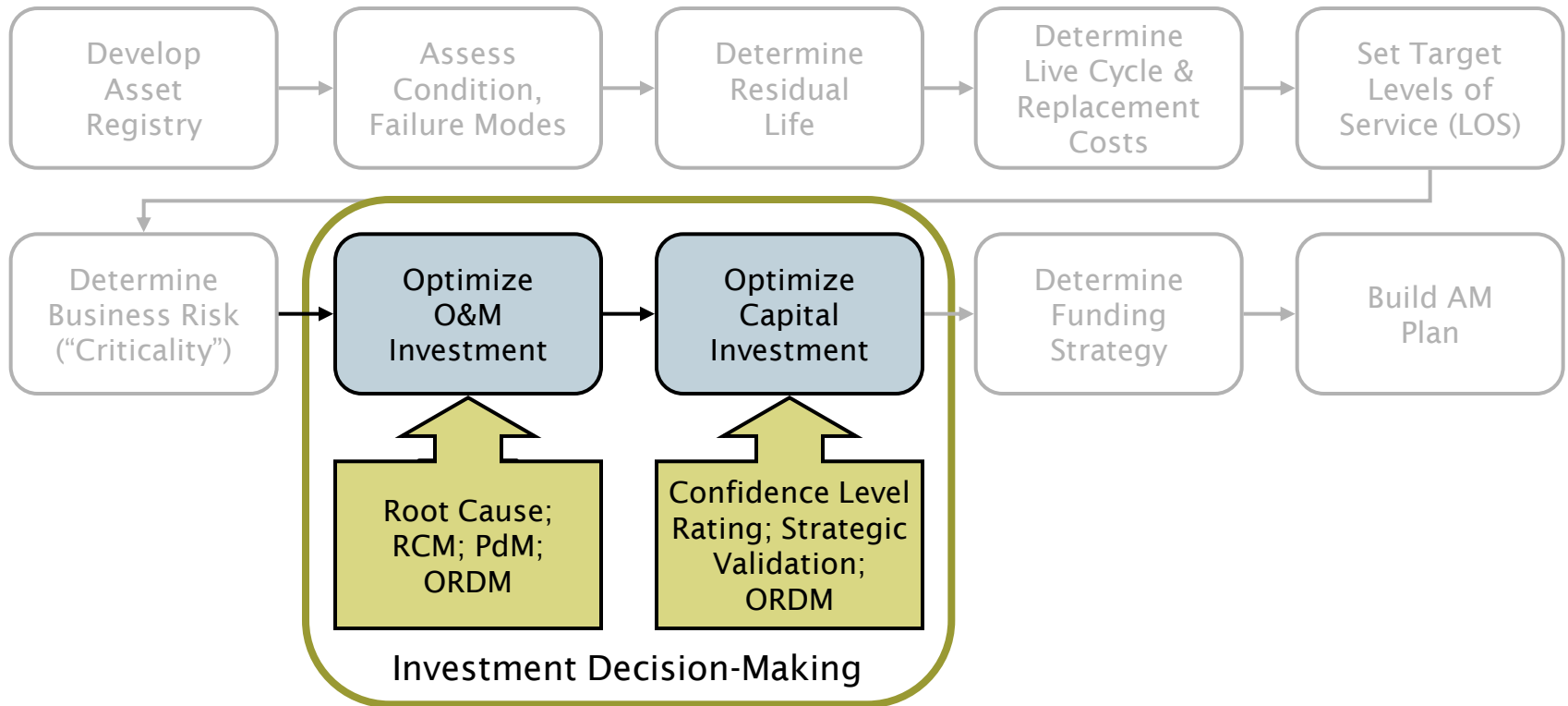

Fundamentals of Asset Management

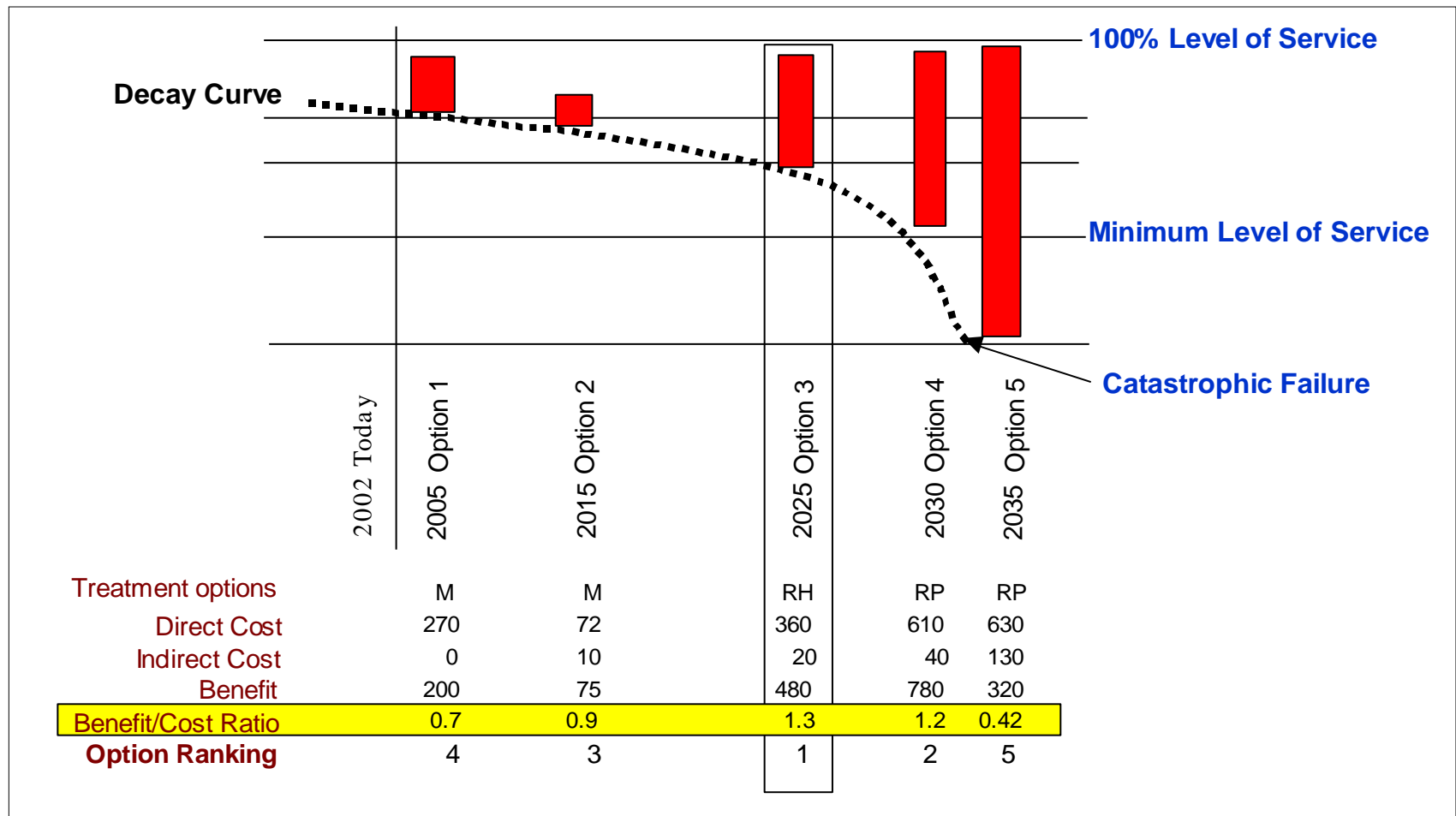
Background: Optimized Investment Decision Making

A Hands-On Approach

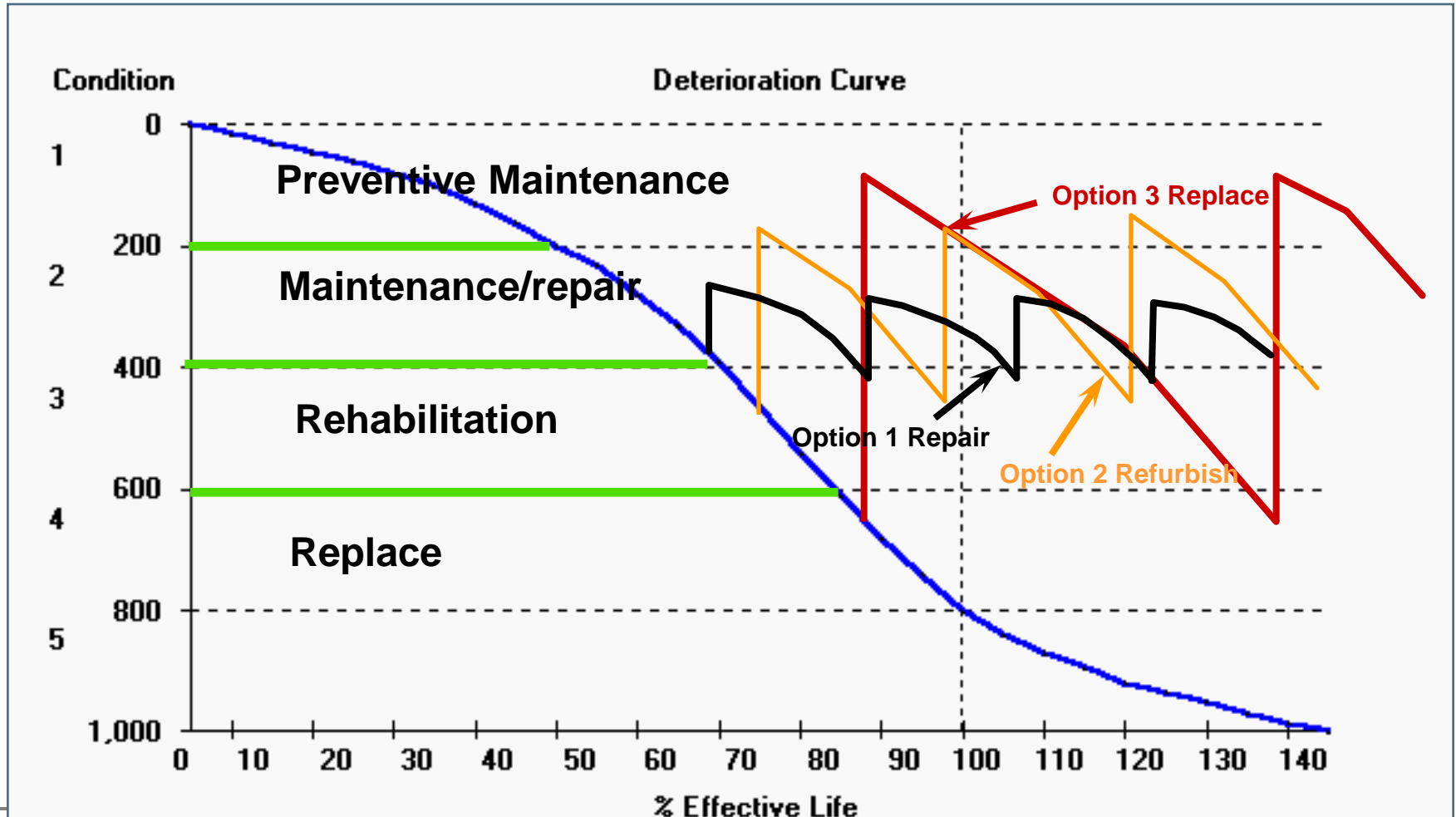
View 6: AM plan 10-step process



There exists for every asset, a theoretical “best” investment



Managing the “asset consumption” process



Levels of sophistication in decision-making

Repair-refurbish-replace decision

1. Fix when broken (run to failure)
2. End of prescriptive life
 - 12 years old
 - 3,000 run-time hours
 - 35,000 miles
3. Rule of thumb
 - 3 breaks per mile or in 24 hours
 - Poor condition (and worst first)
 - $FCI > 6\%$ (Facility condition index—O&M as a percentage of replacement cost)
4. Optimized renewal decision making (ORDM)

What is optimized decision making?

- Systematic search for lowest-cost renewal investment
- Based on interaction of
 - Cost trends (direct O&M, indirect)
 - Condition trends (decay/survivor curve)
 - Risk-consequence trends
- Three major approaches
 - Valued expert judgment
 - Lowest projected average life-cycle cost per year of residual life;
 - Operational costs
 - Risk-weighted, full economic costs
 - Intervention factors; condition, performance, reliability, Business Risk Exposure, etc.

Three levels of ORDM

- *Level 1* Decision tables/trees
 - Structured, often substantially qualitative, value judgment-based
 - Event-focused, scenario-based
- *Level 2* Lowest average PV life cycle cost scenario analysis
 - Specific decision event-focused
 - Spreadsheet-driven
 - Can be used to refine decision tables/trees
- *Level 3* Integrated intervention and full economic life cycle cost optimization
 - Sophisticated modeling
 - Objective function-driven
 - Both portfolio- and event-driven

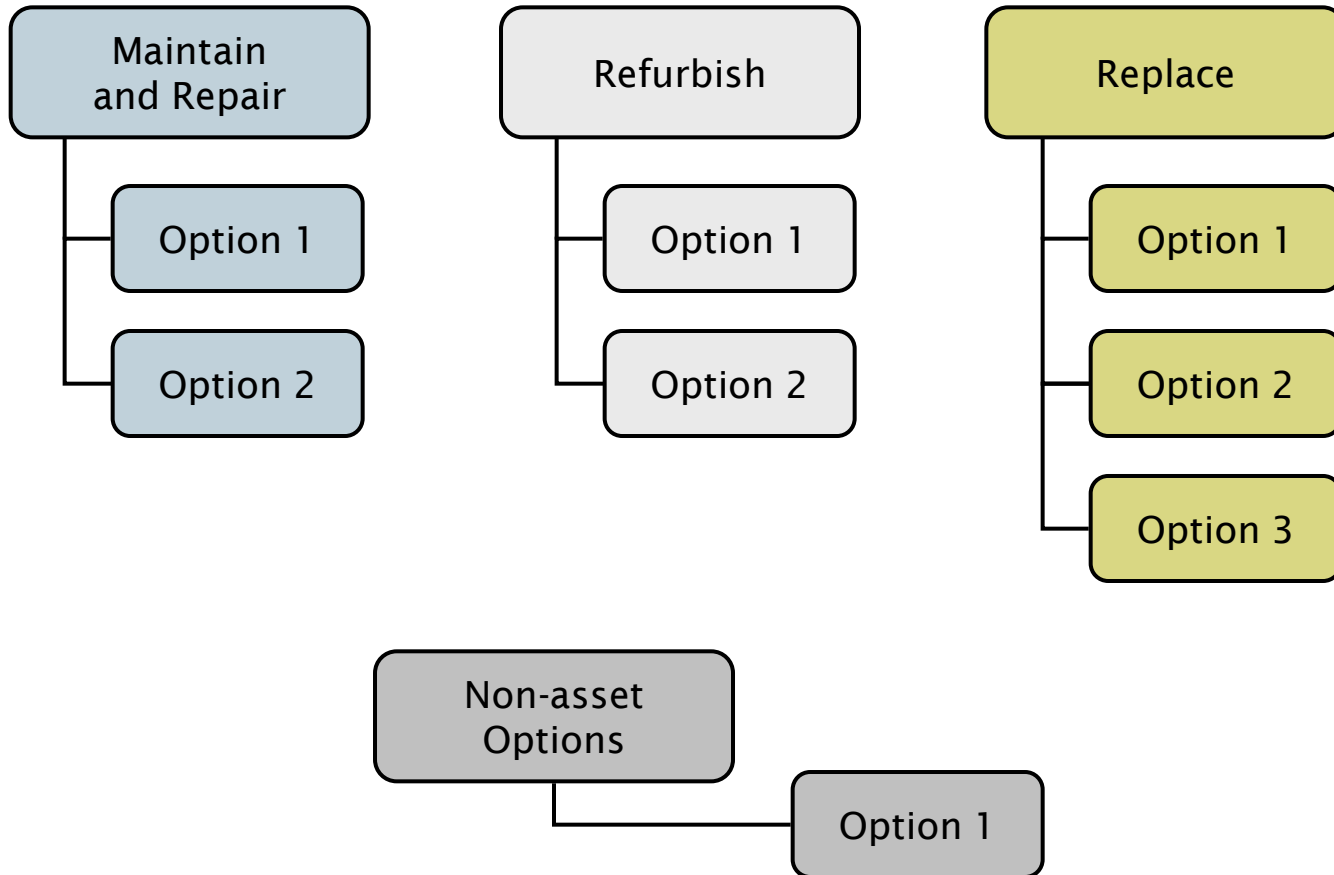
So, what do we mean by...

Minimum life cycle cost strategies

- Fundamental asset management options available to the management team are
 - Do nothing (zero-based strategy)
 - Status quo
 - Operate differently
 - Maintain differently—run to failure, preventive-based, predictive-based (condition, usage)
 - Repair
 - Refurbish/rehabilitate
 - Replace
 - Decommission
 - Non asset-based
- Which strategy for each asset?
- Combinations over life cycle

It's *all* investment!

What do we mean by “alternative treatment options”?



ORDM decision rules

- *Which* strategies?
Lowest average annual cost (PV) is used to determine which strategies to use
- *When* to change strategies?
 - Lowest marginal cost is used to determine when to transition to the next strategy, or
 - When intervention point is triggered by interaction of trend lines

PV is present value

Setting up the basic analysis: lowest annual life cycle cost

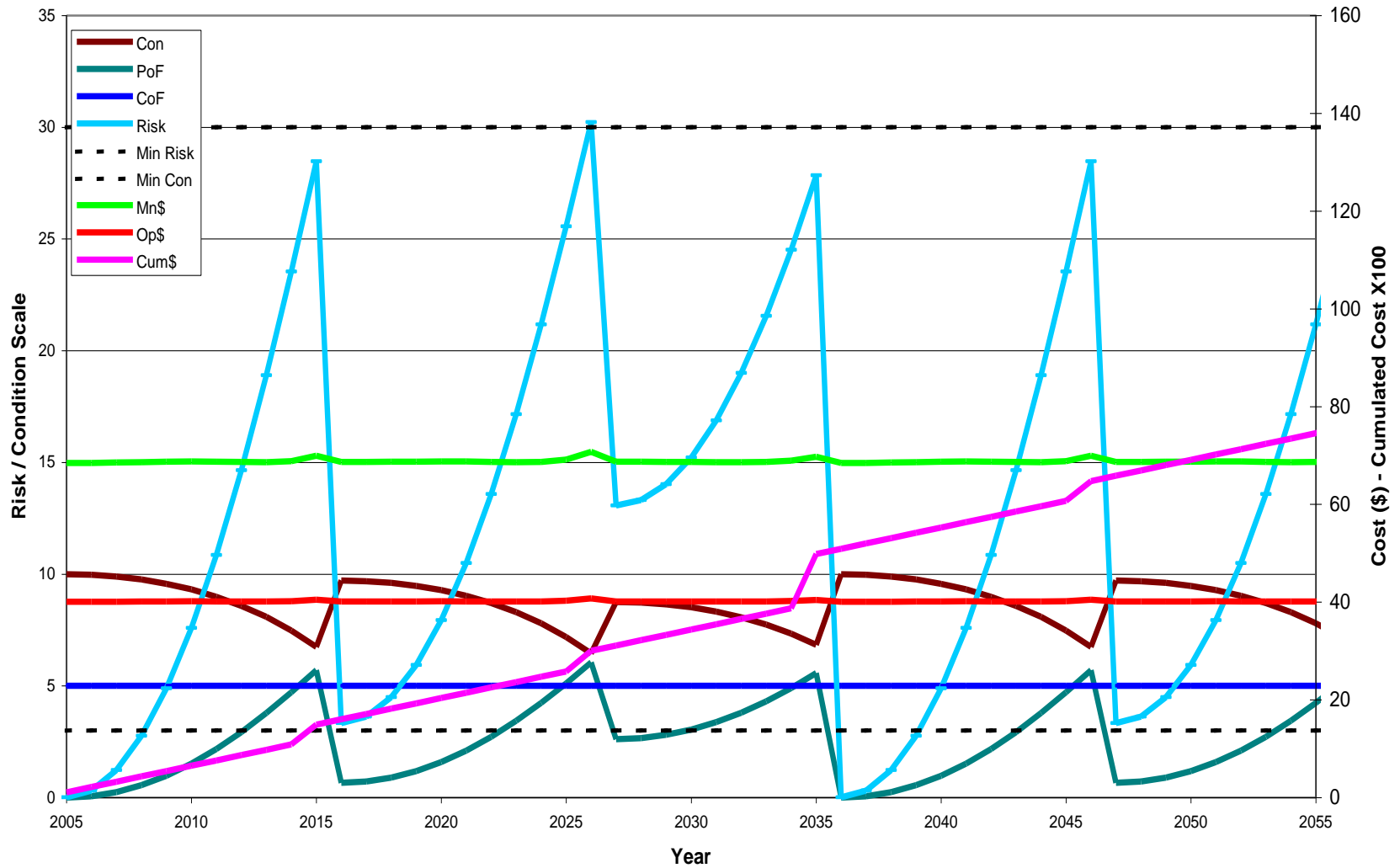
Microsoft Excel - ODM Example.xls

File Edit View Insert Format Tools Data Window Help Adobe PDF

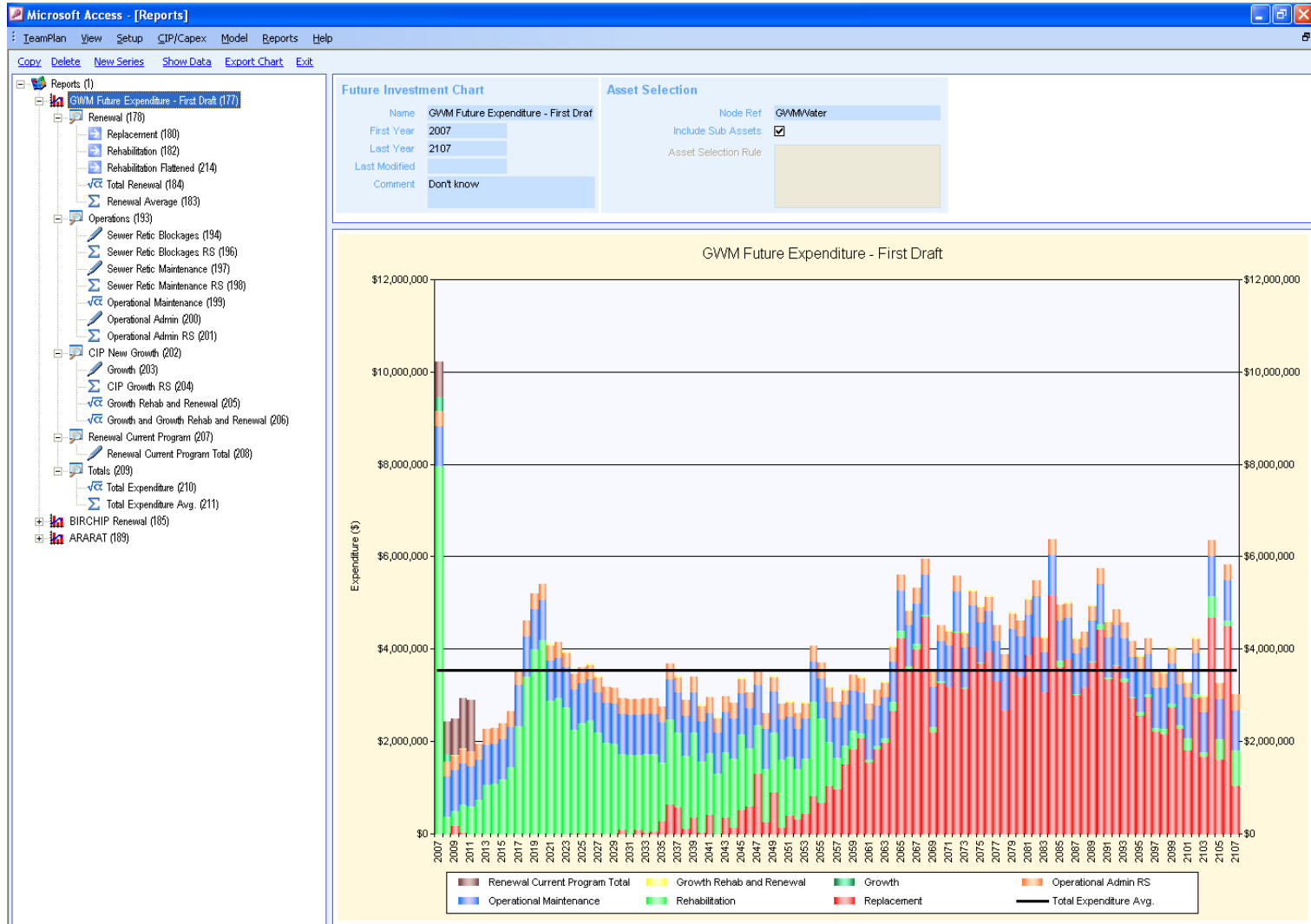
Arial 10 B I U \$ % , +.0 -.00

	A	B	C	D	E	F	G	H	I	J	K	L
1	Discount Rate	1.0%	Avg Annual \$									
2	Repair/Maintenance	Total		1	2	3	4	5				
3	Capital	\$ 4,500		\$ 4,500	\$ -	\$ -	\$ -					
4	Operations	\$ 2,033.91		\$ 350.00	\$ 402.50	\$ 414.58	\$ 427.01	\$ 439.82				
5	Maintenance	\$ 1,803.29		\$ 350.00	\$ 365.25	\$ 360.58	\$ 365.99	\$ 371.48				
6	Total Costs	\$ 8,337.20	\$ 1,667	\$ 5,200.00	\$ 757.75	\$ 775.15	\$ 793.00	\$ 811.30				
7	PV Total Costs	\$ 8,259.45	\$ 1,652	\$ 5,200.00	\$ 750.25	\$ 759.88	\$ 769.68	\$ 779.64				
8												
9	Refurbish			1	2	3	4	5	6	7	8	
10	Capital	\$35,500.00		\$ 1,775.00	\$ 1,775.00	\$ 1,775.00	\$ 1,775.00	\$ 1,775.00	\$ 1,775.00	\$ 1,775.00	\$ 1,775.00	\$ 1,775
11	Operations	\$ 7,515.19		\$ 325.00	\$ 329.88	\$ 334.82	\$ 339.85	\$ 344.94	\$ 350.12	\$ 355.37	\$ 360.70	\$ 366
12	Maintenance	\$ 6,887.73		\$ 275.00	\$ 279.13	\$ 283.31	\$ 287.56	\$ 291.87	\$ 296.25	\$ 300.70	\$ 305.21	\$ 309
13	Total Costs	\$49,902.92	\$ 2,495	\$ 2,375.00	\$ 2,384.00	\$ 2,393.14	\$ 2,402.41	\$ 2,411.82	\$ 2,421.37	\$ 2,431.07	\$ 2,440.91	\$ 2,450
14	PV Total Costs	\$45,382.14	\$ 2,269	\$ 2,375.00	\$ 2,360.40	\$ 2,345.98	\$ 2,331.75	\$ 2,317.71	\$ 2,303.85	\$ 2,290.17	\$ 2,276.68	\$ 2,263
15												
16	Replace			1	2	3	4	5	6	7	8	
17	Capital	\$61,000.00		\$ 1,525.00	\$ 1,525.00	\$ 1,525.00	\$ 1,525.00	\$ 1,525.00	\$ 1,525.00	\$ 1,525.00	\$ 1,525.00	\$ 1,525
18	Operations	\$ 10,853.58		\$ 200.00	\$ 203.00	\$ 206.05	\$ 209.14	\$ 212.27	\$ 215.46	\$ 218.69	\$ 221.97	\$ 225
19	Maintenance	\$ 12,243.67		\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 225.00	\$ 228.38	\$ 231.80	\$ 235
20	Total Costs	\$84,097.25	\$ 2,102	\$ 1,925.00	\$ 1,928.00	\$ 1,931.05	\$ 1,934.14	\$ 1,937.27	\$ 1,965.46	\$ 1,972.06	\$ 1,978.77	\$ 1,985
21	PV Total Costs	\$69,240.55	\$ 1,731	\$ 1,925.00	\$ 1,908.91	\$ 1,893.00	\$ 1,877.25	\$ 1,861.68	\$ 1,870.06	\$ 1,857.77	\$ 1,845.63	\$ 1,833
22												

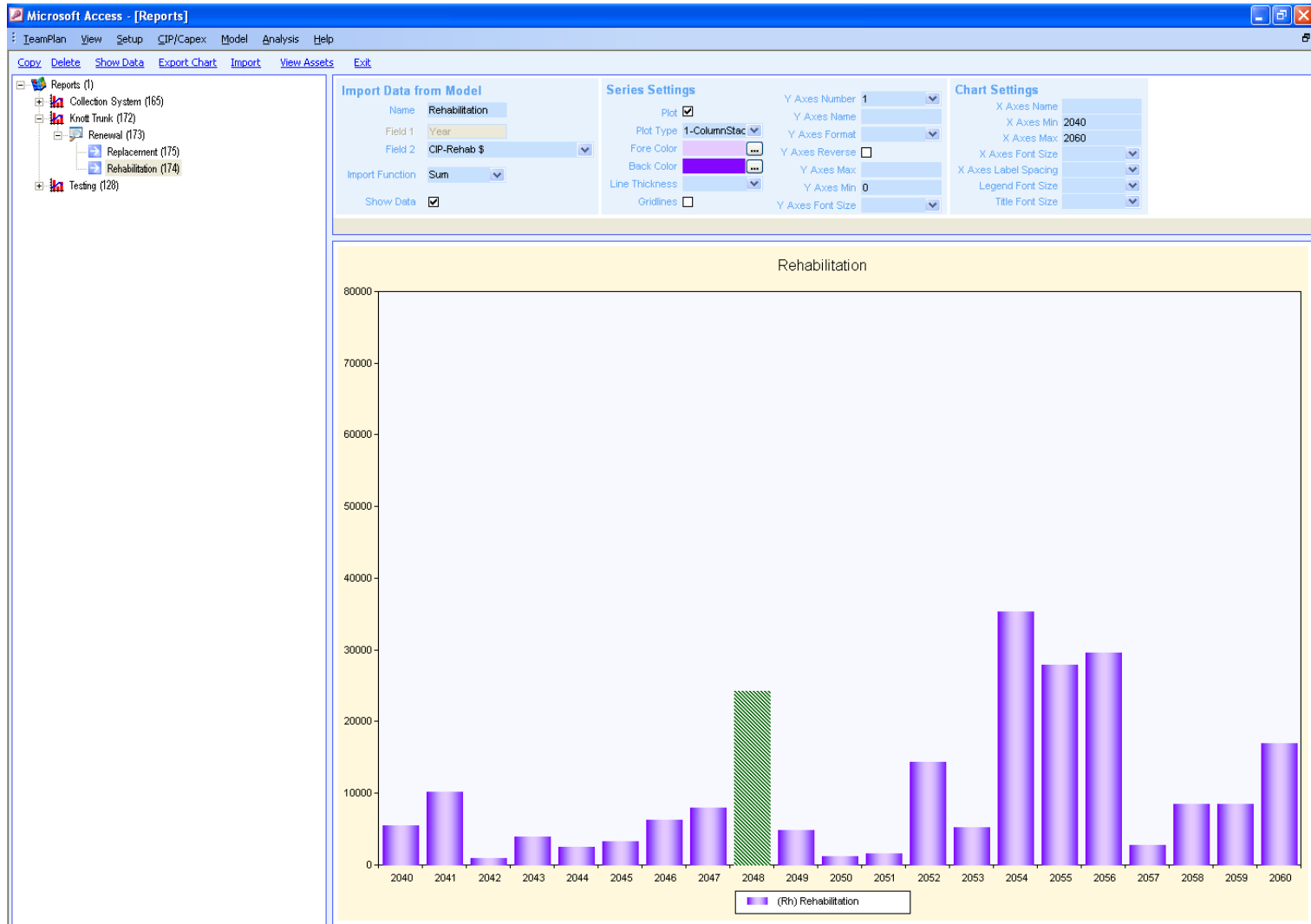
ORDM decision logic



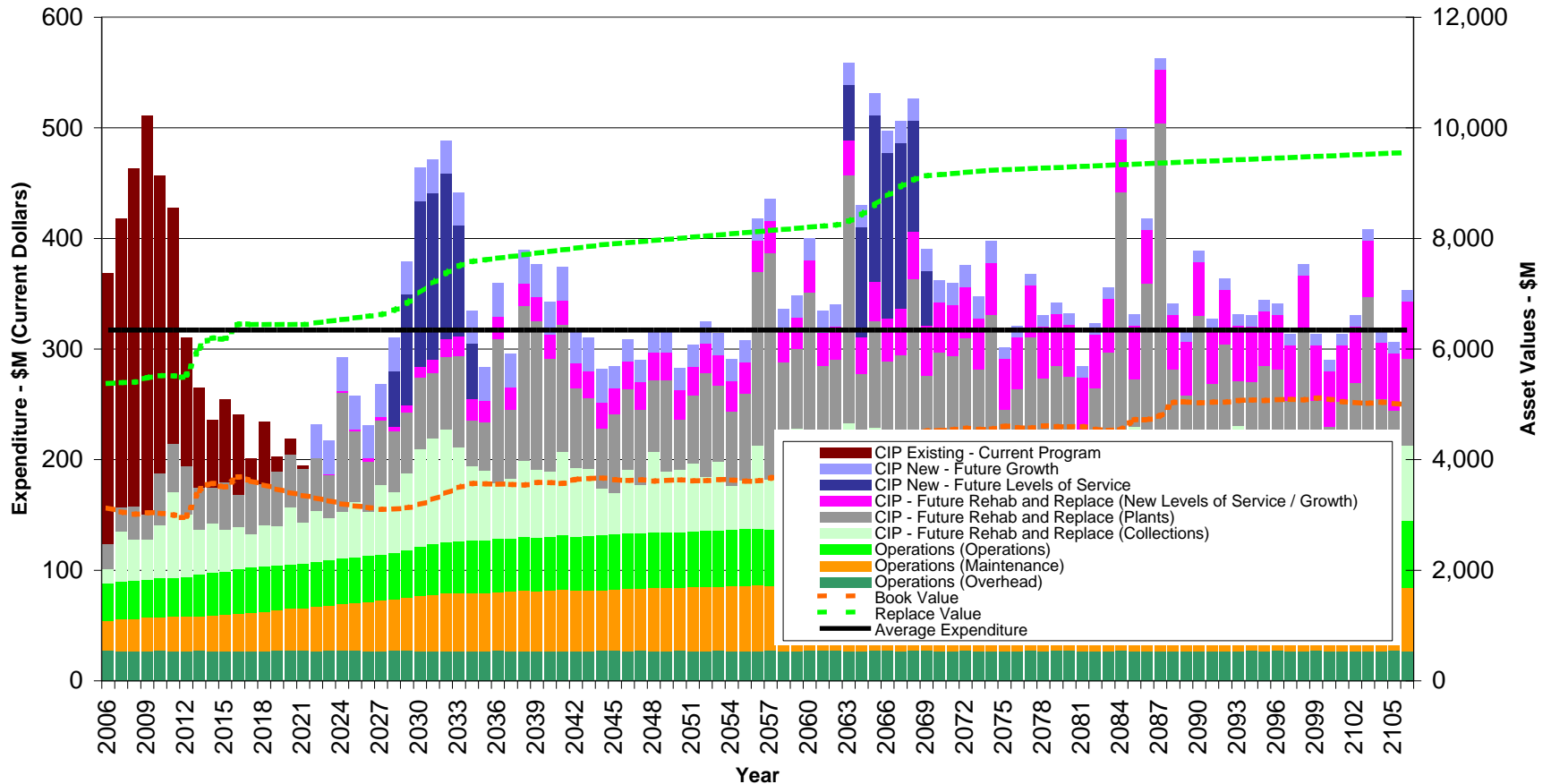
Reporting and scenarios



Drilling into assets



Overall projected (optimized) expenditures



Key points from this session

How do I optimize O&M and capital investment?

Key Points:

- Follow a logical best practice process – Optimized Decision Making or Life Cycle Costing Analysis.
- Get the best information and data you have, consider all feasible alternatives, and generate your best strategy.
- Consider non-asset solutions!

Associated Techniques:

- Optimized renewal decision-making
- Life-cycle costing (including projections)
- Decision-tree analysis
- Weighted decision tables