Managing Aging Infrastructure

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- **Introduction**
  - What are the issues?
  - What are the resulting concerns?
- **What can be done?**
  - What others have tried
- **Infrastructure Assets Management (IAM)**
  - Why do it?
  - What to do and how?
- **IAM - is it for my community?**

Some of the Issues…
for everyone

- **Infrastructure ages naturally**
- **Lack of maintenance/repairs accelerates the deterioration process**
- **Demand changes ↗ or ↘**
- **Resources constraints: financial, human, material**
- **Increasing expectations and regulatory requirements**
- **Competing priorities**

Some of the Issues…
for small water systems

- **Small population (< 500)**
- **Financial stability**
- **Changing demographics**
- **Underpaid or volunteer system operators**
- **Multi-tasking operators**
- **Lack of technical expertise or access to it**
- **High servicing costs**
- **Difficulty to access education and training**

(from Adaptive Policy Changes in the Management of Small Water Systems, Presentation by H. Khan)

These issues lead to concerns

- **Failures leading to service interruptions and costly (to user and agency) repairs**
- **Decreasing level of service**
  - Quality
  - Quantity
  - Health and safety hazards?
- **Uncertain long term sustainability**
- **Increasing needs**

You are not the only ones to have these concerns....

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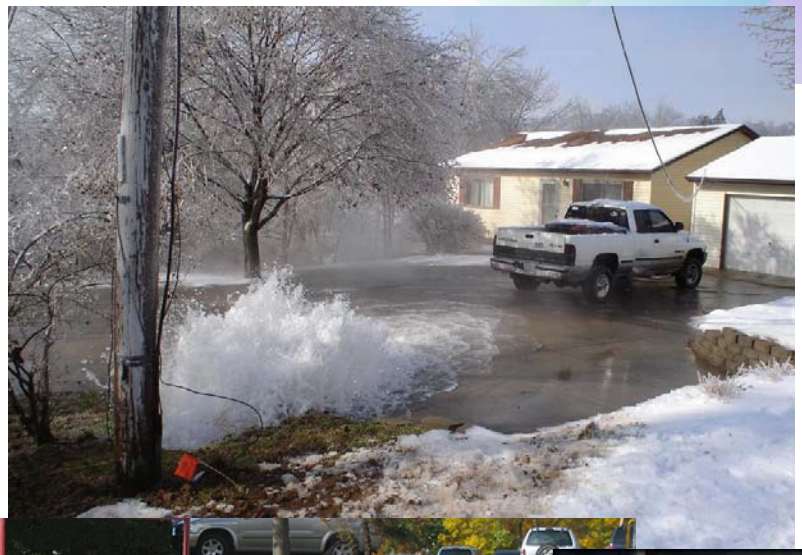
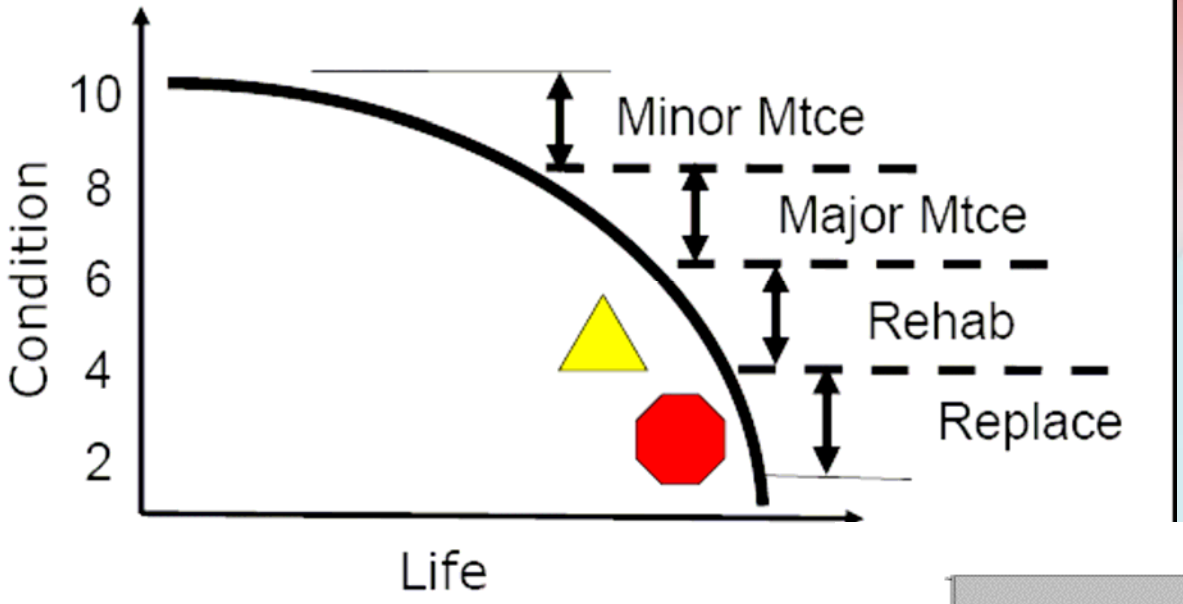
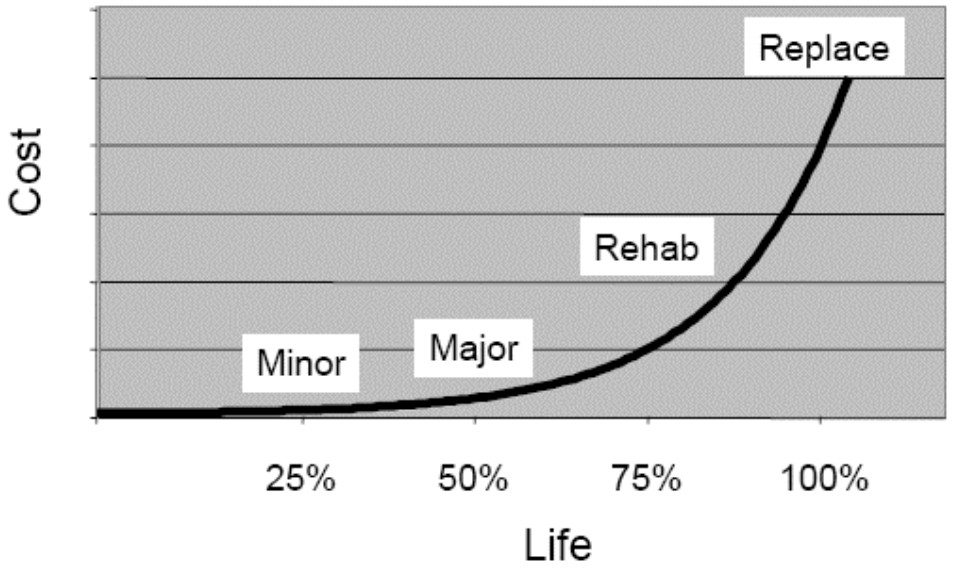


But there are options





From City of Hamilton

Amongst all this uncertainty… what to do?

- **Cannot continue to operate as done for last 50 years.**
- **Aging and deterioration cannot be stopped but can be slowed down, controlled:**
  - E.g., cathodic protection on metal pipes
- **So the game plan is to:**
  - Slow down deterioration/ Increase service life
  - Increase cost effectiveness/avoid unnecessary expenditures
  - Minimize unplanned interventions
  - Maintain/enhance level of service

And how to do all this?

- **By managing the assets!**

- **InfraGuide definition of Asset Management:**

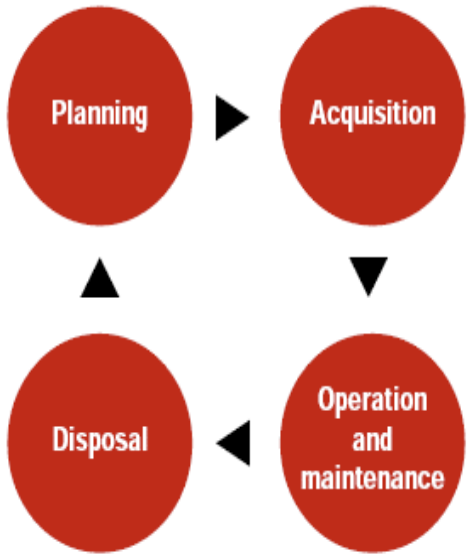
Asset management — The combination of management, financial, economic, engineering, operational and other practices applied to physical assets with the objective of providing the required level of service in the most cost-effective manner.

Infrastructure Assets Management – Principles

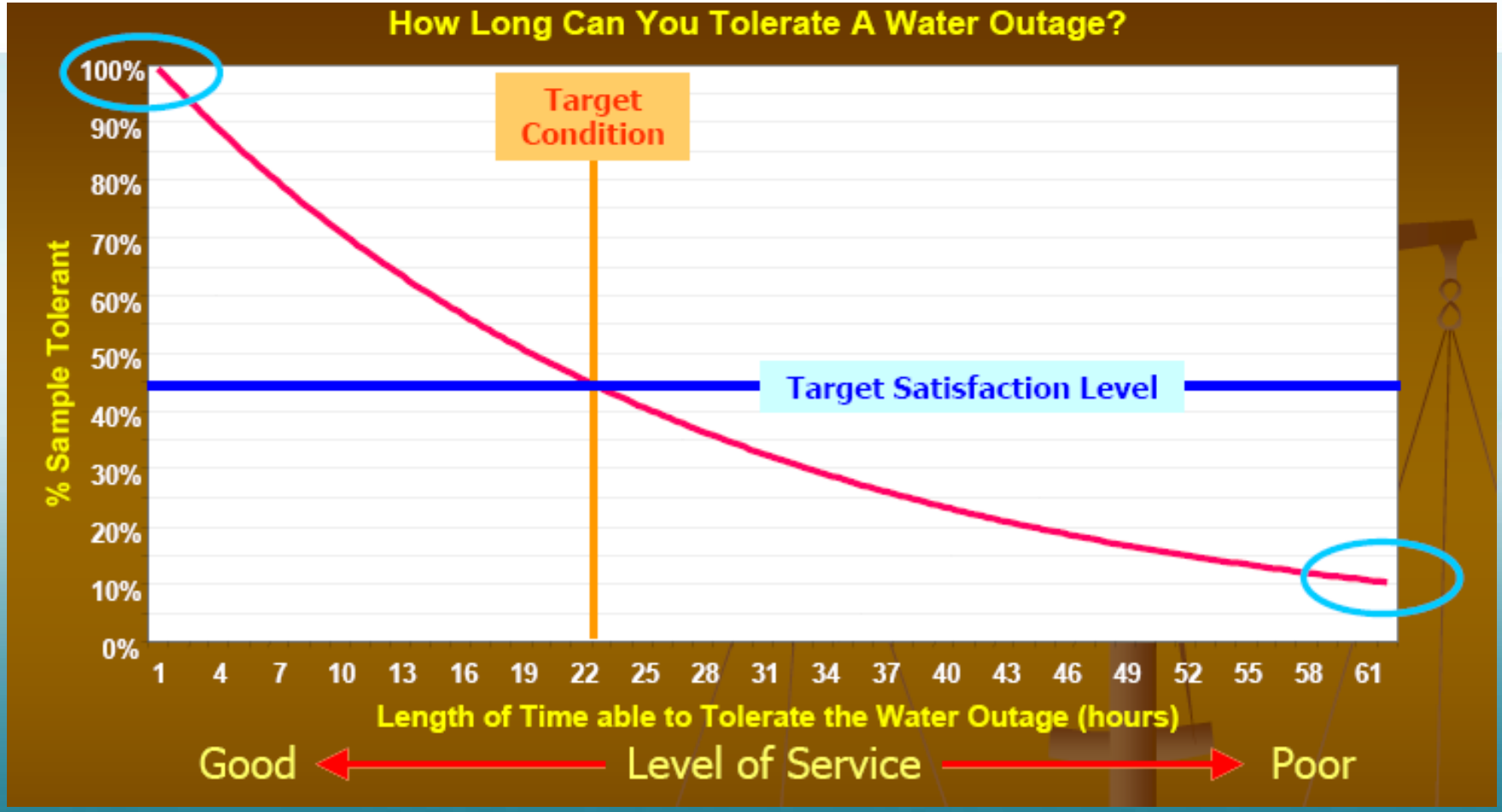
- **Strategic and Proactive approach**
  - Based on sound data and information,
  - Requires interdepartmental collaboration, and
  - Essential: interdisciplinary management approach
- **Comprehensive long-term view of infrastructure performance and cost**
  - Emphasis on sustainability objectives
- **Explicit, visible, and transparent approach**
  - Effective communication among all its stakeholders
- **Business processes involving investment choices**
  - Policy and performance driven
  - Explicit trade-offs among competing priorities

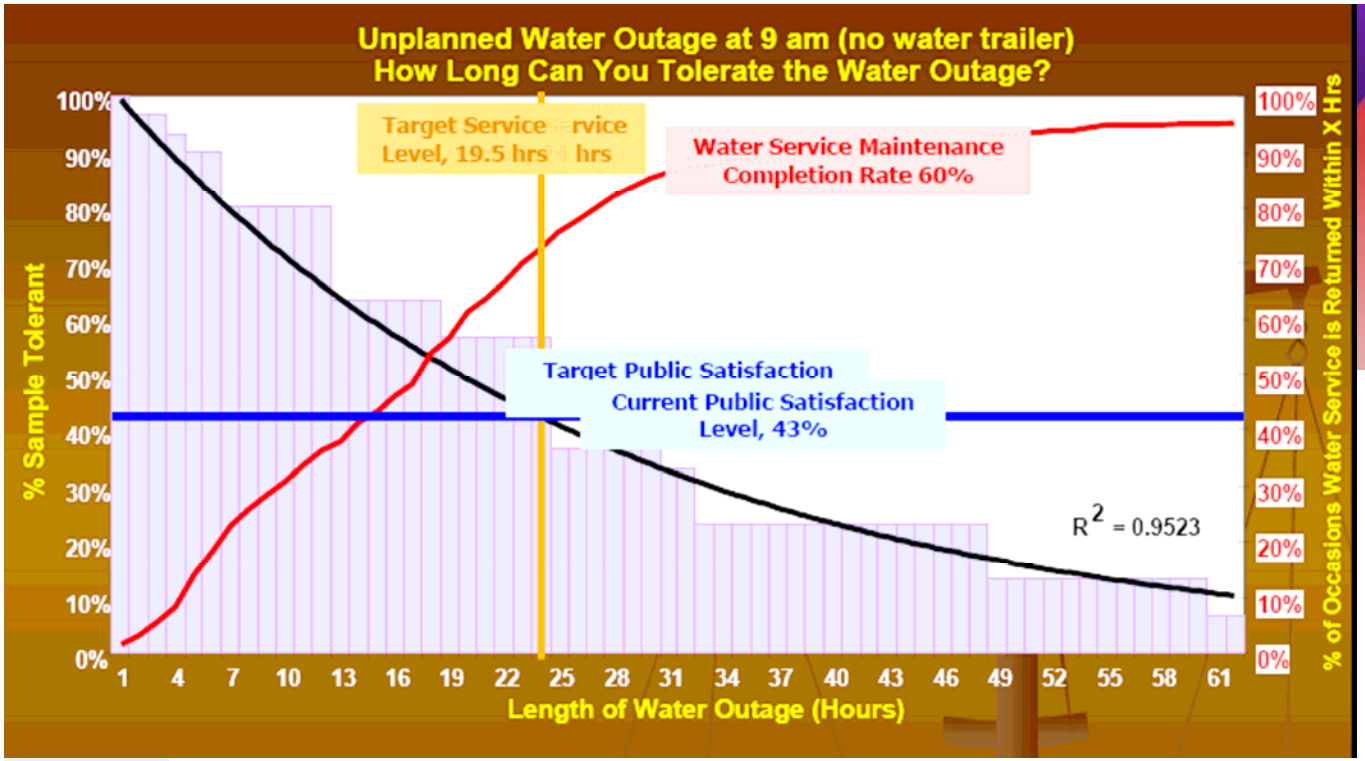
Infrastructure Assets Management – Linkages

- **Cannot discuss AM without dealing with:**
  - Levels of service
    - What are they?
    - How are they defined?
    - What corporate objectives do they relate to?
  - Life-cycle of infrastructure



- **Tolerability study Saskatoon/Regina**





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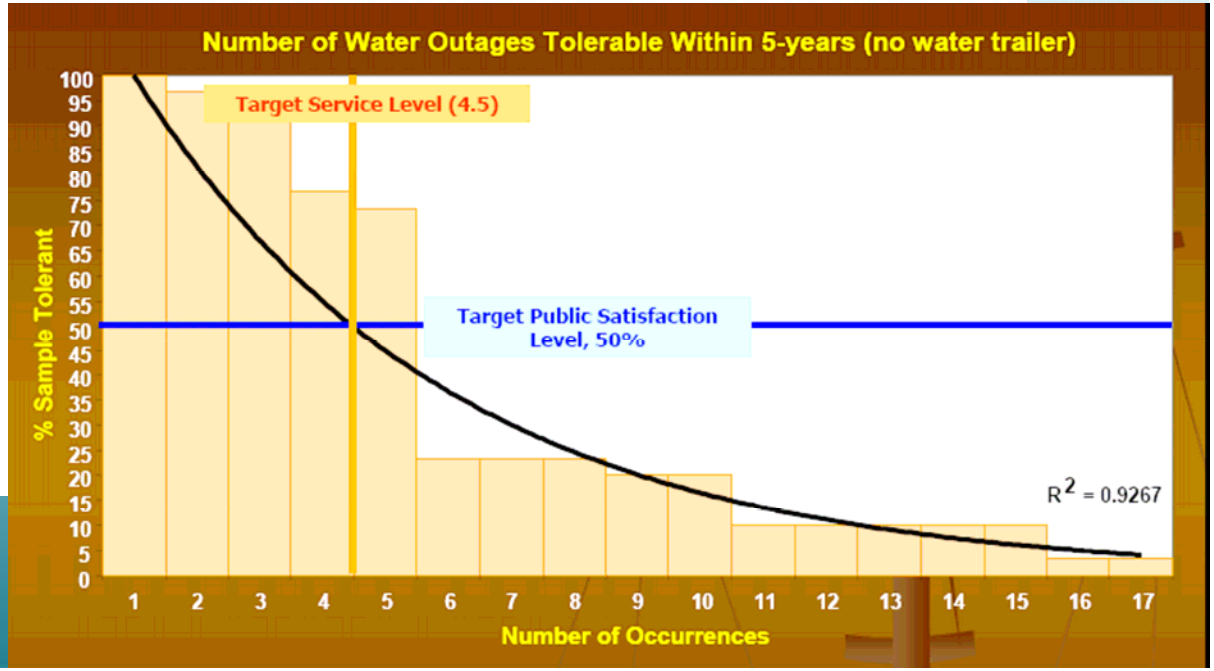
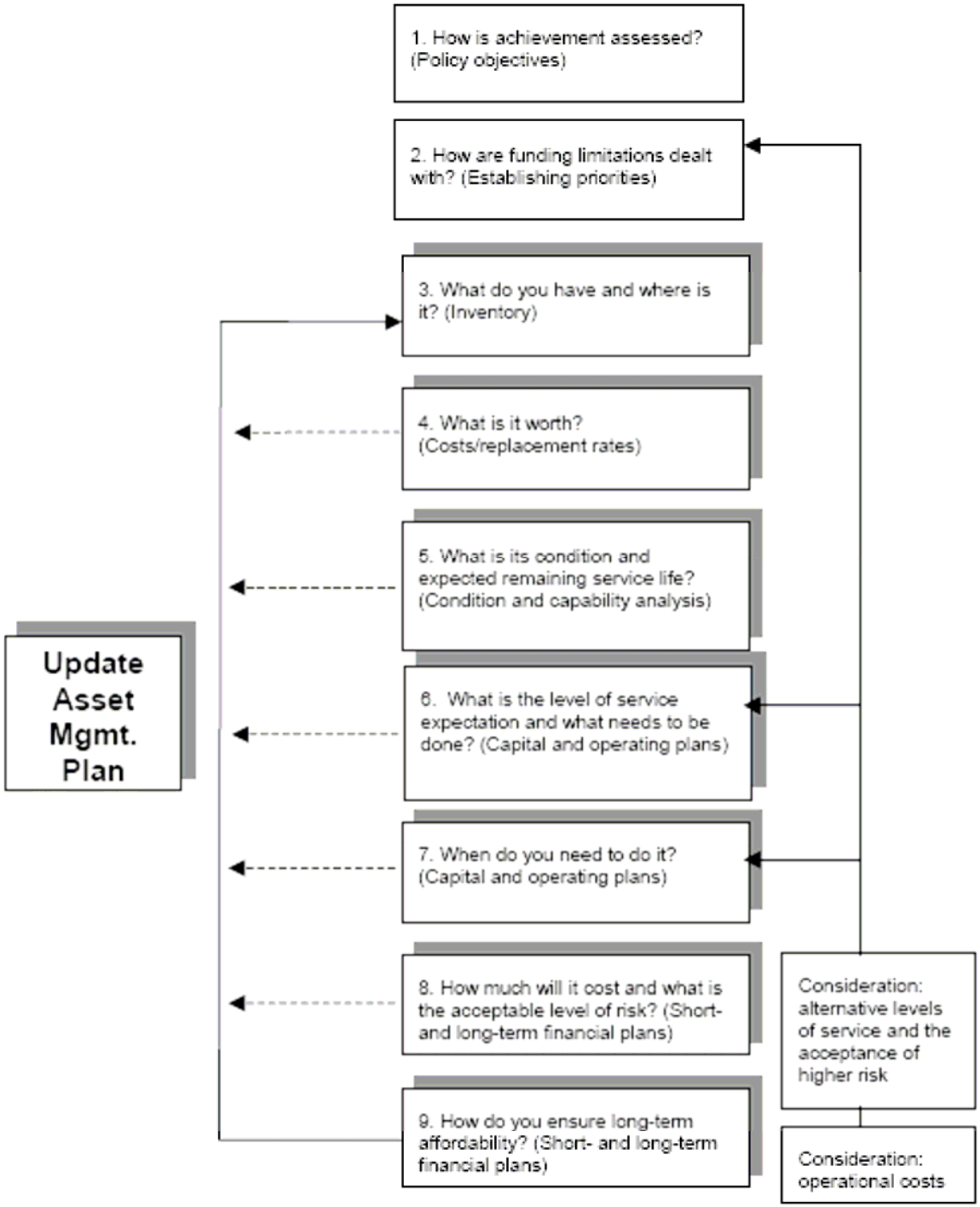


Infrastructure Assets Management – Warnings

- **AM process NOT to be driven by technology**
- **ONE size does NOT fit all**
- **AM has to become a CULTURE within organization**
  - People
  - Senior management/decision-makers leadership
- **AM is not a one-time-deal:**
  - Continuous (improvement) process
- **AM must feed the decision-making process – support, NOT replace**
- **AM should have actionable outputs … not just another report**



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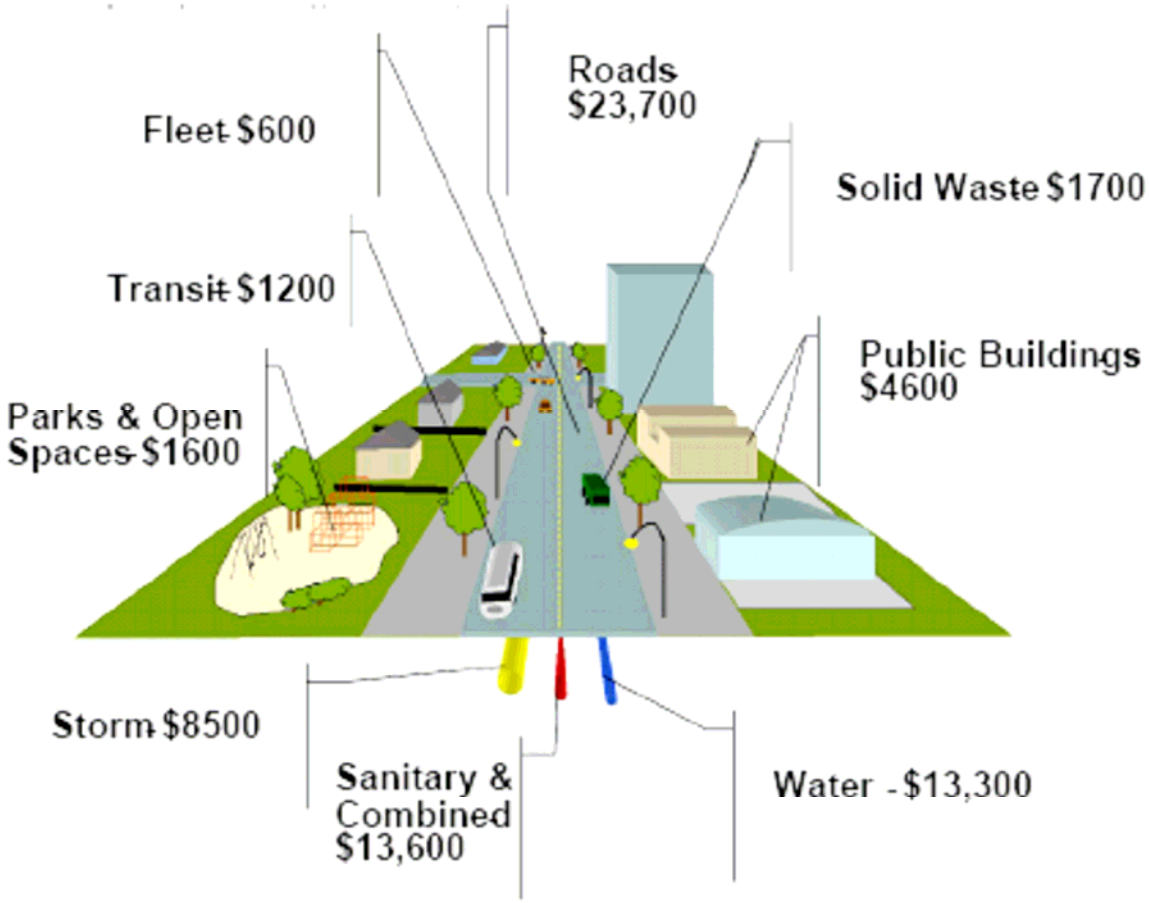
Infrastructure Assets Management – How to (1)

- **What do you have and where is it?** (Inventory and location)
- **What is it worth?** (Costs/replacement rates)
- **What is its condition and expected remaining service life?** (Condition, capability and performance analysis)
- **What is the level of service expectation, and what needs to be done?** (Prioritization, capital and operating plans, alternative service mechanisms)

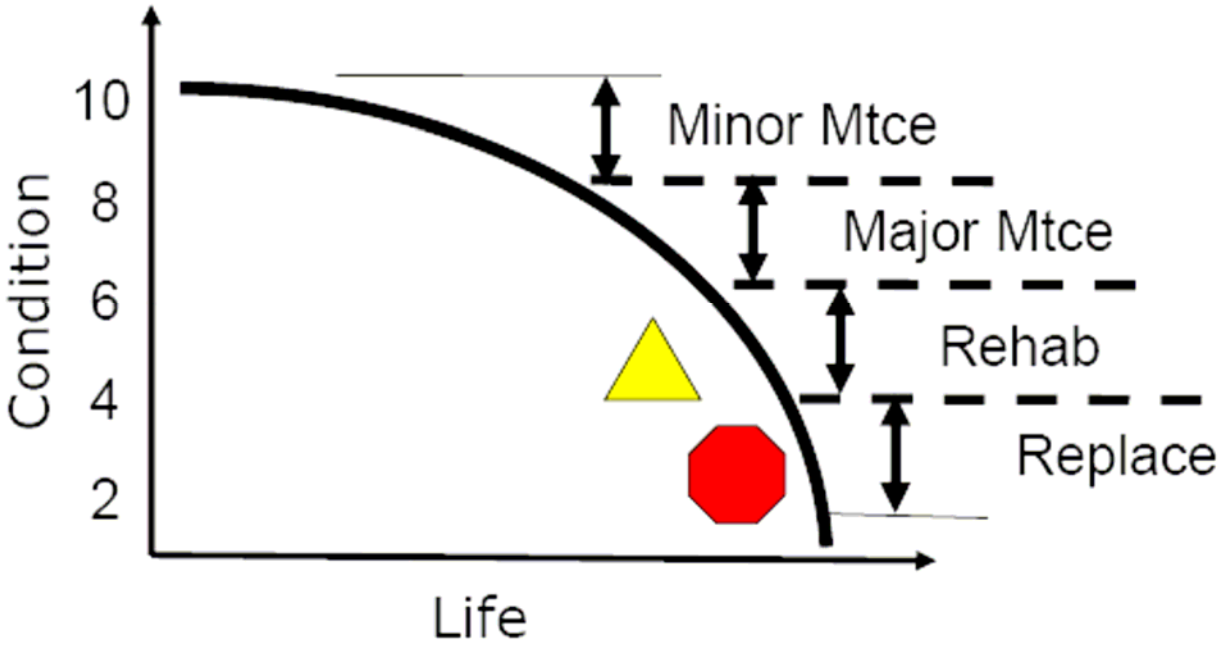
Asset Replacement Value

per 50' property frontage

Total Value = $68,800



From City of Hamilton



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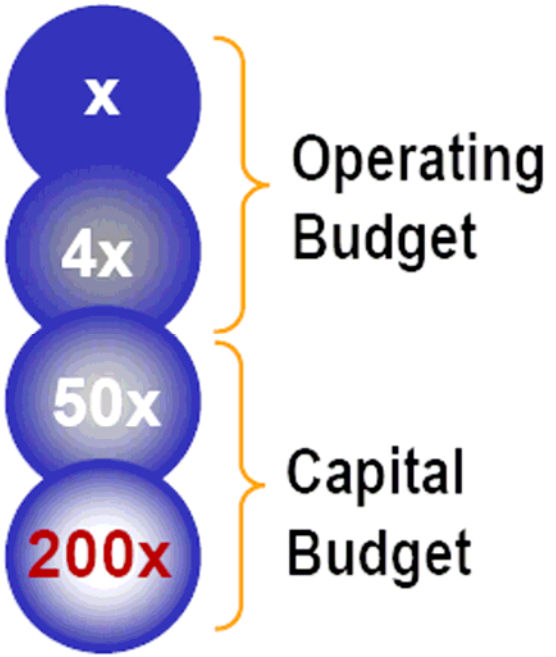
0–25% of asset life
Minor Maintenance

25–50% of asset life
Major Maintenance

50–75% of asset life
Rehabilitation

75–100% of asset life
Replacement



Infrastructure Assets Management – How to (2)

- **When do you need to do it?** (Prioritization, capital and operating plans)
- **How much will it cost and what is the acceptable level of risk(s)?** (Short- and long-term financial plan, risk analysis)
- **How do you ensure long-term affordability?** (Short- and long-term financial planning, alternative revenue sources) – further information on Capital Financing at the end of this presentation

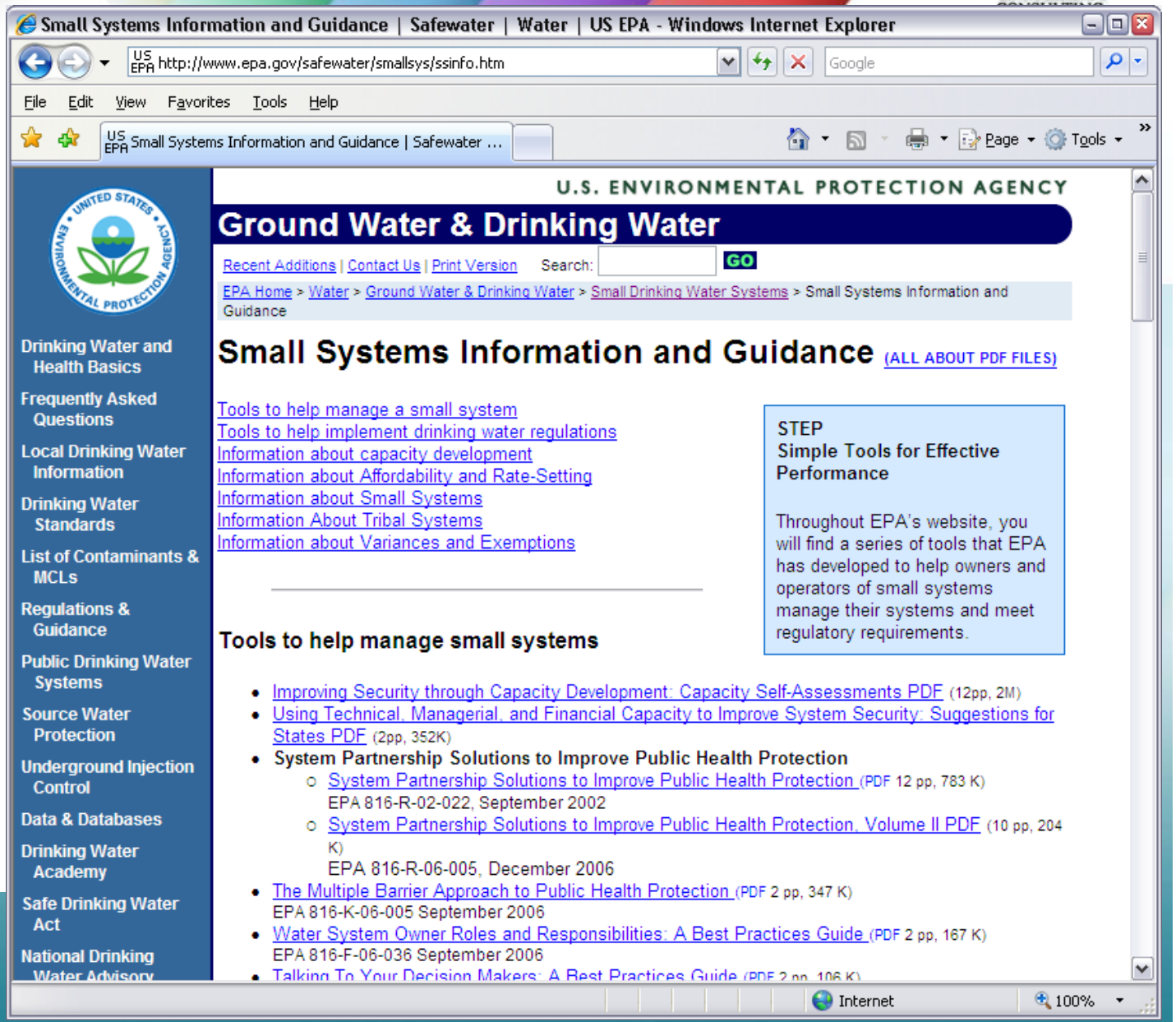
IAM - Supporting decision-making

- **At what level?**
  - **Operational (project, single network)**
    - Prioritize
    - Develop financial plans
  - **Tactical (across networks)**
    - Coordination of works
    - Integration (e.g., data repositories)
  - **Strategic (across the corporation)**
    - Support initiatives (e.g., economic development)

Is IAM for your community?

- **The 101 wrong reasons why not:**
  - We are too small!
  - We don’t have the resources!
  - I’m alone and don’t have time!
  - It’s going to cost too much!
  - We don’t have enough data!
  - Council will never go for it!
  - …..
  - It’s an accounting problem (PSAB 3150)!
  - …..
  - …..

A good resource



Asset Management: A Handbook for Small Water Systems

One of the Simple Tools for Effective Performance (STEP) Guide Series

What Is the Asset Management Process?

Asset management consists of the following five steps:

1. **Taking an inventory.** Before you can manage your assets, you need to know what assets you have and what condition they are in. This information will help you schedule rehabilitations and replacements of your assets.

2. **Prioritizing your assets.** Your water system probably has a limited budget. Prioritizing your assets will ensure that you allocate funds to the rehabilitation or replacement of your most important assets.

3. **Developing an asset management plan.** Planning for the rehabilitation and replacement of your assets includes estimating how much money you will need each year to maintain the operation of your system each year. This includes developing a budget and calculating your required reserves.

4. **Implementing your asset management plan.** Once you have determined how much money you will have to set aside each year and how much additional funding (if any) you will need to match that amount, you need to work with your management and customers and with regulators to carry out your plan and ensure that you have the technical and financial means to deliver safe water to your customers.

5. **Reviewing and revising your asset management plan.** Once you have developed an asset management plan, do not stick it in a drawer and forget about it! Your asset management plan should be used to help you shape your operations. It is a flexible document that should evolve as you gain more information and as priorities shift.

Step #1 – How Do I Inventory My Assets?

Before you can manage your assets, you need to know what you have, what condition it is in, and how much longer you expect it to last. To complete an inventory, list all your assets and collect the following information for each:

1. Condition
2. Age
3. Service history
4. Useful life

The worksheets on the following pages will help you develop an asset inventory and keep track of important information. Detailed instructions are provided.

You may want to keep track of your assets on a computer spreadsheet or use custom software. Appendix D includes information on electronic programs you may want to use.

Inventorying your assets can be an intensive job. Get the best information that you can, but don't get bogged down in this step and use estimates where needed. If you keep up with an asset management program, new information will become available as assets get replaced or rehabilitated, and your inventory of assets will improve.

Introduction to the System Inventory Worksheet

The following System Inventory Worksheet will help you:

- Identify all of your system's assets;
- Record the condition of your assets;
- Record the service history of your assets;
- Determine your assets' adjusted useful lives;
- Record your assets' ages; and,
- Estimate the remaining useful life of each of your assets. Usually, there are two steps to estimating useful life:

    1. Determine the expected useful life by using the manufacturer's recommendations or the estimates provided in the box to the right. Adjust these numbers based on the specific conditions and experiences of your system.

    2. Calculate an adjusted useful life by taking into account the service history and current condition of your asset.

Two copies of the worksheet are provided. The first copy is followed by instructions that will help you understand how to complete it. The second worksheet is an example. Appendix A has blank worksheets that you can photocopy and use.

Estimated Useful Lives

Asset	Expected Useful Life (in years)
Intake Structures	35-45
Wells and Springs	25-35
Galleries and Tunnels	30-40
Chlorination Equipment	10-15
Other Treatment Equipment	10-15
Storage Tanks	30-60
Pumps	10-15
Buildings	30-60
Electrical Systems	7-10
Transmission Mains	35-40
Distribution Pipes	35-40
Valves	35-40
Blow-off Valves	35-40
Backflow Prevention	35-40
Meters	10-15
Service Lines	30-50
Hydrants	40-60
Lab/Monitoring Equipment	5-7
Tools and Shop Equipment	10-15
Landscaping/Grading	40-60
Office Furniture/Supplies	10
Computers	5
Transportation Equipment	10

Note: These numbers are ranges of expected useful lives drawn from a variety of sources. The ranges assume that assets have been properly maintained.

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System Inventory Worksheet						
Date Worksheet Completed/Updated: 1						
Asset	Expected Useful Life	Condition	Service History	Adjusted Useful Life	Age	Remaining Useful Life
2	3	4	5	6	7	8

Example System Inventory Worksheet						
Date Worksheet Completed/Updated: *8/14/02*						
Asset	Expected Useful Life	Condition	Service History	Adjusted Useful Life	Age	Remaining Useful Life
Well 1 (1993)	30	Good		30	9	21
Well 1 pump	10	Good	Rehab (1996)	10	9	1
Well 2 (1993)	30	Good		30	9	21
Well 2 pump	10	Good	Rehab (1998)	10	9	1
Pumphouse (1993)	30	Good		30	9	21
Electrical components	10	Some corrosion	Rehab (1994)	10	9	1
Chlorinator (1993)	10	Good	Rehab (1998)	5	3	2
Storage tank 1 (1993)	40	Good	Rehab (2000) - $17,000	40	9	31
Storage tank 2 (1993)	40	Good	Rehab (2000) - $17,000	40	9	31
Storage tank 3 (2000)	40	Almost new		40	2	38
Distribution System:						
Hydrants (15)	40	Unknown		40	9	11
Valves (45)	40	Unknown	6 valves don't work	40	9	11
6-inch (PVC)	60	Unknown		60	9	51
4-inch (PVC)	60	Unknown		60	9	51
2-inch (PVC)	60	Unknown	Repair breaks (2/year)	60	9	51

Step #2 – How Do I Prioritize My Assets?

Once you have inventoried your assets, your next step will be to prioritize your assets based on their importance to your system. Prioritization means ranking your system's assets to help you decide how to allocate resources. Factors involved in prioritization include:

- How soon will you have to replace an asset (its remaining useful life).
- How important the asset is to the provision of safe drinking water (its impact on public health).
- How important the asset is to the op

Step #3 – How Do I Plan for the Future?

Now that you have prioritized your assets, you will have to determine how much it will cost to rehabilitat properly protect public health and deliver safe water, you need to rehabilitate and replace your assets i systems will need considerable lead-time to budget and gather the necessary funds. By developing an allocate your resources in the most efficient way.

The Required Reserve Worksheet on the next few pages will lead you through the steps necessary to determine how much money you need to put in reserve each year (for the next five years) to fund your highest priority activities. This reserve should be protected from other use.

The worksheet will give you an idea of how much money you should set aside to fund your reserve account this year. Changes in your system's finances and costs of new assets can change from year to year. It is important that you update this worksheet every year. This will ensure that you have enough reserves to cover necessary rehabilitations and improvements. This worksheet only helps account for additional funds you will need to rehabilitate or replace your assets. Standard O&M costs (e.g., chemicals for disinfection) are not included in the calculations on this worksheet.

Step #4 – How Do I Carry Out This Plan?

In the previous section, you may have discovered that you should be reserving additional money every year to co
replacing your assets. Preparing a financial forecast (by estimating how much revenue you expect for the next fi
will need to supplement your revenues to carry out your asset management plan.

If you don't already have a five-year forecast, the Budgeting Worksheet on page 28 will help you complete this task. In addition, to increase or more efficiently use your revenues to operate and maintain your system and carry out your asset management plan you can:

- **Create additional reserve accounts.** Reserve all or some of the money you will need in a protected capital improvement reserve account and create an emergency account to fund unexpected repairs and replacements. You may be restricted in how much money can be placed in reserve accounts. Check with your state or t

Step #5 – What Should I Do Next?

- **Form partne**

Once you have inventoried and prioritized your assets, determined how much money you will need to set aside each year to fund the rehabilitation and replacement of your assets, and explored funding options for your water system, you can use your asset management plan to help plan your water system's future. You will have a good picture of when you will need to replace your assets and how much money you will need to fund those replacements and continue to deliver safe and secure drinking water to your customers.

Remember that the worksheets should be reviewed, revised, and updated on an annual basis. Your asset management plan should help you shape your system's operations and should change as your priorities change. Current information in the worksheets provides a better picture of your system's position, and better prepares you to meet your water system's future needs.

Some information on capital financing

Capital Financing

- **From internal and external sources**
- **Internal**
  - Current operating revenues (property taxes and user fees)
  - Reserve funds (to be spent on specific projects)
  - Special charges (including special assessments, development charges, etc.)
- **External**
  - Federal/Provincial grants
  - Long term borrowing

Table 5: Relative Importance (percent) of Sources of Capital Financing for the Municipal Sector by Province and Territory, 1988-1990 to 2002-04

Provinces & Territories	1988 – 1990			1997 – 1999			2002 - 2004		
	Own Source Revenue	Transfers	Borrowing	Own Source Revenue	Transfers	Borrowing	Own Source Revenue	Transfers	Borrowing
	percent			*percent*			*percent*		
Canada	9.6	17.6	72.8	9.8	25.2	65.1	11.0	8.8	80.2
Newfoundland and Labrador	3.1	29.9	67.0	4.2	64.7	31.1	2.0	32.8	65.2
Prince Edward Island	6.0	6.6	87.4	1.0	11.5	87.5	2.6	4.8	92.6
Nova Scotia	8.6	25.1	66.3	3.1	20.1	76.8	4.6	14.6	80.8
New Brunswick	5.1	31.4	63.6	4.8	18.2	77.0	2.9	13.2	83.9
Quebec	4.6	7.0	88.4	3.9	20.6	75.4	8.7	0.1	91.2
Ontario	7.9	21.1	71.0	7.9	12.7	79.4	9.1	6.2	84.8
Manitoba	3.5	12.0	84.5	5.7	23.1	71.1	12.8	15.5	71.7
Saskatchewan	9.6	11.3	79.1	17.1	9.2	73.7	25.0	28.0	47.1
Alberta	32.4	28.3	39.2	32.2	26.9	40.9	32.4	26.4	41.2

Dedicated Funding

- **Utility or full-cost recovery models** (base utility billing, a levy on the utility bill and, for wastewater and storm water only, a surcharge on the water bill);
- **Property tax models** (dedicated tax increment or surcharge on property tax bill);
- **Fee-for-service models for potable water only** (user or access fees, frontage fees, and tapping fees);
- **Other models** (local improvement charges, development charges and public–private partnerships).

Alternative funding mechanisms (1)

- **Special Levies**
  - Economic instruments that ensure a funding source exists to cover needs that are difficult to fund through user pay, and for which there is a benefit in explicitly identifying them separately from the general tax levy.
  - The mechanics of this method include a variety of potential levy collection venues, such as:
    - a particular residential or commercial tax;
    - a general levy on the property tax bill; or
    - a rate base/utility levy for residential and/or commercial properties

Alternative funding mechanisms (2)

- **Utility Models**
  - A utility model exists where user fees collected are dedicated to the service, and the service is managed autonomously relative to other municipal services.
  - Entails management of capital assets, operations and maintenance on a cost-recovery basis through fees for service.
  - The fee for service must be sufficient to fund the needs of the infrastructure and overhead operations, such as administration, bill collection and management.
  - Only users of the service support the service through the fee for service. The amount paid by users is normally proportional to their use of the service.

Alternative funding mechanisms (3)

- **Tax Exempt bonds**
  - Only Ontario permits them (as of 2003)
    - Through Ontario Municipal Economic Infrastructure Financing Authority
    - Low interest loans to municipalities
- **Public-Private Partnerships (P3s)**

To meter or Not to meter?

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Table 10: Residential Water Rates by Type and by Province in Canada, 1996

Province	Flat Rate Types		Volume-Based Rate Types			Complex	Total
	Flat	Assess.	CUC	DBR	IBR		
Newfoundland	78	1	1	0	0	0	80
Prince Edward Is.	5	0	4	0	0	0	6
Nova Scotia	24	0	0	38	0	0	62
New Brunswick	48	0	8	9	0	0	65
Quebec	303	25	54	7	8	0	397
Ontario	146	9	133	59	24	8	379
Manitoba	10	3	11	25	1	0	50
Saskatchewan	10	0	39	15	7	2	73
Alberta	27	2	79	22	13	0	143
British Columbia	118	0	31	10	13	0	172
Territories	6	0	15	0	0	0	21
POPULATION SIZE GROUP							
Under 5000	451	14	154	75	20	3	717
5,000-9,999	125	3	78	35	11	0	252
10,000-49,999	156	13	96	46	25	4	340
50,000-99,999	22	5	19	11	7	1	65
100,000 plus	21	5	25	18	3	2	74
CANADA TOTAL	775	40	372	185	66	10	1,448

Flat - Flat rate charge

Assess. - Charge based on assessment

C.U.C. - Constant unit charge

D.B.R. - Declining block rate

I.B.R. - Increasing block rate

Complex - Complex rate structure

Source: Environmental Economics Branch, Economic and Regulatory Affairs Directorate, Environment Canada, Ottawa, mimeograph.

- According to Environment Canada, **flat rate customers in Canada use 457 litres of water per capita per day compared to volume based customers who use only 269 litres per capita per day.**
- There are **four underlying and fundamental drivers** for universal metering:
  - equity;
  - water efficiency and environmental stewardship;
  - economic management benefits; and
  - system management**.**

- **Accurate and timely water use measurement is the primary means used by water utilities to:**
  - create equitable charge-out rates for customers;
  - reduce water use wastage and promote water efficiency;
  - measure low and peak flow rates;
  - minimize environmental impacts and the loads on wastewater facilities;
  - measure use of water resource;
  - generate revenue; and
  - ensure future capital costs for the system are apportioned to users.

Key References

- **InfraGuide (2001-2007)**
  - **Assets Management**
    - Municipal Infrastructure Asset Management
    - Alternative Funding Mechanisms
    - Investment Parameters for Municipal Infrastructure
  - **Potable Water - 9 best practices including:**
    - Developing a Water Distribution System Renewal Plan
    - Water Quality in Distribution Systems

See: http://sustainablecommunities.fcm.ca/infraguide/

Thank You

- **Questions**