

Step 1: Map out your system - What do you own?

- List all your asset types. Consult with relevant staff to ensure you are not missing important components.
- Areas of responsibility: exclude assets that are not owned by your organisation (privately owned or owned by the MoTI, regional districts, etc.)
- Simplify your inventory by grouping assets together when possible. For instance, you can include valves and all nodal fittings such as junctions, tees, crosses, bends and ferrules in the unit replacement cost of your mains.
- However, not everything can be put in the same bag. Break down facilities such as treatment plants, pump stations and PRVs into main components based on their service life (e.g. Building Structural, Electrical/Controls, Process Mechanical, Generator, SCADA, etc.)

Don't get lost in small details

WATER	Count	Count (units or length)	Material	Installation Year	Service Life	Unit Cost	Condition	Source
Mains	490 km	✓	✓	✓	✓	✓	✓	LinearUtilities_Simplified1Feb2010.xlsx / Water Facilities.xlsx
Wells	19	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xlsx / Water Facilities.xlsx
Treatment facilities	1	✓	NA	✓	✓	✓	✓	
Booster stations	7	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xlsx / Water Facilities.xlsx
Chlorination stations								
Reservoirs	7	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xlsx / Water Facilities.xlsx
SCADA systems								
PRV stations	20	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xlsx
Valves								
Hydrants	2,280	✓	NA	✓	✓	✓	✓	Water Hydrants - 2009 Summary Final_r2.pdf
Service connections	18,132 units	✓	NA	✓	✓	✓	✓	Water Connections - 2009 Summary Final_r2.pdf
meters	1,601	✓	NA	✓	✓	✓	✓	Water Meters - 2009 Summary Final_r2.pdf
Other								

yann.dellevin: Is this a good representation of the water system or am I missing important components?	yann.dellevin: Included in the mains	yann.dellevin: Included in other facilities	yann.dellevin: FOR WELLS, BOOSTER STATIONS, RESERVOIRS, AND PRV STATIONS: List of active facilities to be validated by relevant staff	yann.dellevin: FOR HYDRANTS, SERVICE CONNECTIONS, AND METERS: 2 options: A. Complete inventory with installation year = ESL. B. Inventory summary (total count, ESL, unit cost) + annual \$ value spent on renewal	yann.dellevin: If you have inspection reports, great. If not I can do without.	yann.dellevin: FOR WELLS, BOOSTER STATIONS, RESERVOIRS, AND PRV STATIONS: I need ideally the condition, or the installation year
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Include other staff when you do this kind of exercise

It is meant to be a repeatable exercise: document every step of it

Step 2: What asset data do you need?

- To conduct this type of long-range analysis, you need to answer two questions for each asset type:
 - When will this asset be replaced?
 - How much will it cost?
- To answer these two questions, you need:
 - The installation year
 - The expected service life
 - The replacement value

Assumption: Assets are replaced by similar assets at the end of their service life.

Condition is the most accurate indicator of the remaining service life of an asset and should be used when available. In the absence of condition data, age can be used as a proxy for determining assets' remaining service life.

The replacement value of an asset is different than its depreciated value. PSAB 3150 and TCA reports can be used to determine installation years and installation costs but depreciated values are not good indicators of current replacement costs.

For water, sewer and storm mains, diameter and material pipes are also nice to have. However, it is often possible to guess these parameters in the absence of reliable data.

Where to look for asset data?

- GIS
- PSAB 3150 / TCA Reports
- Paper based or digital asset inventories

- Databases
- Condition assessment studies
- As-built drawings
- Maintenance management systems
- Local knowledge

PSAB 3150 outputs are a good place to look for installation years and installation costs.

Step 3: From raw data to data you can use

- Once you collected all asset data available, you need to translate this raw data into data you can use for the purpose of this analysis.

Got data gaps? Fill in the blanks

- Remember that the outputs of this kind of analysis do not provide information on specific assets. This allows you to make assumptions in order to account for assets for which basic data is missing. Making assumptions is a necessary step because you cannot expect your inventory to be perfect, regardless of the size of your utility. And yet, each asset requires at least an installation year.

- Prioritize by asset type. The level of effort invested in bridging data gaps can depend on financial, operational or safety considerations. It doesn't have to be perfect. Striking the right balance between accuracy and practicality is the goal.

Accuracy VS Practicality

Unknown Parameters	Length in Raw Inventory	As % of the Raw Inventory	After Assumptions
At Least One Unknown Parameter	167,790	71%	4%
Unknown Material	151,801	65%	4%
Unknown Installation Year	45,033	19%	0%
Unknown Diameter	13,360	6%	0%

Explain and document your assumptions

- There are different techniques available to fill in the blanks. Most of the time, making educated guesses or using medians and averages is good enough for the level of detail required by this exercise. However, in some instances, it can be worth spending more time on populating unknown asset data. It is the case for mains as they usually represent 50% or more of the valuation of a typical water or sanitary sewer system in BC.

IF UNKNOWN			THEN			Length in meters
Material	Installation Year	Diameter	Material	Installation Year	Diameter	
X			Unknown Materials guessed based on existing data			120,111
X	X		Unknown Materials guessed based on existing data	Unknown Installation Years guessed based on existing data		18,719
		X		Unknown Installation Years guessed based on existing data		15,599
X	X	X	Unknown Material (80 year Expected Service Life for the purpose of this study)	Unknown Installation Years guessed based on existing data	Unknown Diameters guessed based on existing data	10,465
X		X	Unknown Materials guessed based on existing data		Unknown Diameters guessed based on existing data	2,506
	X	X		Unknown Installation Years guessed based on existing data	Unknown Diameters guessed based on existing data	250
		X			Unknown Diameters guessed based on existing data	140

A real life example using the "quota" method:

- Pipes installed before 1970 have no material recorded.
- You make obvious assumptions ("No PVC and HDPE before 1970", "Bob remembers that the first concrete pipes were installed in 1975", etc.)
- You build a profile of known data using percentages (e.g. 26% of pipe length installed in the '70s was in Asbestos Cement, 41% in ductile iron, etc)
- You apply this profile to your unknown data.
- It is not perfect but more accurate that assuming that 100% of pipes installed prior to 1970 were in one material only.

Do not underestimate the value of local expertise

Step 4: Populate Template #1: Linear inventory

- Summarize your linear inventory by grouping pipes together by age, material and diameter. This will reduce the inventory to a more manageable size.

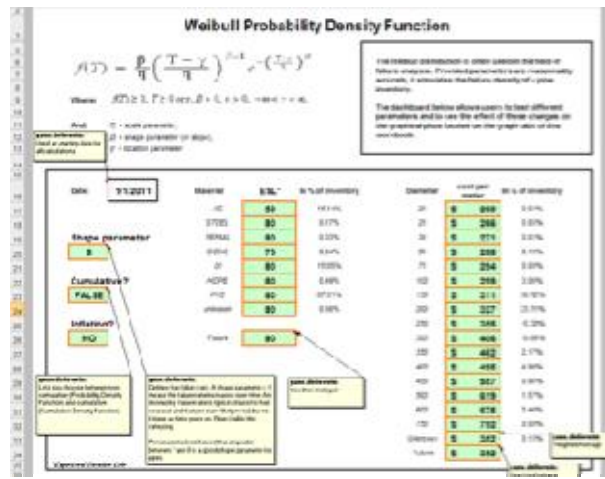
- Paste your reduced inventory (Year, Length, Material) on tab CALC_Length_1. Adjust the number of rows and years if needed.

MS Excel's Pivot Tables are very useful for this type of job.

- Repeat this step for the tab CALC_Cost_1: Paste your reduced inventory (Year, Length, Diameter, and Material) on tab CALC_Cost_1 and adjust the number of rows and years if needed.

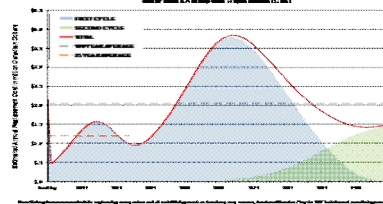
- The FIRST CYCLE line of CALC_Length_1 becomes the Length input for the calculation of your second cycle (tabs CALC_Length_2 and CALC_Cost_2). It's all linked together so you should not have to worry about that.

Weibull Distribution Calculation Sheet LENGTH - FIRST CYCLE													
Pipe Group No.	Mean Year of Installation	Length	Material	Expected Life (year) WEIBULL BETA	Remaining Service Life	ALPHA (Weibull Slope)	Cumulative Prob	Year	2002	2003	2004	2005	2006
389	2007	76	PVC	80	77	0	FALSE	2002					
390	2007	88	PVC	80	76	0	FALSE	2002					
400	2007	2,081	PVC	80	76	0	FALSE	2002					
401	2007	4,179	PVC	80	76	0	FALSE	2002					
402	2007	2,095	PVC	80	76	0	FALSE	2002					
403	2007	236	PVC	80	76	0	FALSE	2002					
404	2008	462	HDPE	80	77	0	FALSE	2002					
405	2008	427	PVC	80	77	0	FALSE	2002					
407	2008	3,300	PVC	80	77	0	FALSE	2002					
408	2008	5	PVC	80	77	0	FALSE	2002					
409	2008	700	PVC	80	77	0	FALSE	2002					
410	2008	222	PVC	80	77	0	FALSE	2002					
411	2008	2,662	PVC	80	77	0	FALSE	2002					
412	2009	63	DI	80	78	0	FALSE	2002					
413	2009	174	PVC	80	78	0	FALSE	2002					
414	2009	174	PVC	80	78	0	FALSE	2002					
415	2009	1,937	PVC	80	78	0	FALSE	2002					
416	2009	129	PVC	80	78	0	FALSE	2002					
417	2009	174	PVC	80	78	0	FALSE	2002					
418	2009	3,424	PVC	80	78	0	FALSE	2002					
419	2009	371	PVC	80	78	0	FALSE	2002					
420	2009	196	PVC	80	78	0	FALSE	2002					
421	2009	371	PVC	80	78	0	FALSE	2002					
422	2009	143	PVC	80	78	0	FALSE	2002					
423	2009	49	PVC	80	78	0	FALSE	2002					
424	2010	726	PVC	80	79	0	FALSE	2002					
425	2010	128	PVC	80	79	0	FALSE	2002					
426	2010	180	PVC	80	79	0	FALSE	2002					
427	2010	76	DI	80	79	0	FALSE	2002					
428	2010	76	DI	80	79	0	FALSE	2002					
429	2010	490,816	490,816	490,816	490,816	490,816	490,816	490,816	490,816	490,816	490,816	490,816	490,816
430	2010	490,795	490,795	490,795	490,795	490,795	490,795	490,795	490,795	490,795	490,795	490,795	490,795
431	TOTAL	4,558	4,558	4,558	4,558	4,558	4,558	4,558	4,558	4,558	4,558	4,558	4,558
432	WEIBULL SERVICE LIFE	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916	5,272,916
433	IF you want to	491,116	491,116	491,116	491,116	491,116	491,116	491,116	491,116	491,116	491,116	491,116	491,116
434	CUMULATIVE	4,558	7,097	8,646	10,194	11,743	13,291	14,840	16,389	17,938	19,487	21,036	22,585



- The output of your second cycle is looked up on the line SECOND CYCLE of CALC_Length_1 and CALC_Cost_1. Both cycles are then summed up on the line TOTAL of the same tabs.
- All parameters (Service lives, unit costs, cumulative and shape parameter) are conveniently centralised on the parameter tab. Once your model is built, these parameters are the only changes you have to make to run scenarios.

Change parameters, see the results →

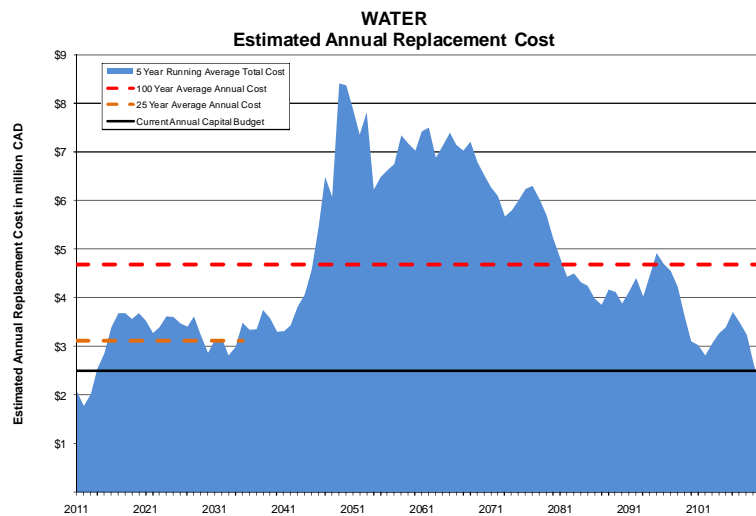
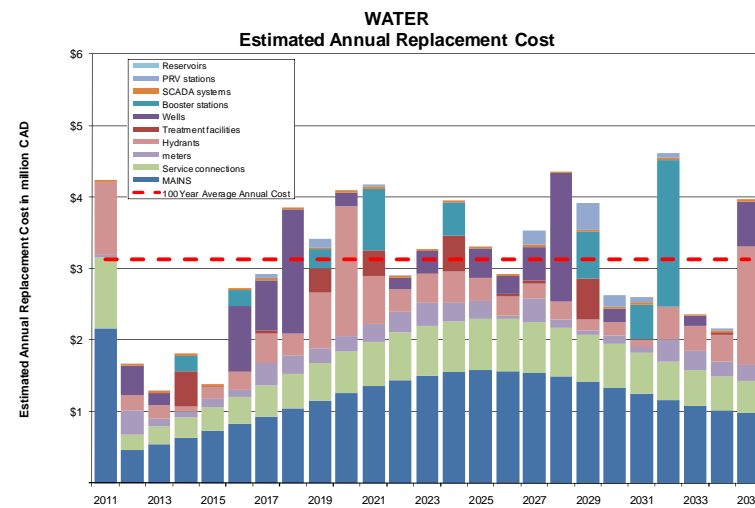


Step 5: Populate Template #2: Vertical inventory

- Import your raw data tabs in the file for future reference.
- Summarize and merge your data when needed.

Link service lives to a look up table. You can then make changes on the fly

- Paste your summarized data into the source data tabs.
- All calculations are already entered in the source data tabs but you will have to adjust the number of rows according to the number of assets, and the number of columns according to the number of cycles that fit in 100 years.



- Link Expected Service Lives to a look-up table to facilitate changes and scenarios.
- Total life cycle costs are automatically calculated on tab CALCULATIONS
- Paste Special/Transpose the output of the Linear Template (line TOTAL of CALC_Cost_1) in the column MAINS of the tab CALCULATIONS.
- Tab CALCULATIONS is the source data tab for all graphs.
- Paste your data from column A to G in the INVENTORY tab for a printable summary of all your assets.

That's it, you're done!
You just completed a Long-Range Renewal Capital Plan for your utility

Top Down Asset Management for Dummies: Template User Guide

This guide is a resource for the use of MS Excel templates
AECOM_TOPDOWN_Template_1_Linear.xlsx
AECOM_TOPDOWN_Template_2_Summary.xlsx

Available free of charge

www.nationalbenchmarking.ca

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Key Points

- 1. You don't need perfect data and you don't need expensive software or equipment**
- 2. If kept simple, it can be done quickly**
- 3. Communicate your results within (and outside) the organisation**

