Level of Service – National



Results

- Health warning on data inputs.
- Use of small vactors for fix first time & NPO's provide opportunities to reduce direct costs & improve performance.
- Low cost monitoring provides opportunity to improve service & reduce total costs.

Conclusions - Quick Wins

- Fix first time – avoid repeats
- Challenge historic cleansing programmes; are they still relevant?
- Report failures against assets as well as against properties, plus use the data.
- Incentives staff and contractors on performance; not on cost per blockage.
- Improve customer service with field customer managers – single point of contact.
- Benchmarking activities against best practice – see guidance in report.
- Use the cost benefit model to assess improved practices; Are current activities cost beneficial?

Conclusion - Source Control

- Most blockages are due to inappropriate use of the sewerage system
 - Fats Oils and Grease
 - Gross solids discharge
 - “Flushable” household products
- Potential to tackle this through use of “Network Protection Officers”.
 - Benchmark current activities
 - Initial review suggests that there are benefits from significant numbers of staff in this role
 - Further information is required on activities, costs and effectiveness
 - Refine cost benefit model to confirm strategy

Conclusion - Emerging Technologies

- **Low cost inspection techniques**
 - Combination of Sewerbatt and Quickview provides a potential solution.
 - Provide the ability to deliver 'Fix first time' strategy.
 - BELS model indicates service improvement & savings, but input data needs to be confirmed.
- **Level monitor technology**
 - Economic maintenance strategy when considering total costs.
 - Length of sewer monitored is key
 - Flow monitors provide ability to assess more of network
 - Issue & cost with telemetry systems, plus understanding data.
- **Flushing Chambers**
 - Potential strategy, but need to understand performance benefits & maintenance requirements.
 - Not suitable for all locations; Not US of CSO's or at head of system

Conclusion - Least Cost Maintenance and Economic Level of Service

- The cost benefit modelling indicates:
 - Lowest cost to the company is 0.43 to 0.56 / km /yr
 - Lowest cost to UK plc is 0.12 to 0.19 /km / yr
- These improvements can be achieved with:
 - Fix first time policy
 - Proactive sewer cleansing and maintenance
 - Focus on source control
 - On-line sewer monitoring and possibly flushing chambers
- This will roughly double direct costs to the company
 - Need to prove customer willingness to pay
 - Need to include in next business plan

Recommendations

- Check customer willingness to pay for improved level of service
- Persuade OFWAT operational efficiencies should not prevent delivery of improved service.
- Trial and benchmark techniques; Fix first time, network monitoring, network protection officers, etc
- Each company should use the BELS cost benefit model as part of forward looking business planning process during the AMP and for the periodic review.
- Consider using BELS to predict private sewer OPEX costs.
- Companies should collaborate to improve accuracy and confidence of model input data.
- Establish a Working Group as part of Water UK 'SNAP'.

Summary

- Currently there are 0.51 blockages per km of sewer per year
- Economic Level of Service for Sewer Blockages is:
 - 0.43 to 0.56 / km /yr - Lowest cost to the company
 - 0.12 to 0.19 /km / yr - Lowest cost to UK plc
- Fix first time has potential to provide lowest direct costs.
- Benefits of current and emerging technologies needs to be confirmed.
- PR14 to establish case to spend more on operational costs to make significant improvement to blockage performance and service

Benefits

- BELS allows Economic Level Service to be identified for different blockage maintenance strategies.
- Project has identified a number of 'Quick Win' blockage maintenance processes.
- BELS has been used to assess different maintenance strategies and identify BMP based on economic and service criteria.
- BELS provides the ability to demonstrate how management practices can impact to customer service and economics.

Questions ?

- Is their enough focus on reducing service impacts due to blockages?
- If not, why?
- How can we better integrate blockage management within the DAP process?