Financial Planning for the Rehabilitation / Replacement of Water and Wastewater Infrastructure

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Halton
a World Class Place To Be.

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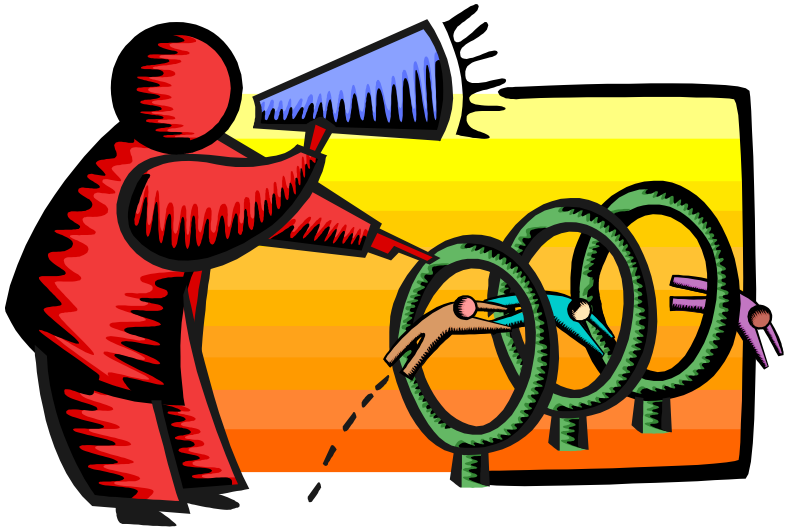
Boss says…



*" **You need to do asset management** – its the strategic allocation of necessary funds amongst varied and competing assets to **cost effectively** maintain / improve **levels of service** within prescribed limits without incurring unacceptable **levels of risk**…"*

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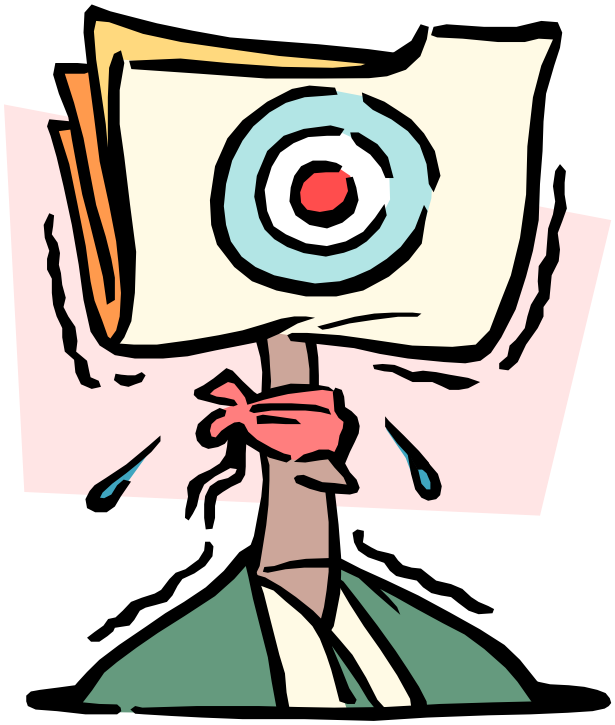
You think…



Yeah right… How am I gonna do this??

- Little detailed **inventory**
- Little **condition / performance information**
- Little **budget**
- Little **time**
- I'm a dead man!!

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1972 Pinto (475,000 mi)

- How do you measure condition & performance?
- How do you track that information and make decisions?
- Owner's approach vs. Mechanic's approach

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Agenda

- Asset Management Planning and Implementation Approaches
  - Top – Down (Program Level) Approach
  - Bottom – Up (Project Level) Approach
- Information Technology Tools (Software)
- CAFÉ – Top Down Approach
- CAPS – Bottom Up Approach
- How to get started with your AMPs

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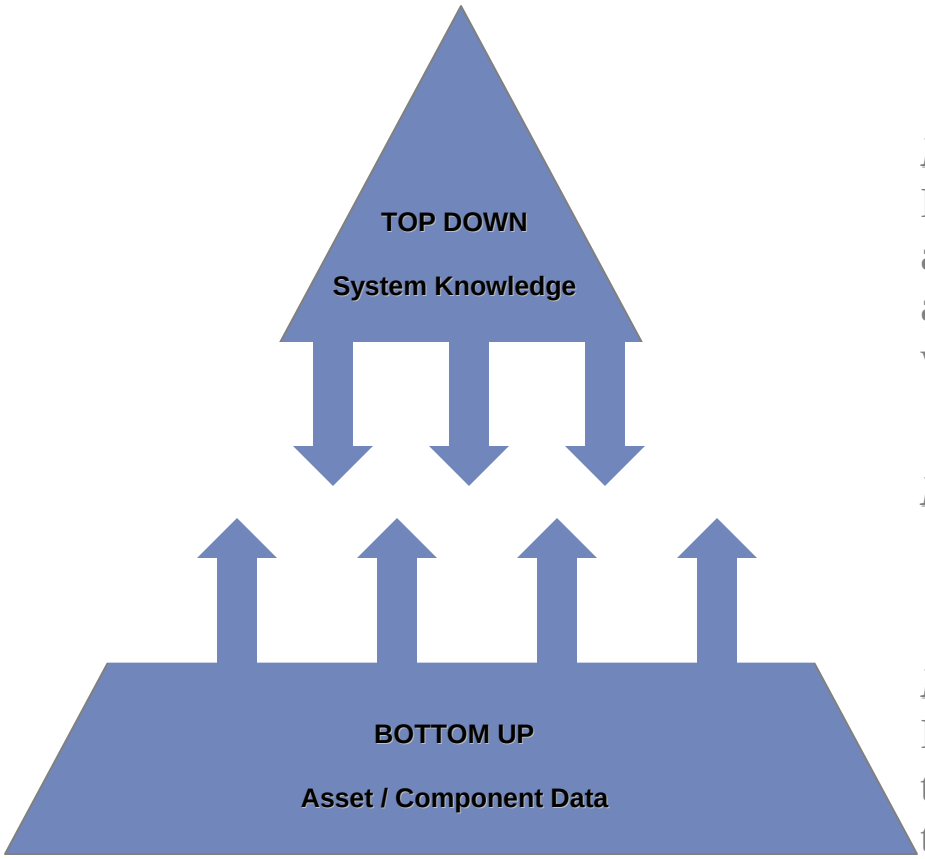
AM implementation Plan



PROGRAM LEVEL

High-level (generalized) decision-making / assessment based on performance of groups of assets and aimed at forecasting needs on a system-wide basis. Synonymous to "Top-Down Approach".

Mixture of both

PROJECT LEVEL

Detailed assessment on an asset-by-asset basis used to prioritize one project over another. Synonymous to "Bottom-Up" Approach.

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Comparing Approaches

	Program Level (Top Down) Approach	Project Level (Bottom Up) Approach
Advantages	▪ Identifies weaknesses in plan earlier and focuses on appropriate data as opposed to perceived data needs ▪ Initially less resource intensive ▪ Better use of limited resources ▪ Quick Results	▪ Outputs are data-driven with a high degree of confidence ▪ Data is of a high quality ▪ Ability to undertake data modeling and improve decision making ▪ Continuous plan revision is simpler
Disadvantages	▪ Potential for compromised quality and completeness of data ▪ Assumptions required to make decisions ▪ Potential for inappropriate decision making ▪ Inability to undertake detailed modeling and sensitivity analysis	▪ Data collection takes time / resources ▪ Time of production can impact ability to make urgent decisions ▪ Potential to lose focus on objectives – too focused on data issues ▪ Costly and time consuming ▪ Organization can become data rich and information poor

CAFÉ with Other Tools

Features\Assets	Water	Water	Water/ Wastewater	Water/ Wastewater	Water/ Wastewater	Water/ Wastewater
Software	**KANEW**	**PARMS**	**WILCO**	**CARE-W CARE-S**	**CAFÉ**	**CAPS**
Life Cycle	✓	✓	✓	✓	✓	✓
Stochastic Model	✓	✓	✓	✓	✓	✓
Condition Assessment	X	X	✓	✓	X	✓
Service Life	✓		✓	✓	✓	✓
Risk	X	✓	✓	✓	X	✓
Cost Prediction	✓	✓	✓	-	✓	✓
GIS	X	X	✓	-	X	✓
Reports/Output	✓	✓	✓	✓	✓	✓
Compatibility	✓	-	✓	✓	✓	✓

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CAFÉ

Capital Asset Financing Evaluator

(Top-Down Approach)

What is CAFE

- CAFE = Capital Asset Financing Evaluator
- Stochastic approach to life cycle analysis
- Allows municipalities to assess infrastructure reinvestment requirements with a minimum effort and data input
  - Capital Planning and Budgeting
  - Cash Flow Prediction
  - Rate Studies
  - Rehab / Replacement / Maintenance policies
- Program Level Asset Management
  - Manages on GROUPS of assets that perform similarly

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When to Use

- High level (Program Level) vs. Detail Level (Project Level)
- Use to:
  - Choose lowest cost investment option
  - Predict future funding requirements
  - Visualize the “age wave”
  - Test approaches to infrastructure reinvestment (cost / benefit)

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A little theory…

- Based on the premise that some assets fail prematurely while others are long-lived (Variable service life and life expectancy)
- The behavior of homogenous asset groups (size and material) over life cycle can be approximated using probability theory
- Weibull probability traditionally regarded as most closely approximating the behaviour of natural degrading systems

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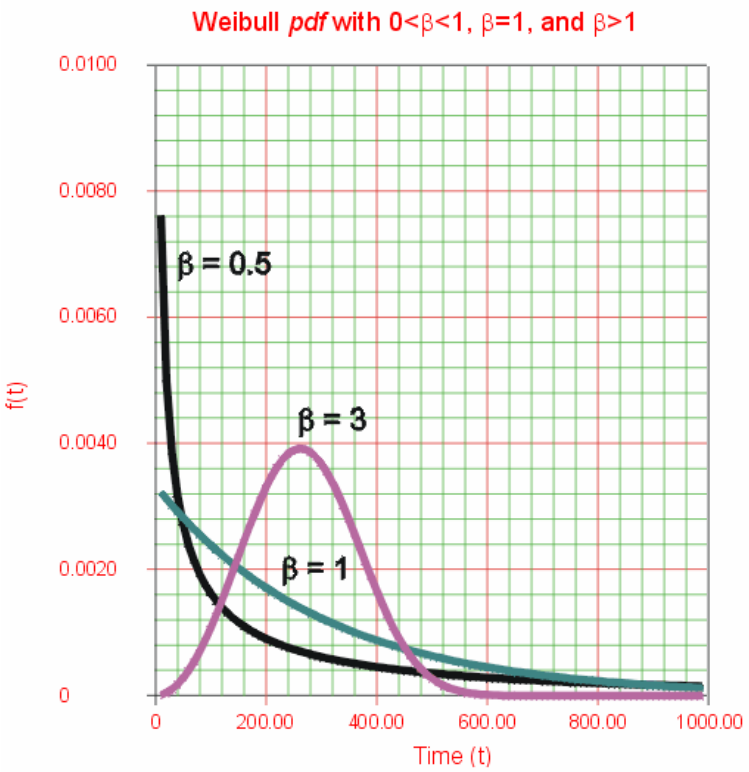
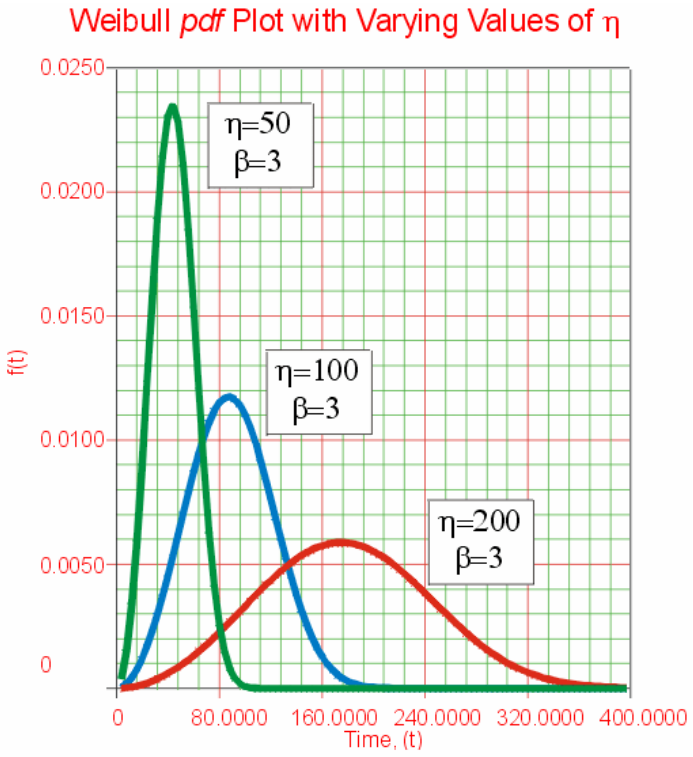
Weibull Parameters Used



Shape Parameter



Failure Concentration

Then use Life Expectance Parameter to place in time

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A Brief History

- Utilizes similar life cycle analysis principles that have been used in industry for many years
- Applies principles to infrastructure assets
- Originally developed for the City of Ottawa using Excel in support of the Capital Budget process in 2001/2002
- Used to estimate funding requirements for long-term (10 to 20-yr) plan and generated reasonable results
- Demonstrated the process and benefits of an infrastructure management approach

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Since then...

- Used to estimate funding requirements in several cities
  - Vancouver (several individual cities > 300-500k)
  - Region of Halton (400k population)
  - Region of Peel (1 million population)
  - Region of Durham (500k population)
  - Brantford (100k population)
  - City of London (350k population)
  - Niagara Falls (100k population)
  - Others (45k to over 1 M population)

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Ongoing Improvements...

- Adapted from Excel into a more robust database driven format using latest version of MS Access
- Expanded to investigate the impact of operational changes, rehabilitation, etc.
- Selects the least cost option as the preferred operational policy for each asset group
- Allows for consideration of replacements on replacements
- Integration of condition and risk data with asset valuation module (future)
- Interoperability with systems such as Harfan, ESRI, SAP and other GIS based mapping systems (future)

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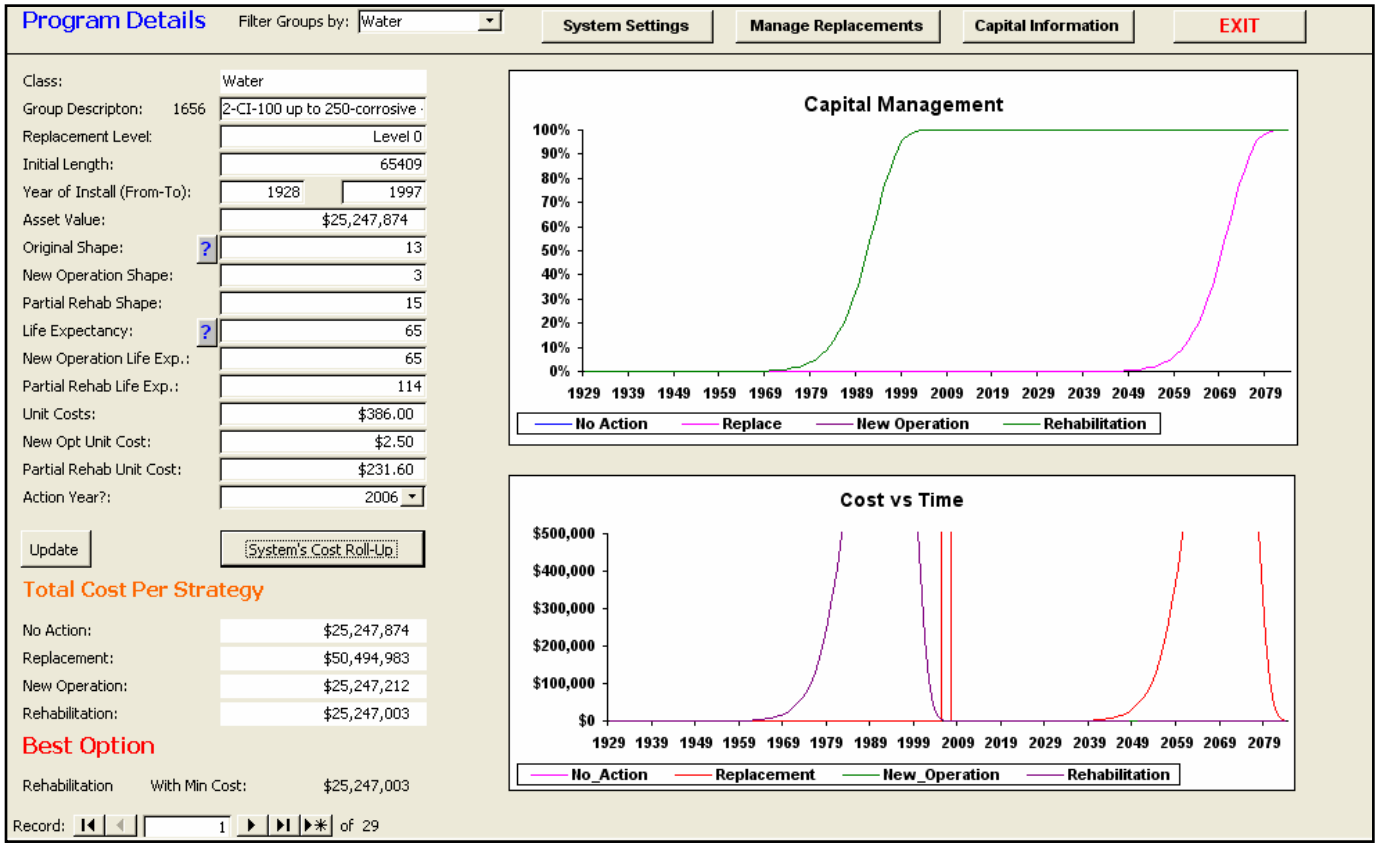
CAFÉ Results

- Create/modify infrastructure groups
- Establish statistical parameters
- Visualize impact of operational changes
- Determine program costs
- Create reports and share results



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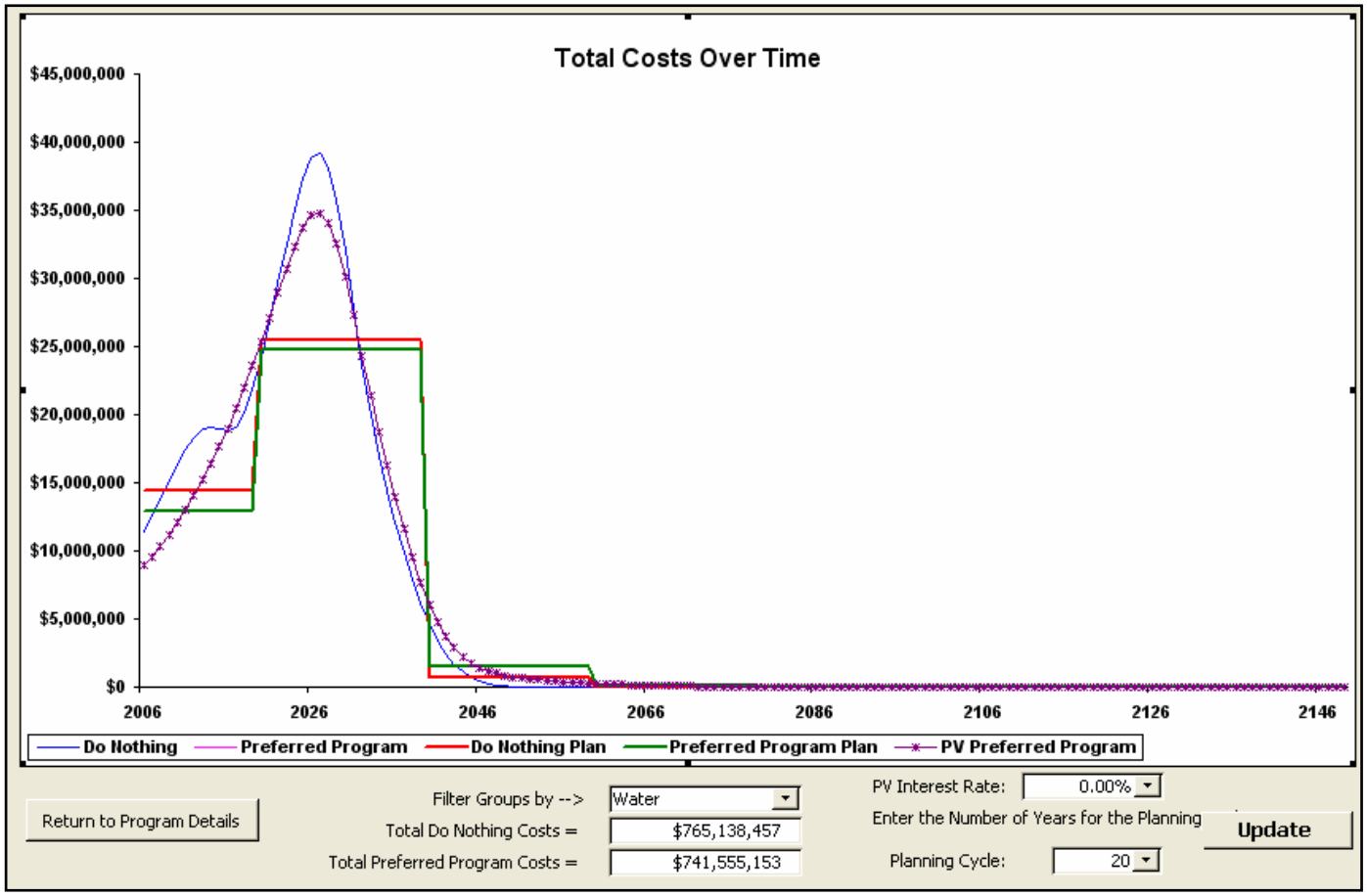
CAFÉ Results

- Visualize future investment requirements
- Evaluate cost-benefit of rehab/reinvestment programs
- Establish funding levels for multi-year plans
- Determine impact of time-value-of-money



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Capital Information

Region of Halton

Asset Class Water

Group	Description	Length	Start	End	Replacement Value	Shape	Scale	Cost	Pref. Option	Cost of Pref. Option
1656	2-CI-100 up to 250-corrosive -	65,409	1928	1997	$25,247,874	13	65	$386	Rehabilitation	$25,247,003
1657	3- CI-300+-corrosive I-not line	22,411	1947	1980	$12,796,681	13	45	$571	Rehabilitation	$12,796,681
1658	4-CI-100 up to 250-corrosive -I	6,078	1948	1980	$2,346,108	13	50	$386	Rehabilitation	$2,337,522
1659	5-CI-300+-corrosive -lined	977	1953	1964	$541,258	10	55	$554	New Operation	$471,848
1660	6-CI-100-not corrosive	546	1951	1967	$168,714	13	55	$309	New Operation	$159,144
1661	7-CI-100 up to 250-not corrosi	131,323	1932	1973	$50,690,678	13	75	$386	New Operation	$47,011,738
1662	8-CI-300+ - not corrosive - not	40,748	1932	1980	$23,267,108	13	75	$571	New Operation	$21,218,369
1663	9-CI-100 up to 250-not corrosi	20,457	1946	1979	$7,896,402	13	60	$386	New Operation	$7,466,692
1664	10-CI-300+ - not corrosive - lin	2,601	1953	1953	$1,440,954	13	65	$554	New Operation	$1,023,232
1665	11 - DI - 100 - corrosive	229	1971	2000	$70,761	15	45	$309	New Operation	$62,302
1666	12 - DI - 100 up to 250 - corro	64,046	1968	2001	$24,721,756	15	45	$386	New Operation	$19,527,897
1678	24 - PVC&PVCTW - 300 to 60	258,707	1953	2003	$147,721,697	10	75	$571	Do Nothing	$147,721,697
1679	25 - PVC & PVCTW - >600	9,793	1952	2003	$10,282,650	10	75	$1,050	Do Nothing	$10,282,650
1680	26 - UNKN & blank - installatio	14,730	1905	1969	$5,685,780	13	90	$386	New Operation	$5,658,897
1681	27 - UNKN & blank - installatio	25,270	1970	2003	$9,754,220	13	55	$386	New Operation	$8,692,352
1682	28 - STL & SS & GALV - up to	3,437	1956	1999	$1,326,682	14	60	$386	New Operation	$939,193
1683	29 - STL & SS & GALV - 300+	11,360	1950	1997	$8,588,160	14	60	$756	New Operation	$6,235,088
1684	30 - CU - all	22,766	1935	2003	$7,034,694	14	75	$309	New Operation	$5,714,617
Totals		*1,820,595*			*$882,162,998*					*$856,584,902*
Earliest Start / End Dates			*1905*	*1953*						
Latest Start / End Dates			*1972*	*2004*						

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CAPS

Capital Asset Prioritization Simulator

(Bottom-Up Approach)

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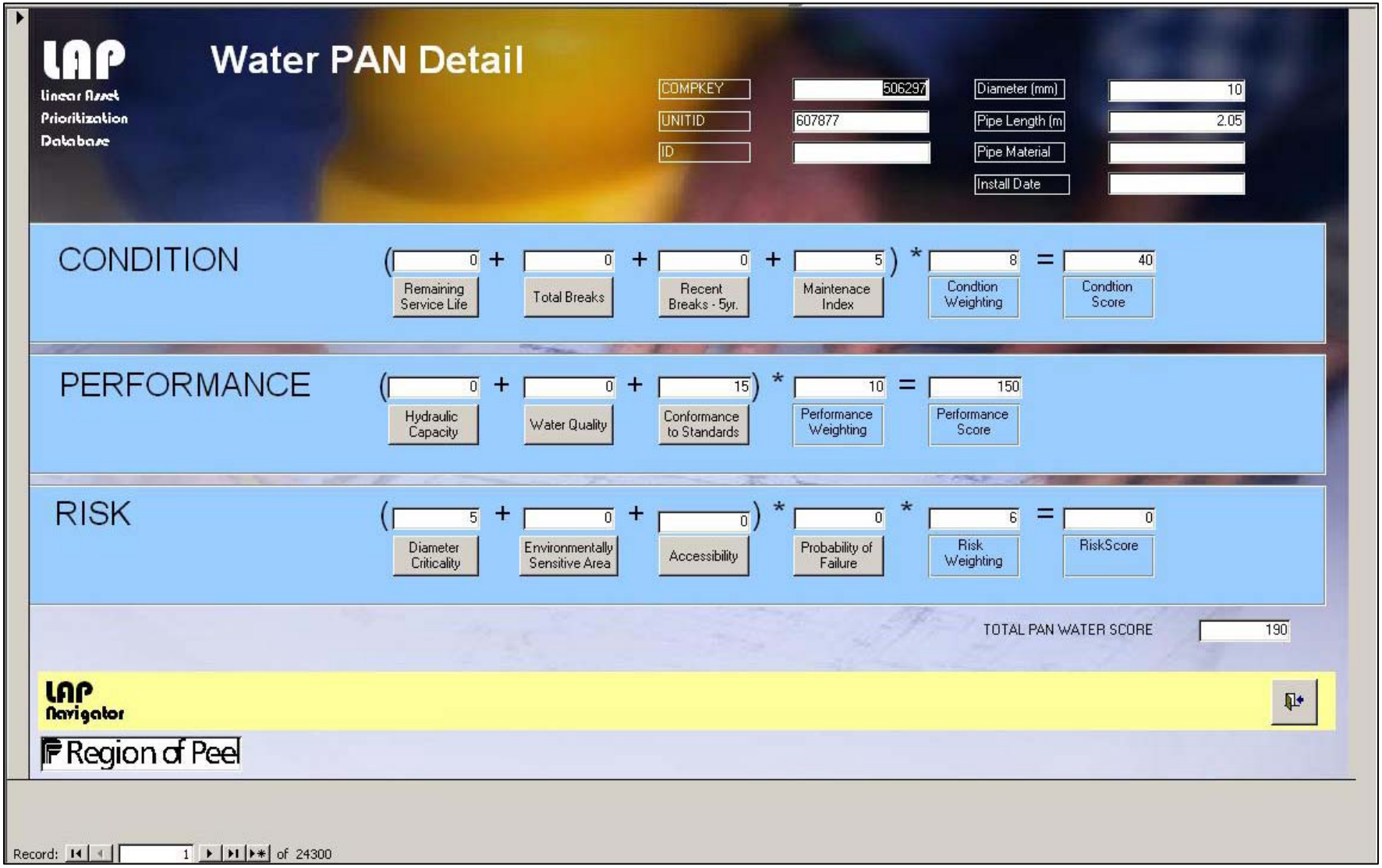

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Sewer Condition
Remaining Service Life

ASSET ID	1799044
COMPKEY	228118

Return to PAN

RSL = Expected Life – Age in Service

INSTDATE	1/19/1966
PIPETYPE	VIT
Expected Life	*65*
Age	*39*
Remaining Life	*26*

Material	Lifespan
Concrete	75
Vitrified Clay	65
PVC	80
AC	75

RL (years)	Score
<15	15
29 – 15	6
50 - 30	3
> 50	0

Remaining Service Life Score *6*

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frm Main Menu : Form

Water Main Rehabilitation And Replacement Prioritization Model

Water Main Data

Prioritization Results

Display Results in GIS

Reports Menu

Construction Conflicts

Administration:

Weighting Factors

Edit Model Parameters

Close & Exit

Version: 2003.04.15

Prioritization of Water Main Replacement

- A Priority Action Number (PAN) is calculated for each water main based on:
  - Agreed-upon algorithms for evaluation
  - Agreed-upon (prescribed) service levels and levels of risk (probability & impact)
- OWASA staff participated in workshop that gave a “weighting” factor to different service criteria

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System Performance Criteria

Service/Performance Criteria	PAN	Weighting Factor
Water Main Age	0 – 100	4
History of Leaks and Breaks	0 – 100	5
Water Quality	5 – 100	0
Water Main Importance	0 – 100	3
Hydraulic Performance	0 – 100	0
Water Main Corrosion	0 – 100	0
Water Main Material	40 – 100	2
Water System Pressure	0 – 100	2
Water Main Location	20 – 100	2
Critical Customer Impact	0 – 100	3

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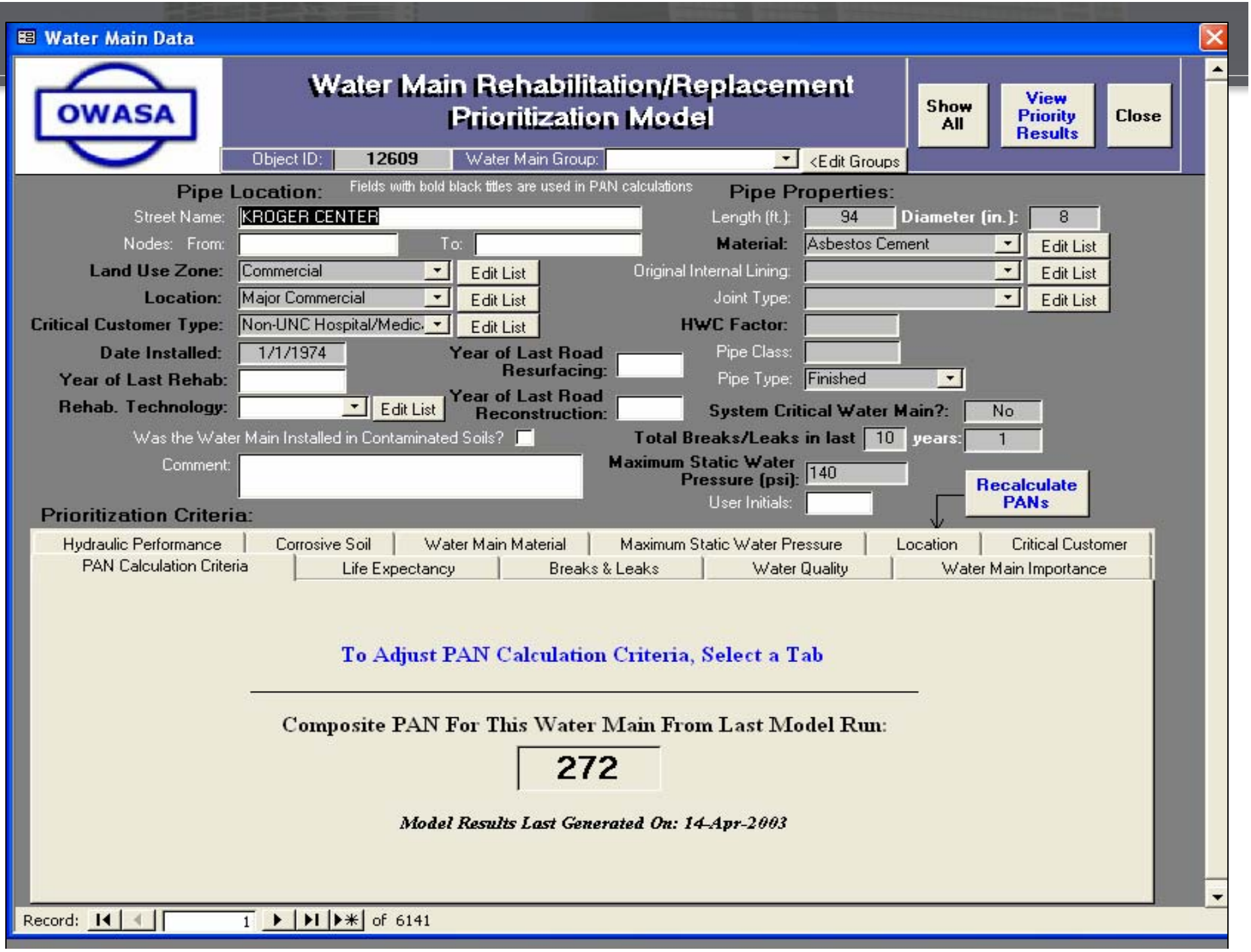
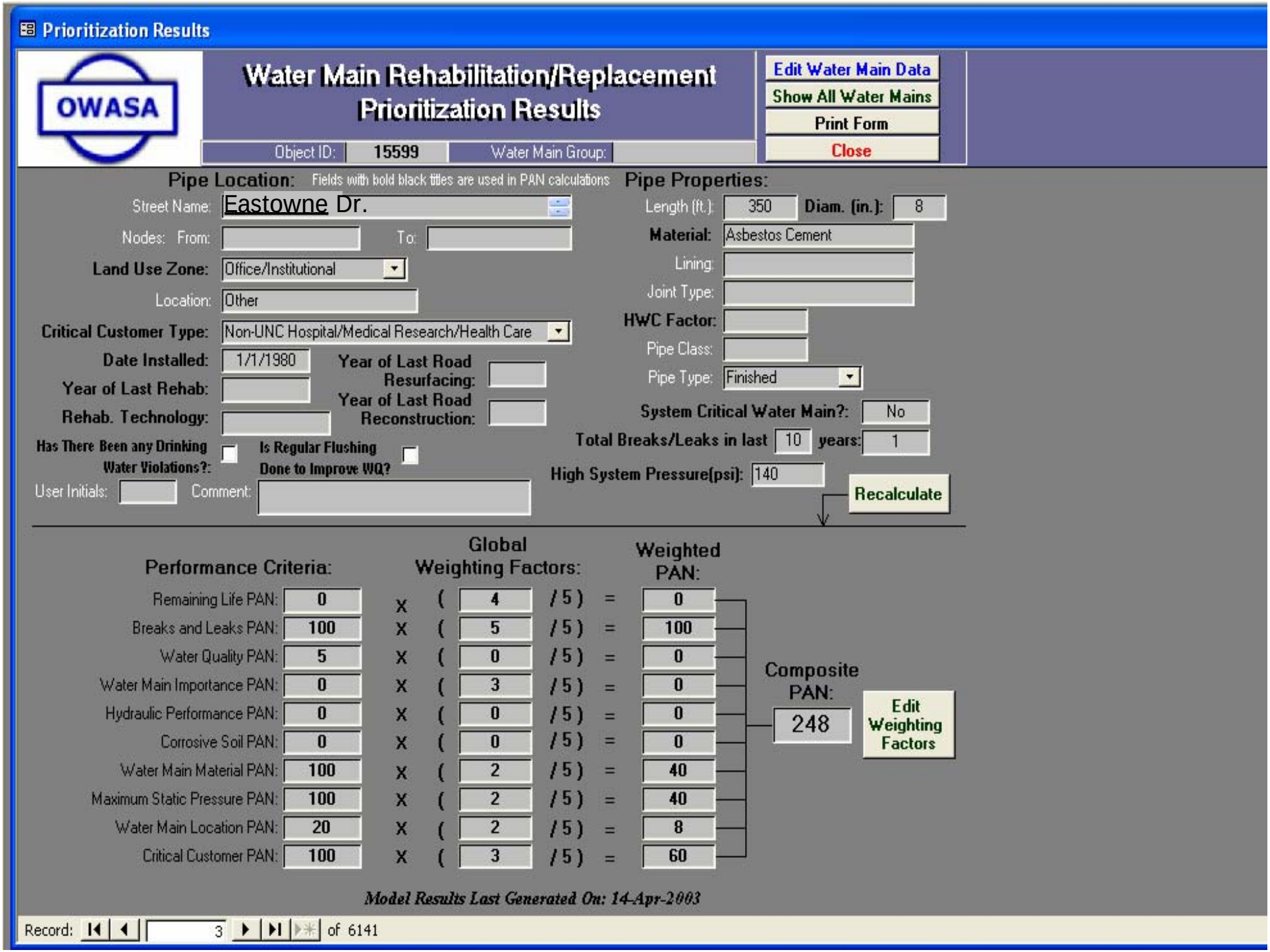
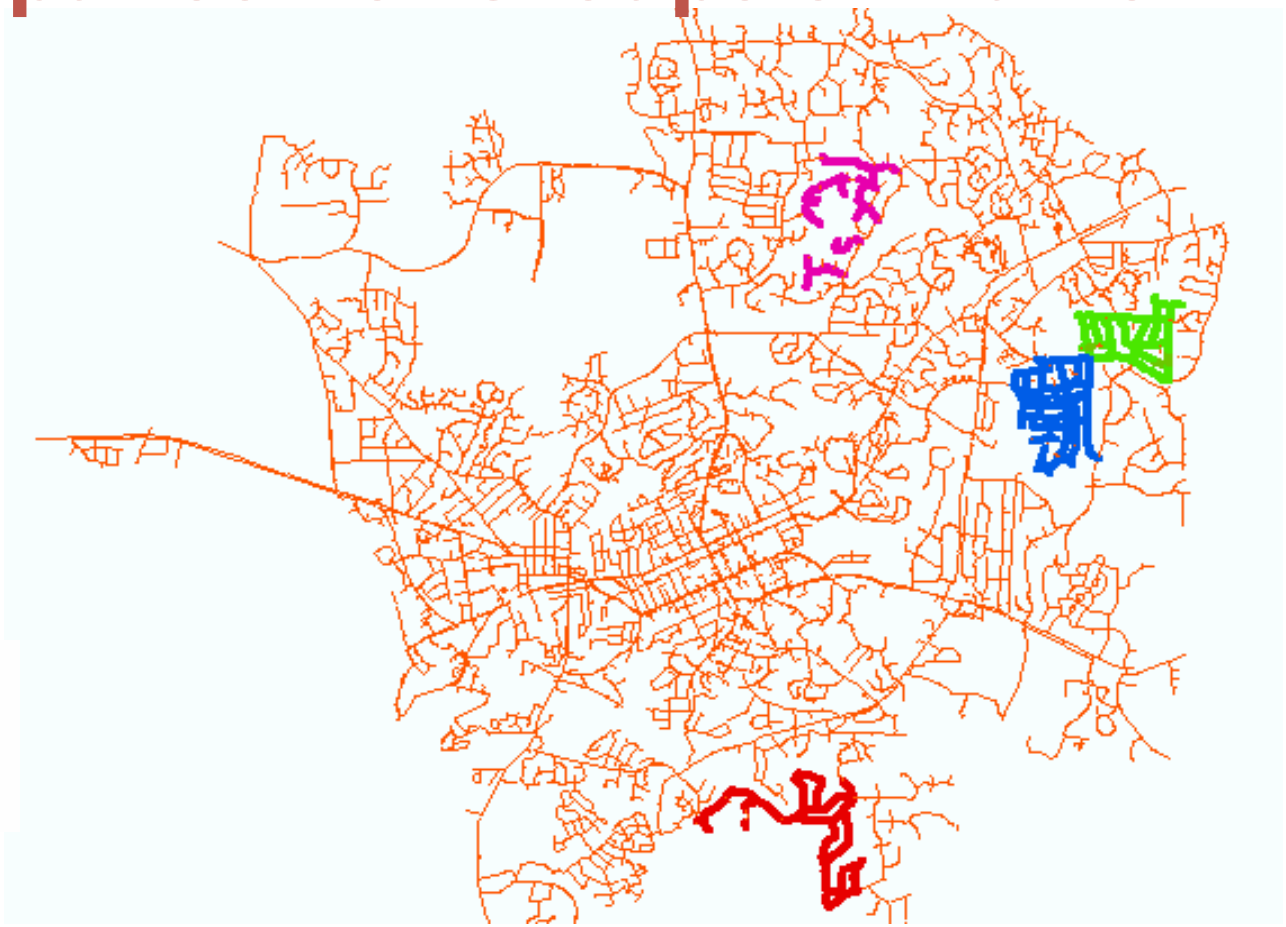

Water Main Data
OWASA
Water Main Rehabilitation/Replacement Prioritization Model
Show All
View Priority Results
Close
Object ID: 12609
Water Main Group:
<Edit Groups
Pipe Location:
Fields with bold black titles are used in PAN calculations
Pipe Properties:
Street Name: KROGER CENTER
Nodes: From:
To:
Land Use Zone: Commercial
Location: Major Commercial
Critical Customer Type: Non-UNC Hospital/Medic.
Date Installed: 1/1/1974
Year of Last Rehab:
Rehab. Technology:
Edit List
Year of Last Road Resurfacing:
Year of Last Road Reconstruction:
Was the Water Main Installed in Contaminated Soils?
Comment:
Length (ft.): 94
Diameter (in.): 8
Material: Asbestos Cement
Original Internal Lining:
Joint Type:
HWC Factor:
Pipe Class:
Pipe Type: Finished
System Critical Water Main?: No
Total Breaks/Leaks in last 10 years: 1
Maximum Static Water Pressure (psi): 140
User Initials:
Recalculate PANs
Prioritization Criteria:
Hydraulic Performance
Corrosive Soil
Water Main Material
Maximum Static Water Pressure
Location
Critical Customer
PAN Calculation Criteria
Life Expectancy
Breaks & Leaks
Water Quality
Water Main Importance
To Adjust PAN Calculation Criteria, Select a Tab
Composite PAN For This Water Main From Last Model Run:
272
Model Results Last Generated On: 14-Apr-2003
Record: 1 of 6141


Prioritization Results
OWASA
Water Main Rehabilitation/Replacement Prioritization Results
Object ID: 15599
Water Main Group:
Edit Water Main Data
Show All Water Mains
Print Form
Close
Pipe Location: Fields with bold black titles are used in PAN calculations
Street Name: Eastowne Dr.
Nodes: From:
To:
Land Use Zone: Office/Institutional
Location: Other
Critical Customer Type: Non-UNC Hospital/Medical Research/Health Care
Date Installed: 1/1/1980
Year of Last Rehab:
Rehab. Technology:
Year of Last Road Resurfacing:
Year of Last Road Reconstruction:
Has There Been any Drinking Water Violations?:
Is Regular Flushing Done to Improve WQ?
User Initials:
Comment:
Pipe Properties:
Length (ft.): 350
Diam. (in.): 8
Material: Asbestos Cement
Lining:
Joint Type:
HWC Factor:
Pipe Class:
Pipe Type: Finished
System Critical Water Main?: No
Total Breaks/Leaks in last 10 years: 1
High System Pressure(psi): 140
Recalculate
Performance Criteria:
Global Weighting Factors:
Weighted PAN:
Remaining Life PAN: 0 X (4 /5) = 0
Breaks and Leaks PAN: 100 X (5 /5) = 100
Water Quality PAN: 5 X (0 /5) = 0
Water Main Importance PAN: 0 X (3 /5) = 0
Hydraulic Performance PAN: 0 X (0 /5) = 0
Corrosive Soil PAN: 0 X (0 /5) = 0
Water Main Material PAN: 100 X (2 /5) = 40
Maximum Static Pressure PAN: 100 X (2 /5) = 40
Water Main Location PAN: 20 X (2 /5) = 8
Critical Customer PAN: 100 X (3 /5) = 60
Composite PAN: 248
Edit Weighting Factors
Model Results Last Generated On: 14-Apr-2003
Record: 3 of 6141

Comparison of Groups of Mains



- Briarcliff (PAN 108)
- Colony Woods (PAN 114)
- N Lake Forest (PAN 68)
- Bayberry (PAN 74)

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How to get started with your AMPs…

- Develop Goals & Assess Needs
- Recognize the benefits and limitations of the top-down vs. bottom-up approach
- If you don't have clear policies to manage your W/WW system, establish them
- Ensure your available information can support your approach to asset management
- Do what you can now… your problem will not go away, it will only get worse
- Prepare a strategy for implementing more robust asset management practices going forward

Questions

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