

Conducting a Water Distribution System Renewal Plan in Smaller Utilities: Getting Started

Prepared for the AECOM Technology
Practices Network (TPN)

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Outline

- Walkthrough of a “Top Down” Asset Management Assessment for a Linear Network (water, sewer, storm)
- Present some Excel-based tools and techniques that we have used with success
- Show how the results can front end a stakeholder education process designed to help you increase utility funding
- What do you do then?

This Procedure is for:

- Small to medium sized utilities that feel they are dramatically under resourced to respond to looming infrastructure renewal demands
- Focuses mostly on underground pipes but can be adapted to include appurtenances and above ground facilities
- May not have complete data about their infrastructure and individual assets
- Assumes you have a basic knowledge of asset management

Situation: Chicken or the Egg?

- In order begin renewing aging infrastructure, you need additional resources
- But you might already be short resources to complete basic O&M needs
- Stakeholders will require convincing evidence that additional resources will be required
- You don't have resources to get conduct detailed asset condition assessment data to support new funding needs
- Where do you begin?

The Customer Service Challenge

- Infrastructure reinvestment is difficult to explain to customers
- You are going to ask them to pay more for a level of service they already have
- Their first response may be that the utility has done something wrong or has been mismanaged
- Before you can get useful feedback, you will need to “educate” your stakeholders

Who Are the Stakeholders?

- Internal Stakeholders may include:
 - Utility Manager
 - City Engineer
 - City Financial Manager (CFO)
 - Chief Administrative Officer (CAO)
- You will need to get through these Stakeholders before you can get to the External Stakeholders
 - City Council and Mayor
 - Utility Customers and Citizens
 - Regulators

Our Customer Stakeholders

- In most communities, customers may know very little about water or wastewater utilities
- They may not even be aware of how much these services costs
- How will you asked them to pay more, perhaps a lot more and they will not receive anything more than they already have?

Asset Management Best Practice Documentation

- Asset management is now well documented
- Numerous Best Practices exist to provide guidance and standards though all phases
 - WERF
 - WRF
 - IAM/NAMS
- This lesson will not summarize or repeat this content.
- This presentation is based on these standards and will outline proven steps to get started

Asset Management Basics

- In general, we approach a population of assets in two distinct ways:
- **Top Down Approach: Very High level**
 - Medium to Long Range Financial Forecast
 - Does not focus on any one asset, but rather considers a population of grouped assets
 - Used for communications and planning
 - IS NOT A CAPITAL PLAN
- **Bottom Up: Detailed Level**
 - Is an optimized Capital Plan that takes into account all of renewal, growth, technical obsolescent, and level of service demands

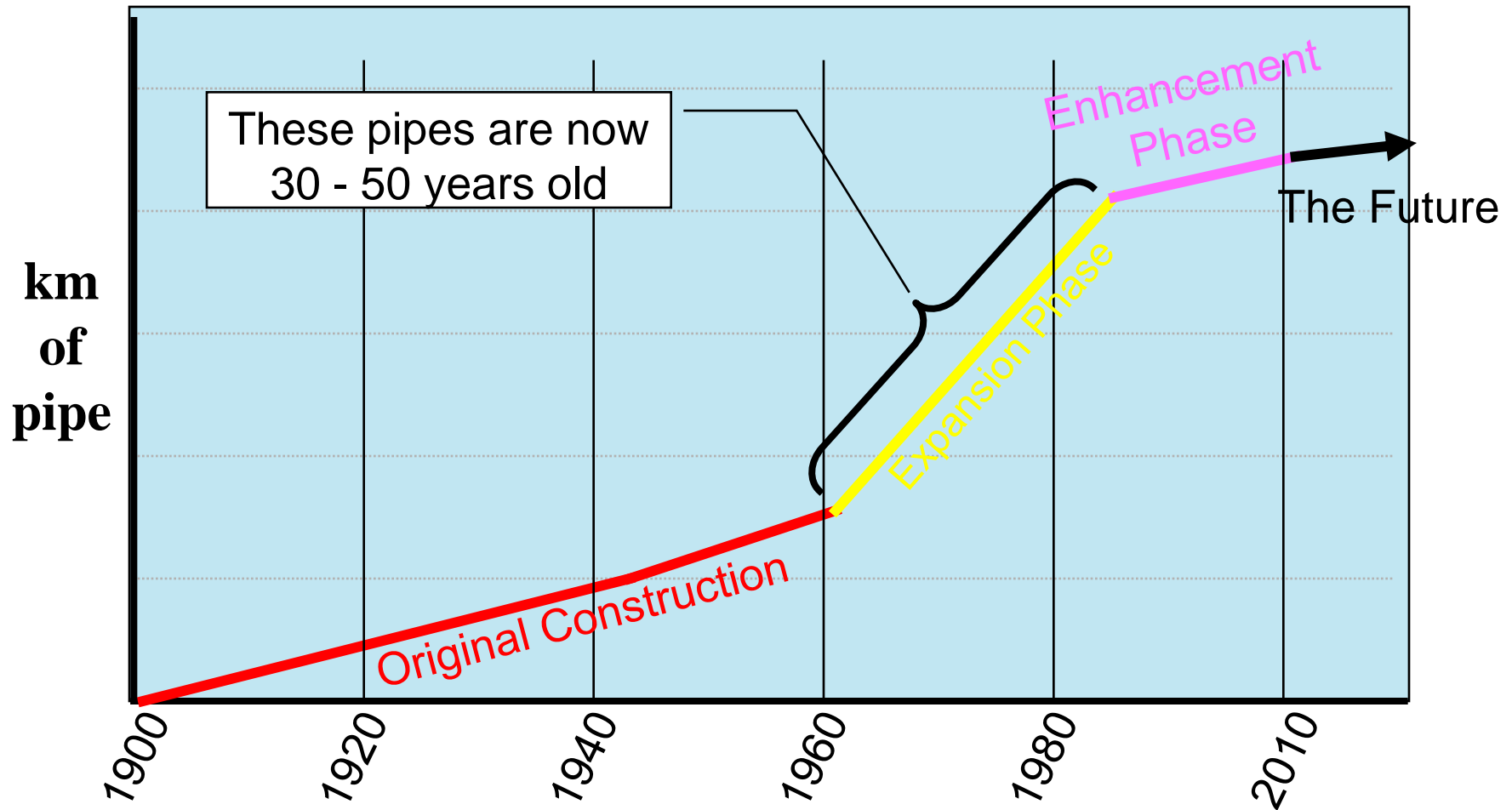
Top Down Asset Management

- The tools and techniques that we use for the Top Down and Bottom up are completely different:
 - Effort for a Top Down Study: 10%
 - Effort for a Bottom Up Study: 90%
- Top Down Study results are a vital part of the stakeholder education process
- Objective? Help get you money!

Top Down Assessment

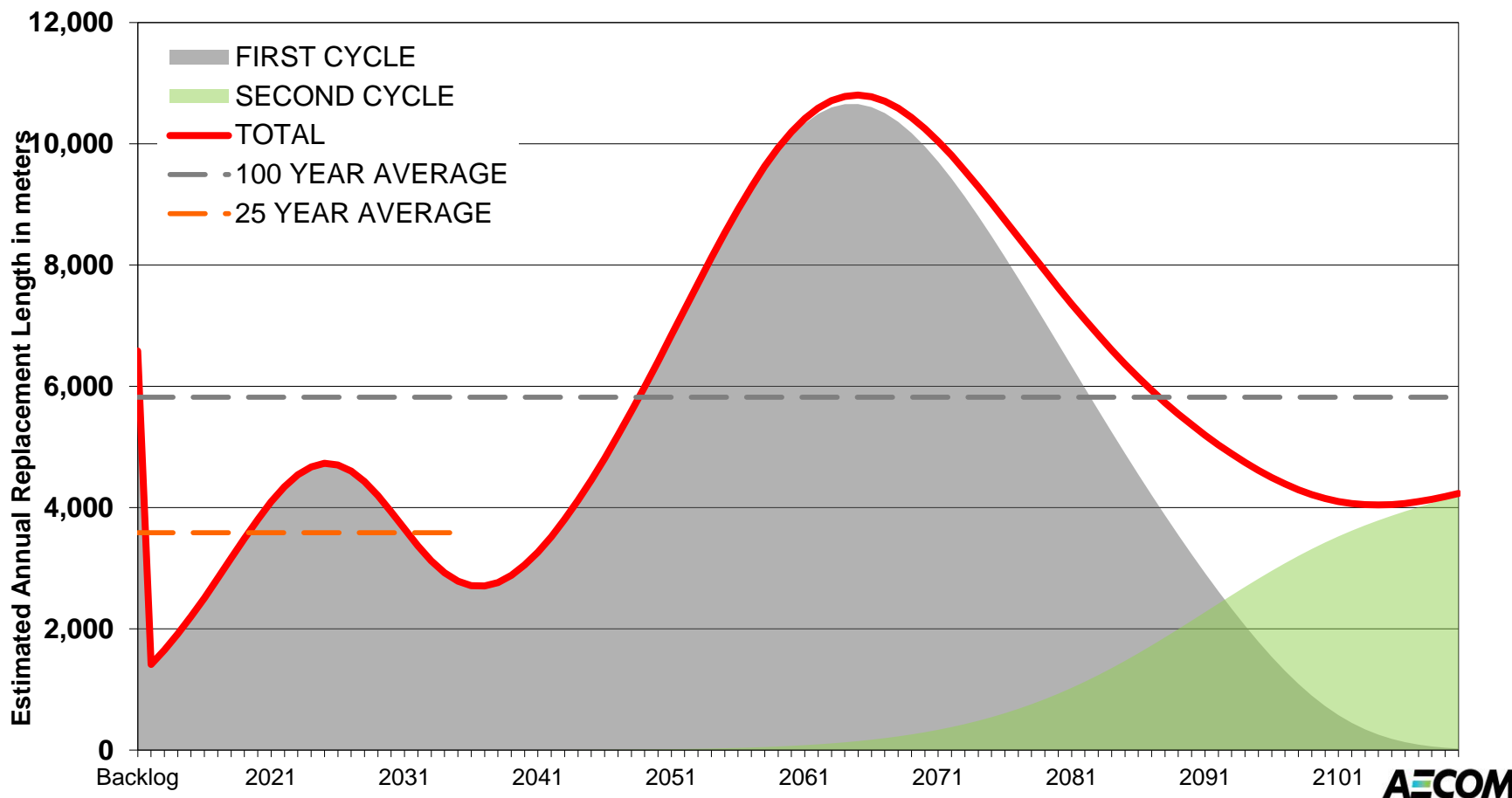
- Describes the infrastructure in terms of its collective replacement value
- Estimates the condition of the infrastructure by comparing each asset's current age to the asset's expected service life
- Using basic mathematics, predicts when each asset will need to be replaced
- Simply adds up the expected replacements in each year to form a long range forecast

Typical Western North American Water Utility Infrastructure Histogram



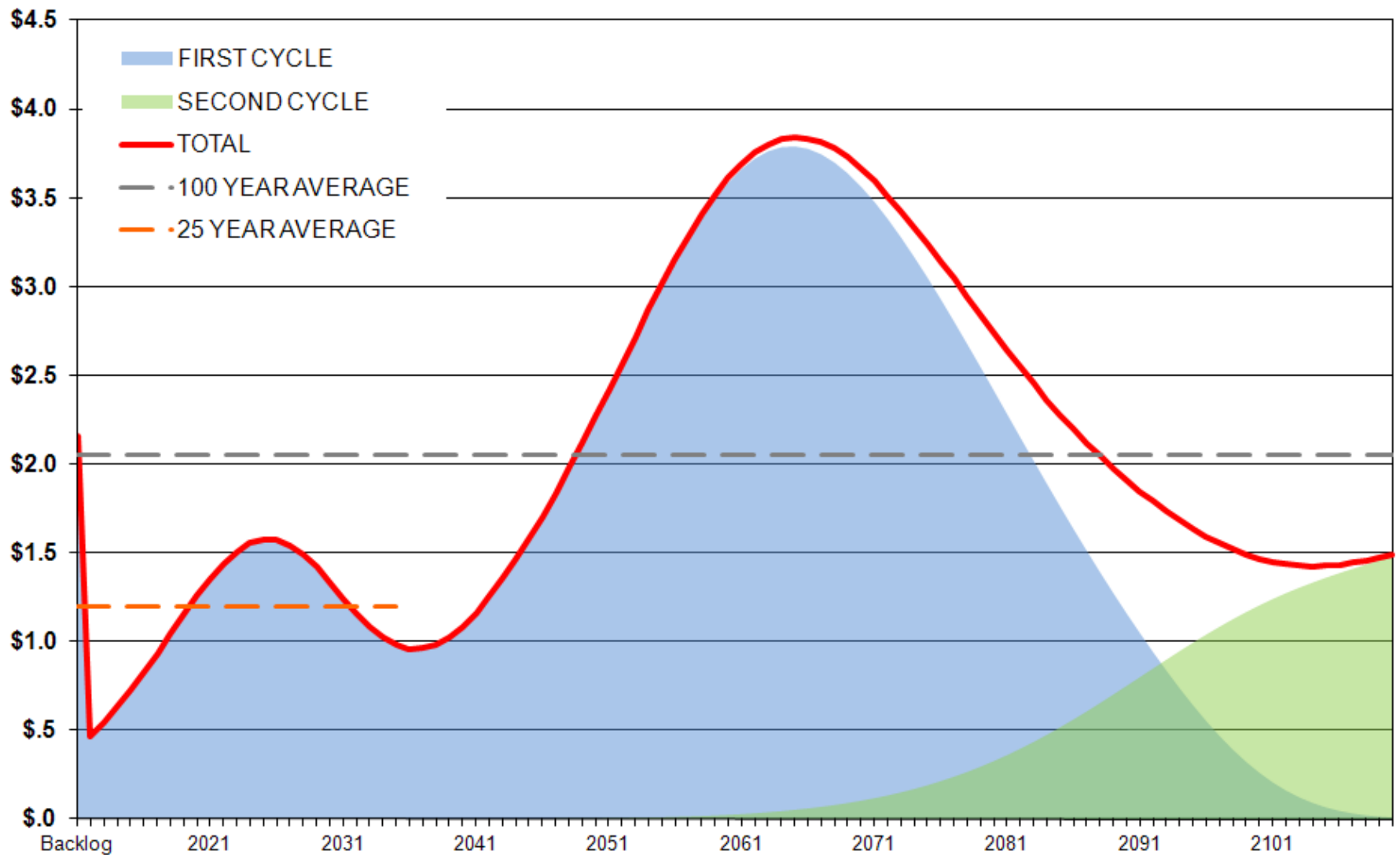
Top Down Assessment Output: Forecast the Lengths of Main that Will Need to be Replaced.....

Water Mains Anticipated Replacement Length

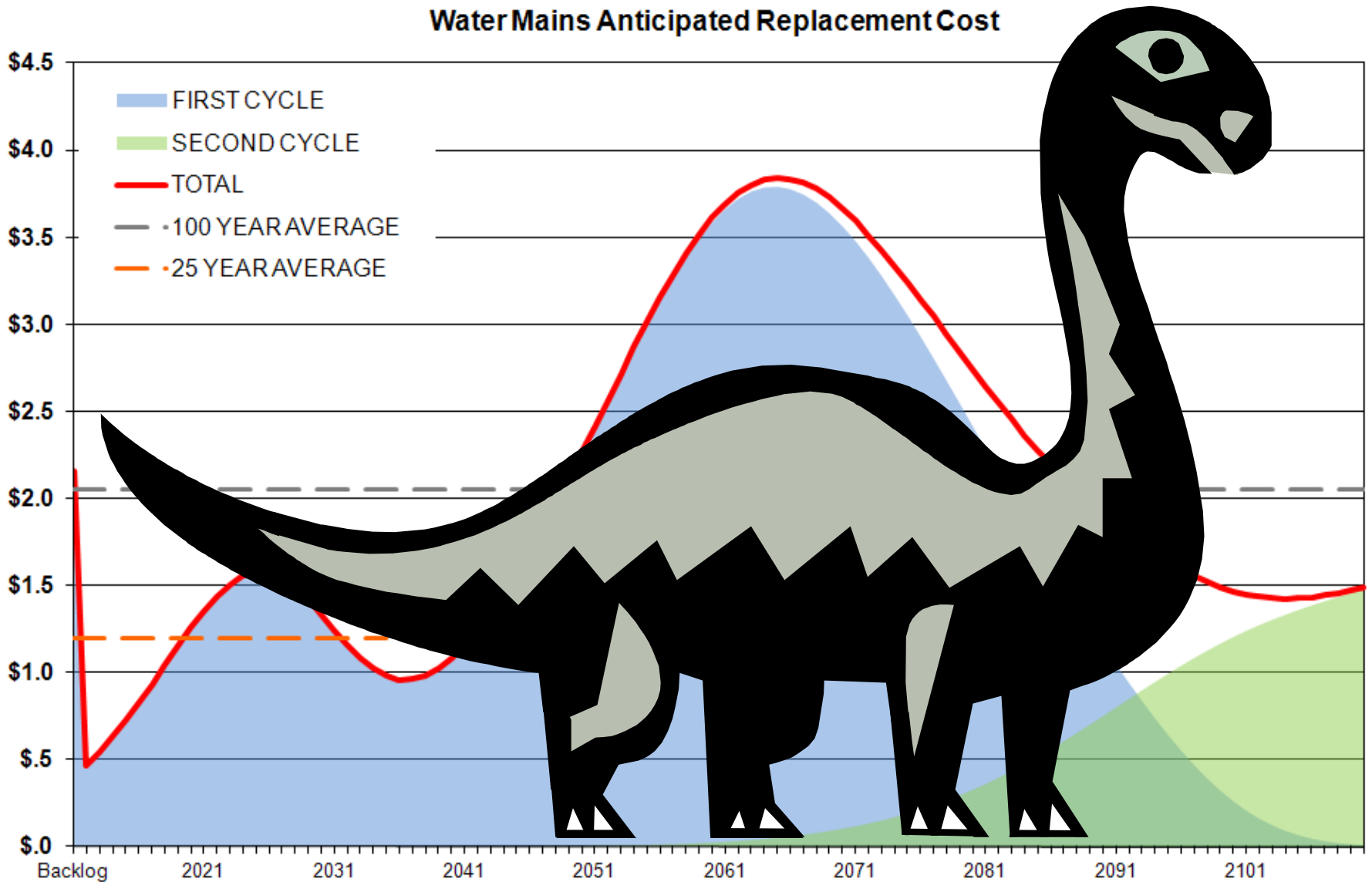


Top Down Output: And the Estimated Cost

Water Mains Anticipated Replacement Cost



Thus, the Nessie Curve:



What is a Top Down Assessment?

(and more importantly, what is it not?)

- Strategic level decision making tool
- High level identification of future infrastructure requirements of a utility
- It is a communication tool

- It is not a detailed analysis
- It does not focus on specific assets
- It is not an Asset Management Plan

How Can it Be Used?

- To identify the approximate funding gap over a planning horizon
- To raise public and council awareness

...but ultimately...



to get more money

Key Points to Keep this Exercise Simple but Useful

- You don't need perfect data, expensive software, or detailed asset analysis
- If kept simple, this can be completed in a short timeframe
- The purpose of the output is not to plan capital works, but to communicate your situation to stakeholders

Excel Renewal Modeling Tool Walkthrough

- Excel tool templates can be downloaded from www.nationalbenchmarking.ca
- Instructional guide also available
- [Templates\AECOM_TOPDOWN_Template_1_Linear.xlsx](#)

You Will Need To Prepare an Simple Excel Table

- Basic asset inventory data for pipe lengths
 - Pipe lengths and diameters
 - Approximate year of installation
 - Pipe material (to help estimate and expected service life)
 - Current pipe replacement costs (though at range will also work)
- If your asset inventory is not complete, you renewal estimates will be incomplete.

STEP 1: Clean up your asset inventory

- Prepare an Excel table to document your asset inventory
- If you have a GIS, this is a great starting point
- May need to check as built drawings or CAD files
- This will be the most time consuming task.
- The more accurate it is the better, but it doesn't have to be perfect

STEP 2: Reduce The Inventory

- From thousands of records to a more manageable size
- Form logical groupings of like pipes (similar age and size is best)

STEP 3: Copy and Paste in Calculation sheets

- Make room for your inventory in the calculation sheets
- Extend formulas
- Paste your inventory columns
- Check the results

Cutting and Pasting Details:

- Paste your reduced inventory (Year,Length,Material) on tab CALC_Length_1
 - Adjust the number of rows and years if needed.
- Repeat this step for the tab CALC_Cost_1
 - 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.

STEP 4: Link to Parameters

- Link material, size and diameters to the parameter tab
- You can define the parameters as you wish based on your local conditions
- By changing the parameters, you can quickly model a range of possible outcome scenarios

Using a Distribution Function

- The probability for a segment to be replaced exactly at the end of its theoretical service life is 3%.

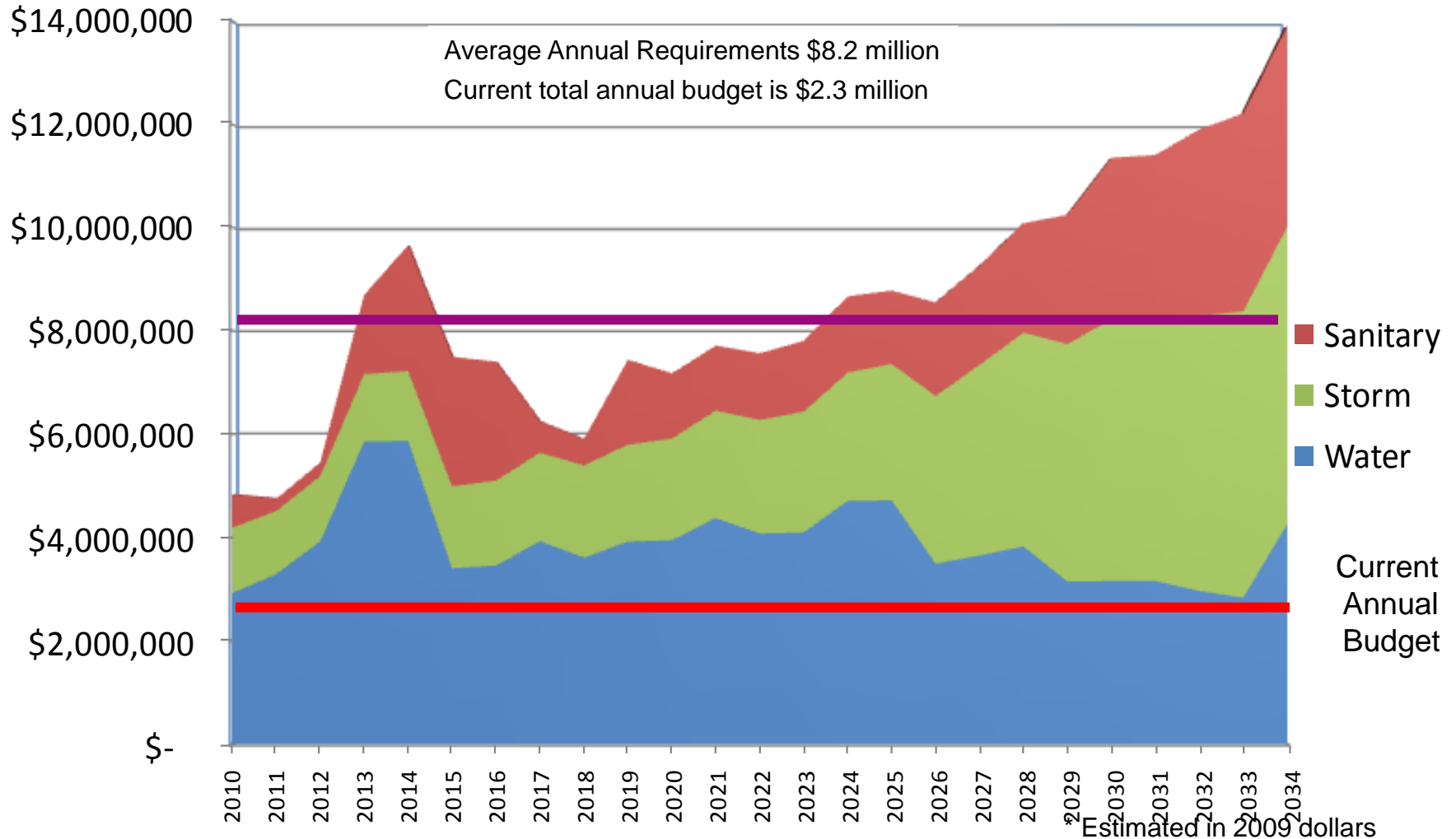
- | A | B |
|------|---|
| Data | Description |
| 105 | Value at which to evaluate the function |
| 20 | Alpha parameter to the distribution |
| 100 | Beta parameter to the distribution |
- | Formula | Description (Result) |
|--------------------------|---|
| =WEIBULL(A2,A3,A4,TRUE) | Weibull cumulative distribution function for the terms above (0.929581) |
| =WEIBULL(A2,A3,A4,FALSE) | Weibull probability density function for the terms above (0.035589) |

Now You Can Begin Forecasting Your Own Renewal Scenarios

- By changing the parameters, use can simulate a wide range of conditions and outcomes
- Easy to understand: Simple mathematical summation of the assets that are anticipated to be replaced in each year
- Then you can now compare the current level of budgeted renewal capital to the amount that is required. (Infrastructure Gap)

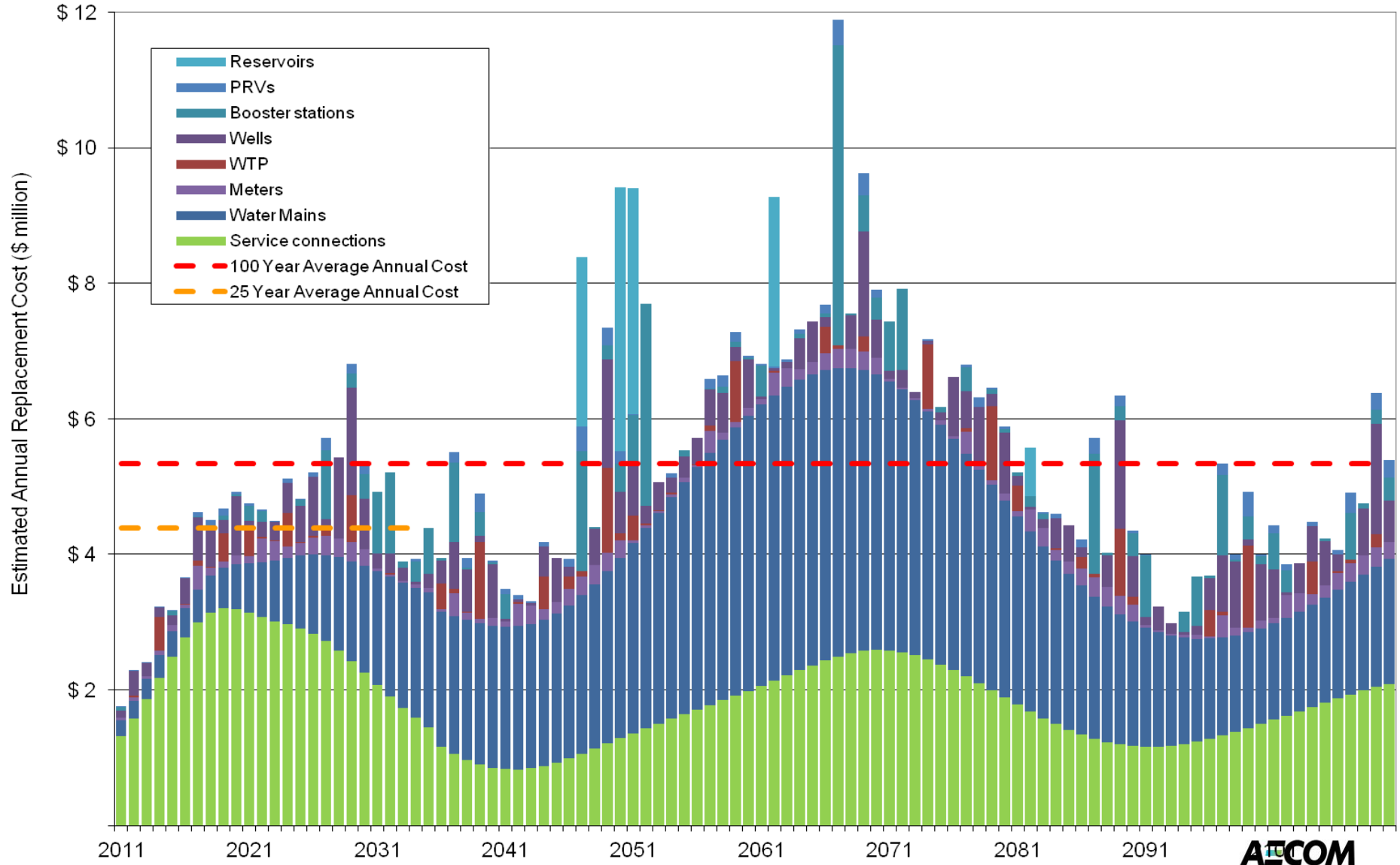
So it looks something like this:

Combined Impact of Water, Sanitary, and Stormwater Replacement Budget Projections – 25 years



Can Include both Linear + Vertical

Water infrastructure: Estimated Annual Replacement Cost



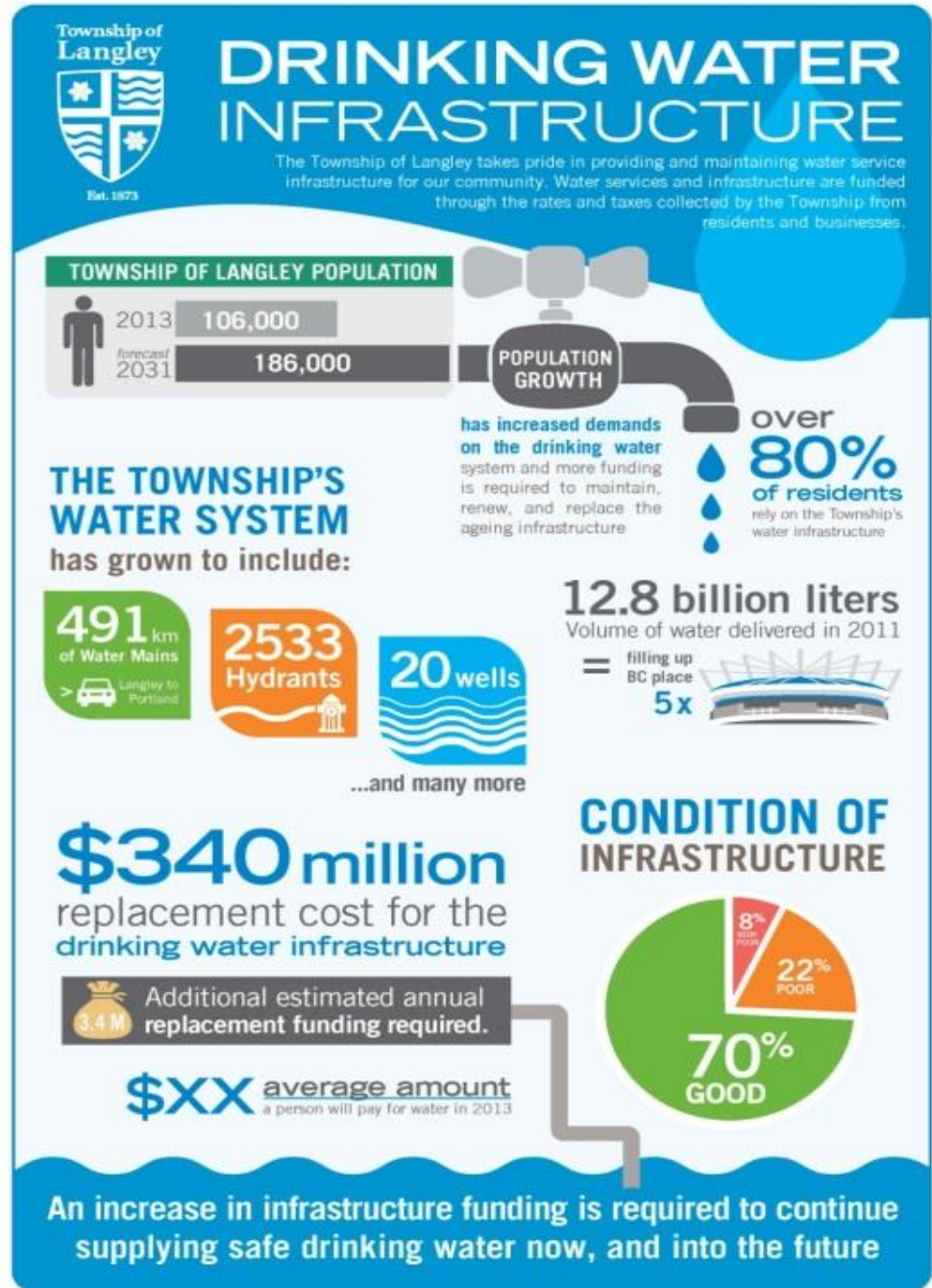
Now What?

- Begin planning your stakeholder education process
- Every community is different, but how do you present “bad news” (eg; rates will have to increase)?
- Begin with providing education about the local infrastructure and the “facts” within the Nessie curves.

Design Your Own Stakeholder Education Process

- Presentations to the Senior City Management, and to Council.
- Consider Utility Brochures and send to all residents.
- Targeted Presentations to Ratepayer associations.
 - Include feed back questionnaire.
- Municipal Website Content
- Public Open House.

Example Brochure



Considerations for Keeping Things Simple

- You must keep materiality in mind:
 - Basic economics: Anything belong 30 years is almost irrelevant.
 - Keep significant figures in mind: Once you make a “guess-timate” (eg: I think that AC pipes will last 60 years), even 2 significant figures is probably incorrect. Don't blow you brains out try to get detailed accuracy on things that do not really matter.

What is Next?

- The next step should be a focused Bottom Up Asset Management Strategy to identify the optimal sequence of individual asset renewals
- These decisions should be based on a methodology that take actual asset condition and criticality into account. This is a much longer and more complicated process.
- The objective of a Top Down assessment is to get adequate resources to complete the Bottom Up assessment

Thanks for your attention

- Good luck!
- Please feel free to follow up with me on any of this