Asset Management:
Highline Water District – A Case Study

Thomas D. Keown, PE

GHD

Copyright © GHD 2009

Agenda

- AM Intro/Background
- Why an Asset Management Plan for Highline Water District?
  - What Is the State of the District's Assets?
  - How are Highline's Levels of Service created?
  - How Will Highline's Assets be Managed?
  - How is Business Risk Determined At Highline?
  - How is the AMP Used in Highline's Day-To-Day?
  - How and When will the AMP Be Improved/Updated?
- Questions

Copyright © GHD 2009

GHD Asset and Facilities Management

- GHD has been consulting in Asset Management for 20+ years
- GHD are considered one of the leading Asset Management consultants in the world
- GHD's Roger Byrne is an original principal author of the "International Infrastructure Management Manual"
  - Considered the 'must have' guide to AM

- GHD has over 50 manuals that cover the full range of Asset Management areas
- GHD have been chosen by the US EPA to conduct AM training workshops across the USA
- WERF / AwwaRF commissioned GHD to create 'SIMPLE' – a web-based tool that enables the user to learn step-by-step on how to sustainable implement AM techniques

Copyright © GHD 2009

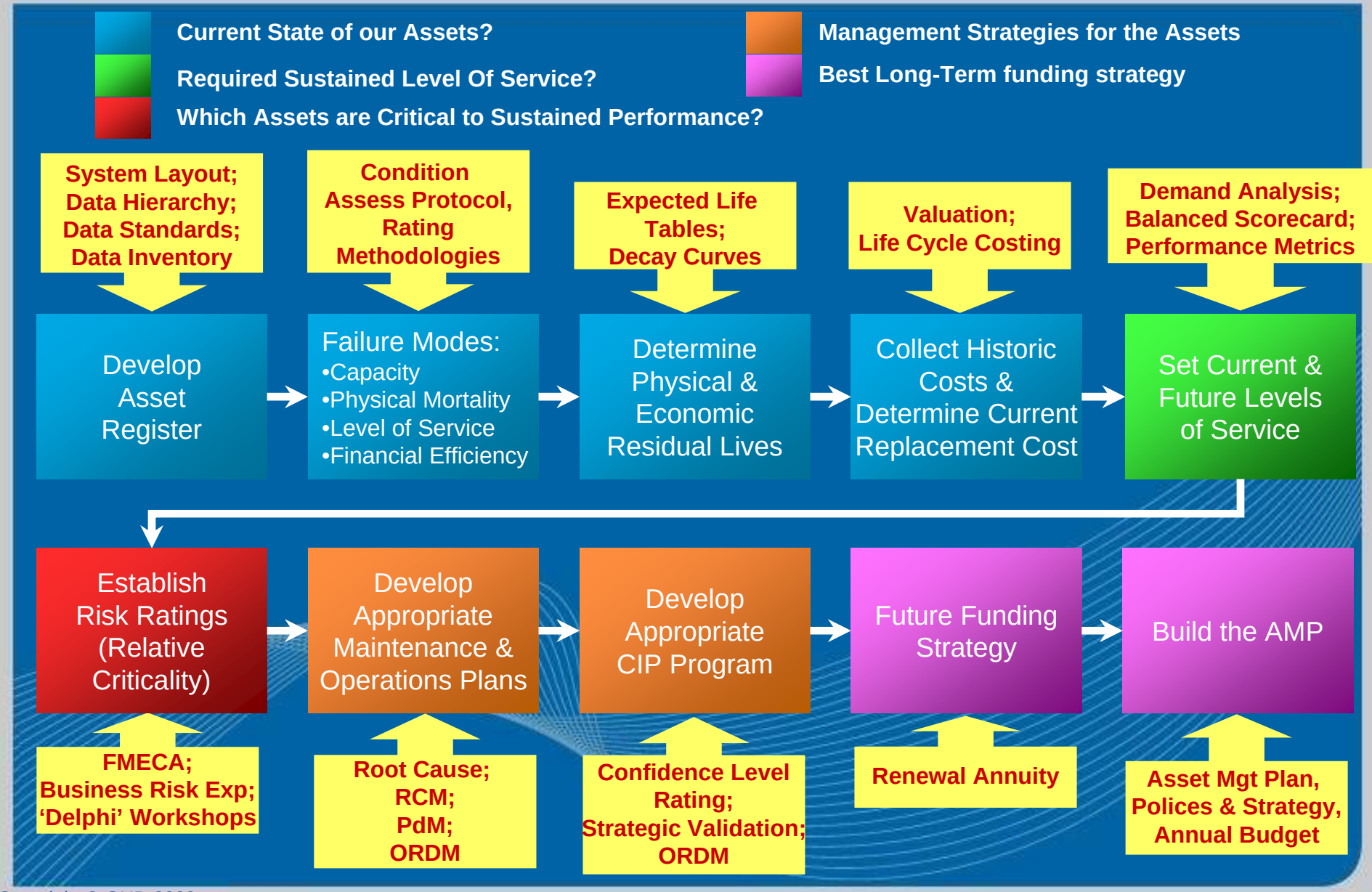
Bottom Line: Emergent Industry Profile

- Increasing aggregate demand – water and wastewater
- Diminishing available water resources
- Leveling of “production efficiencies”
- Increasing output restrictions
- Aging infrastructure
- ***Result: Increasingly expensive treatment options***

- Aging customer base – more and more on fixed income
- Diminishing technical labor pool running larger and more sophisticated plants and facilities
- Outflow of knowledge with retiring labor base
- Increasing resistance to rate increases
- ***Result: Increasingly complex management environment***

Copyright © GHD 2009

Investment Decision Making Process



Copyright © GHD 2009

CLIENTS | PEOPLE | PERFORMANCE

Creating an Asset Management Plan At Highline Water District

Investment Decision Making Process

- Current State of our Assets?
- Required Sustained Level Of Service?
- Which Assets are Critical to Sustained Performance?
- Management Strategies for the Assets
- Best Long-Term funding strategy

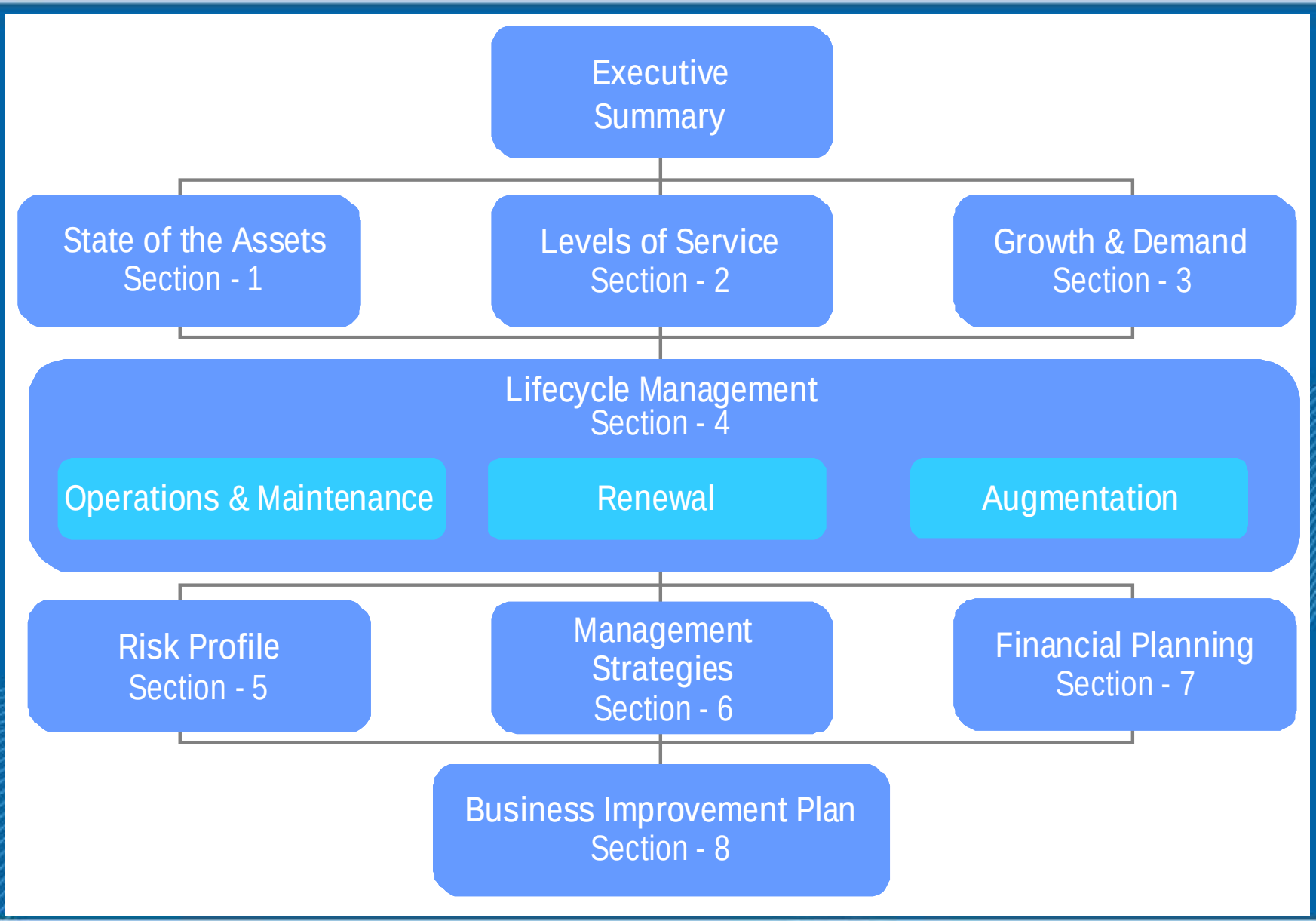
Develop Asset Register → Failure Modes:
- Capacity
- Physical Mortality
- Level of Service
- Financial Efficiency

→ Determine Physical & Economic Residual Lives → Collect Historic Costs & Determine Current Replacement Cost → Set Current & Future Levels of Service

→ Establish Risk Ratings (Relative Criticality) → Develop Appropriate Maintenance & Operations Plans → Develop Appropriate CIP Program → Future Funding Requirements → Build the AMP

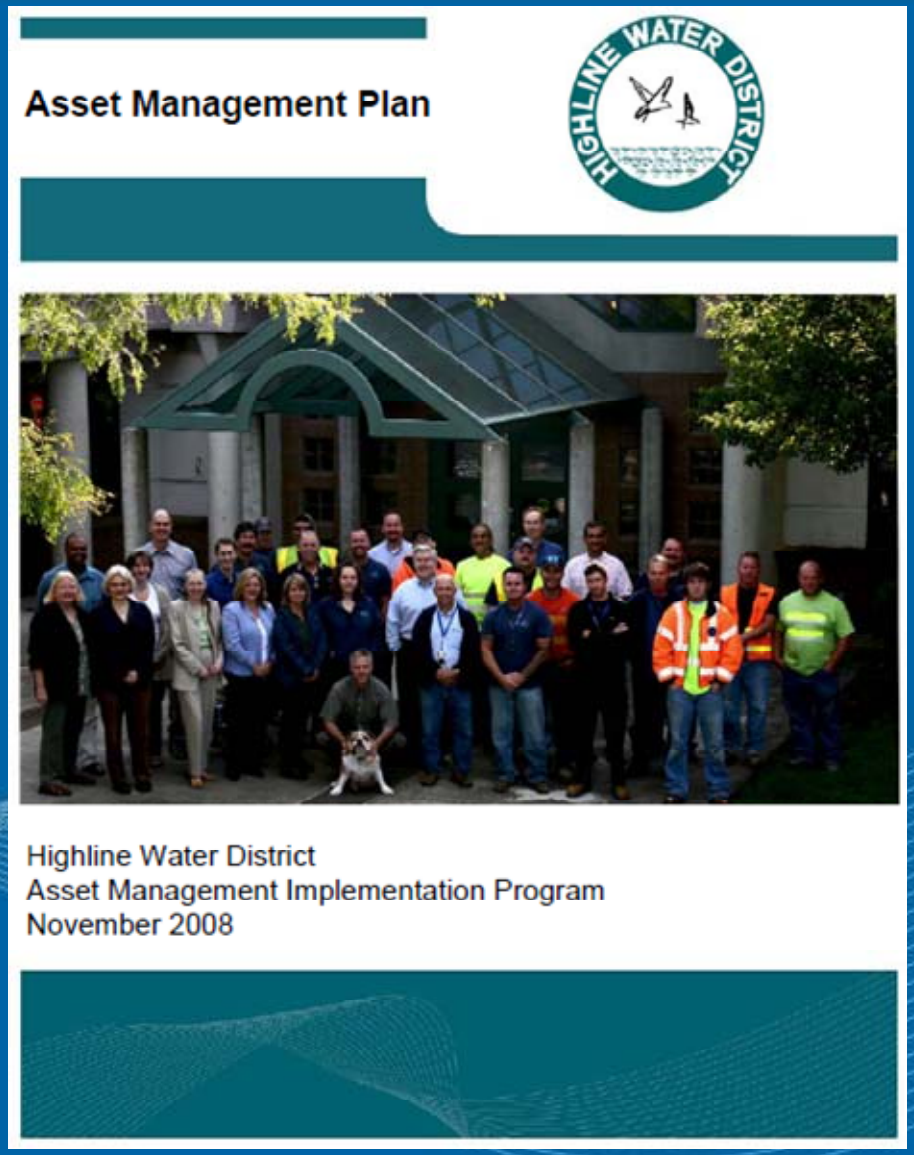
Copyright © GHD 2009

Asset Management Plan Structure



Copyright © GHD 2009

The Enterprise Asset Management Plan



Copyright © GHD 2009

Highline Water District

- Background Information:
  - Special Purpose District (RCW Title 57)
  - Potable Water Only
  - Service Area: 18 sq mi
  - Population Served: Approx. 75,000
  - Water Services: 18,000
  - Miles of Main: 280
  - Number of Employees: 32, plus one team mascot

Copyright © GHD 2009

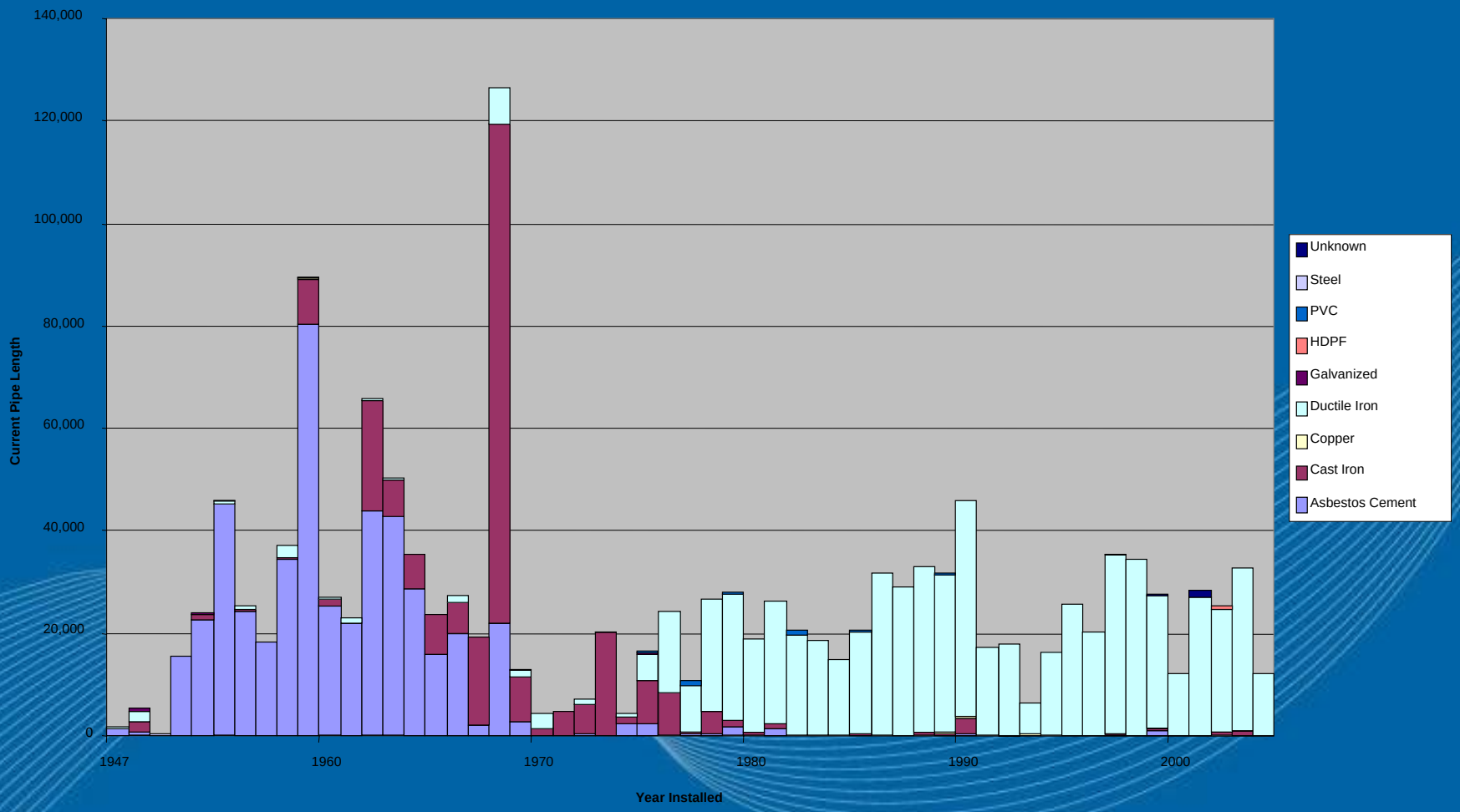
Getting AM Started at Highline Water District

- State of Highline's Assets
- Levels of Service
- Life-cycle Management Strategies
- Business Risk
- Improvements to Plan

Copyright © GHD 2009

Highline WD – Asset

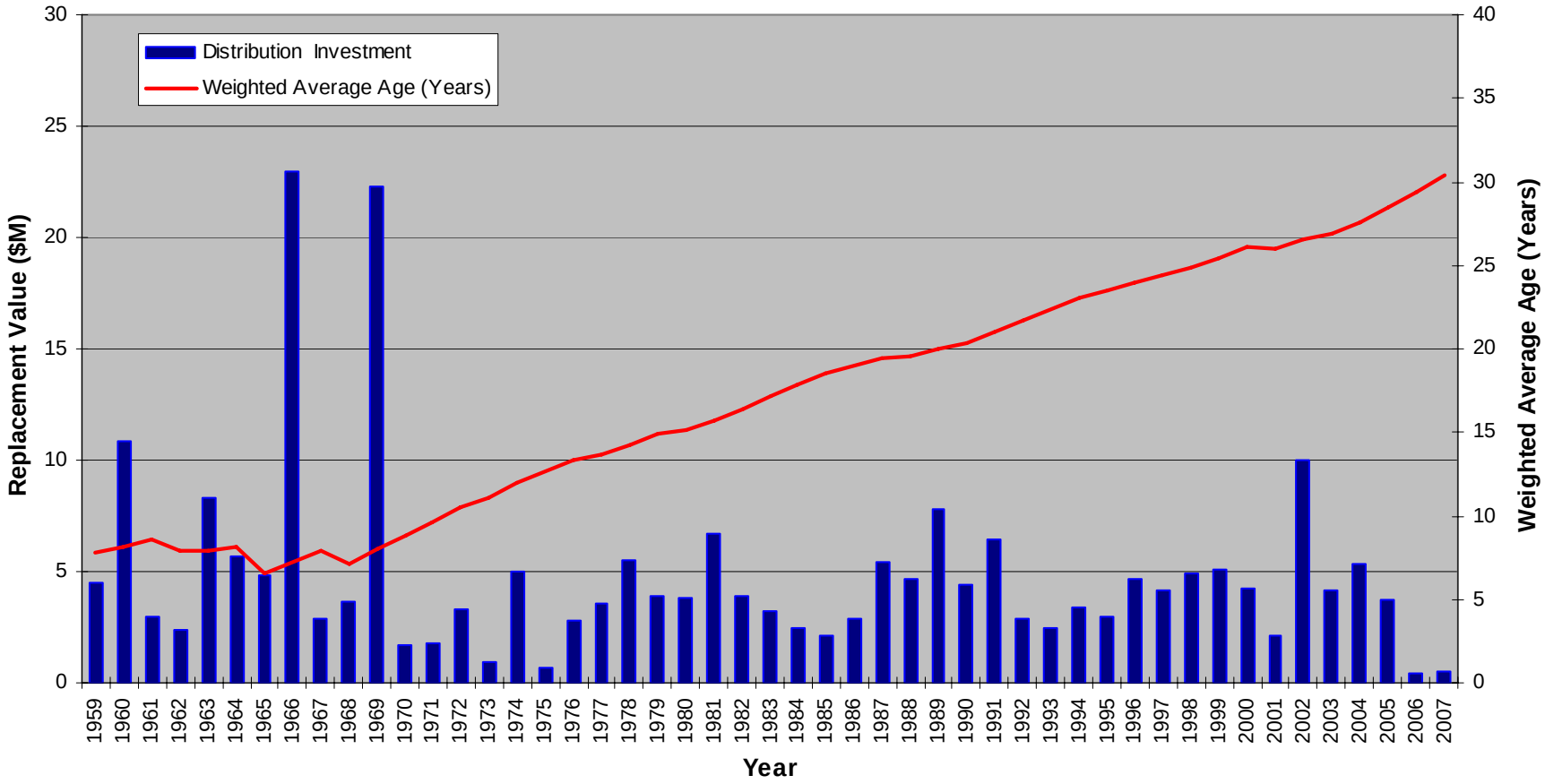
Water Distribution – Pipe Type



Copyright © GHD 2009

Highline WD – Asset Overview

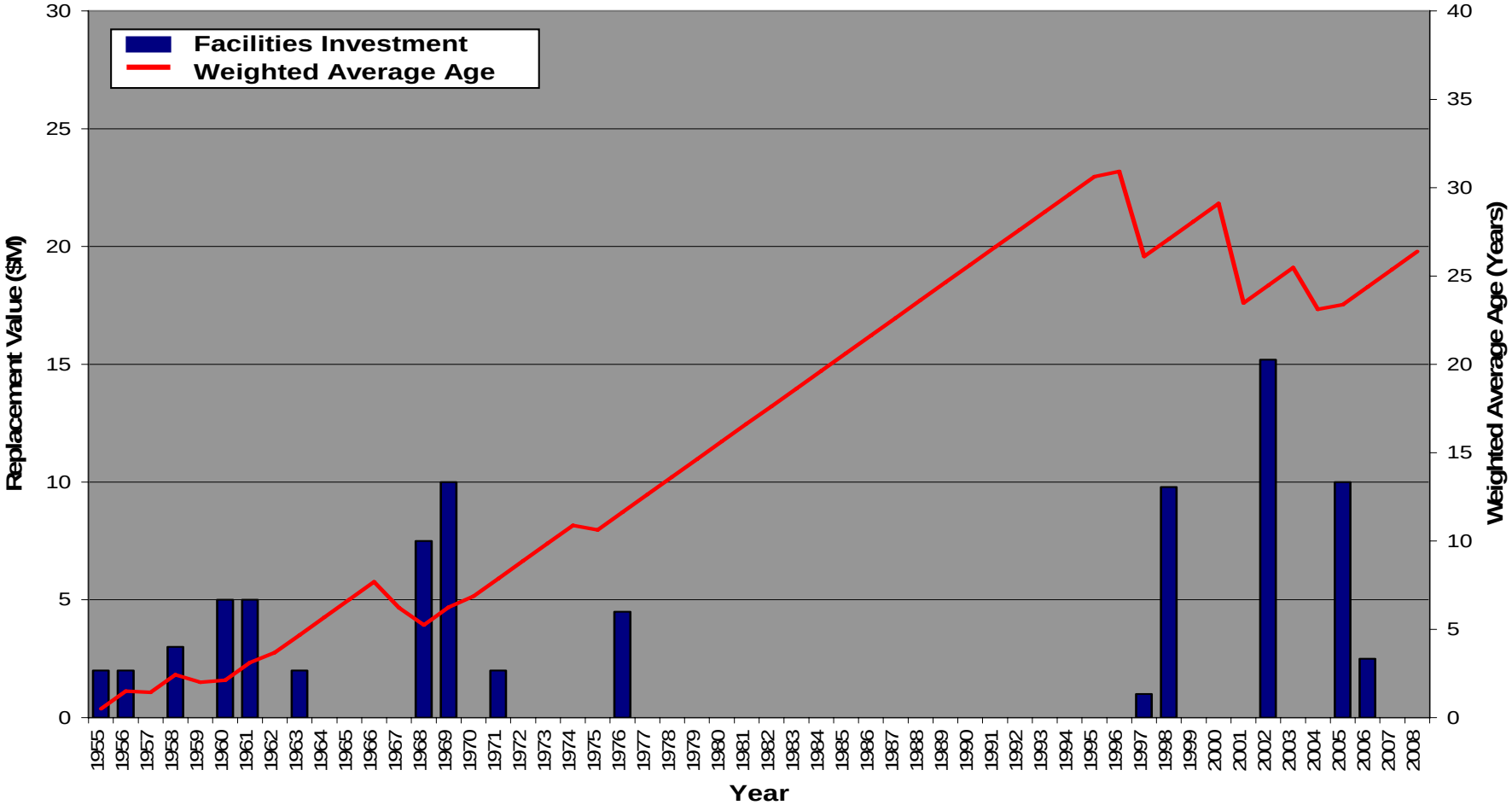
Past Investment – Water Distribution



Copyright © GHD 2009

Highline WD – Asset Overview

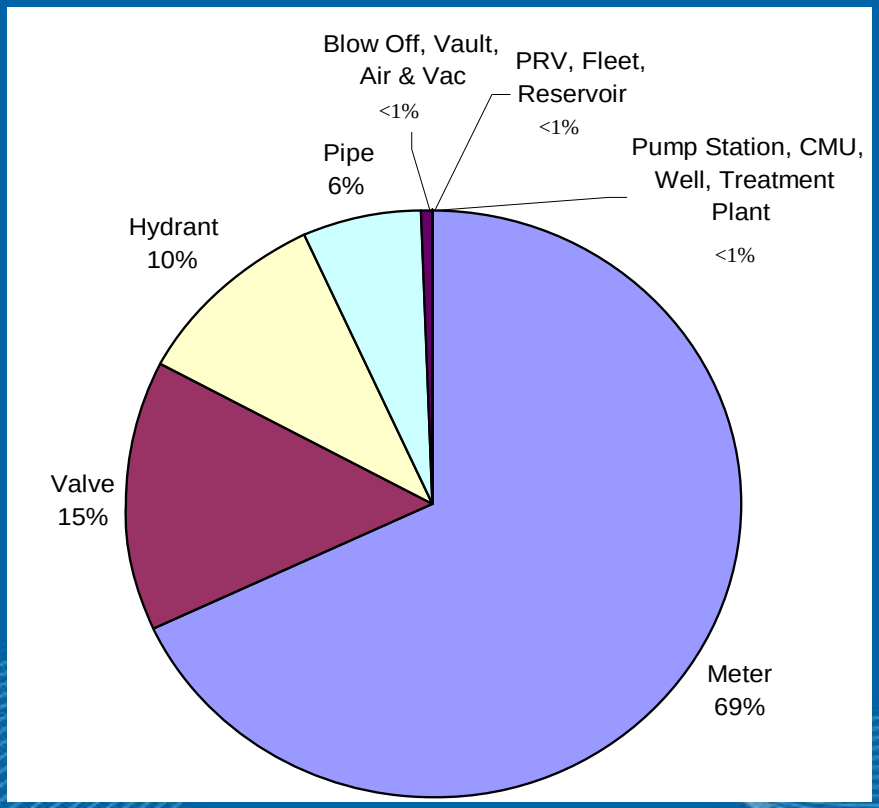
Past Investment – Supply



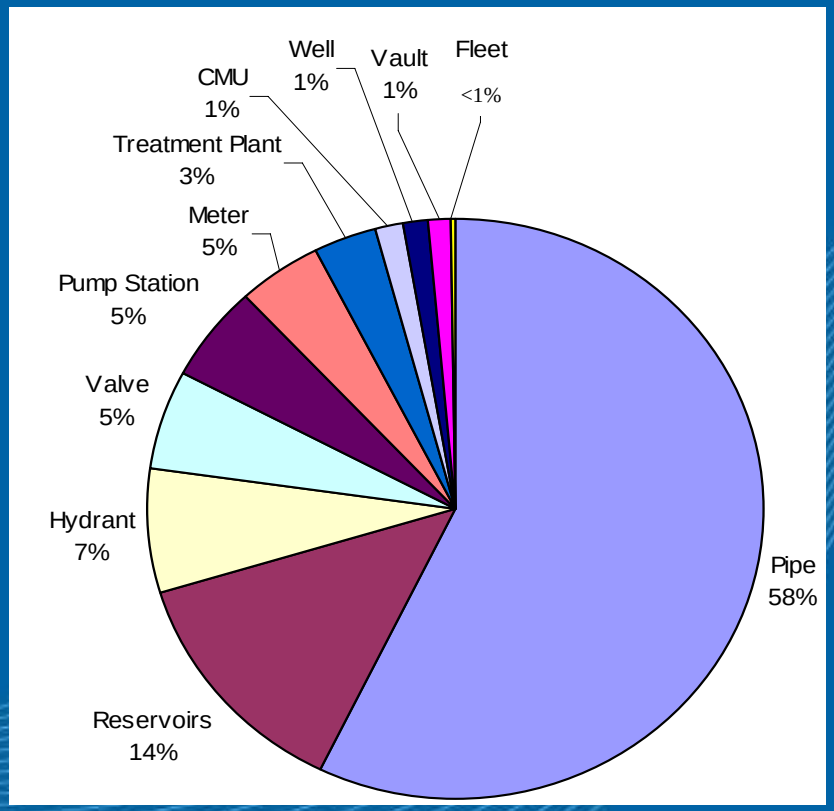
Copyright © GHD 2009

Highline WD – Asset Overview

Number of Assets by Group

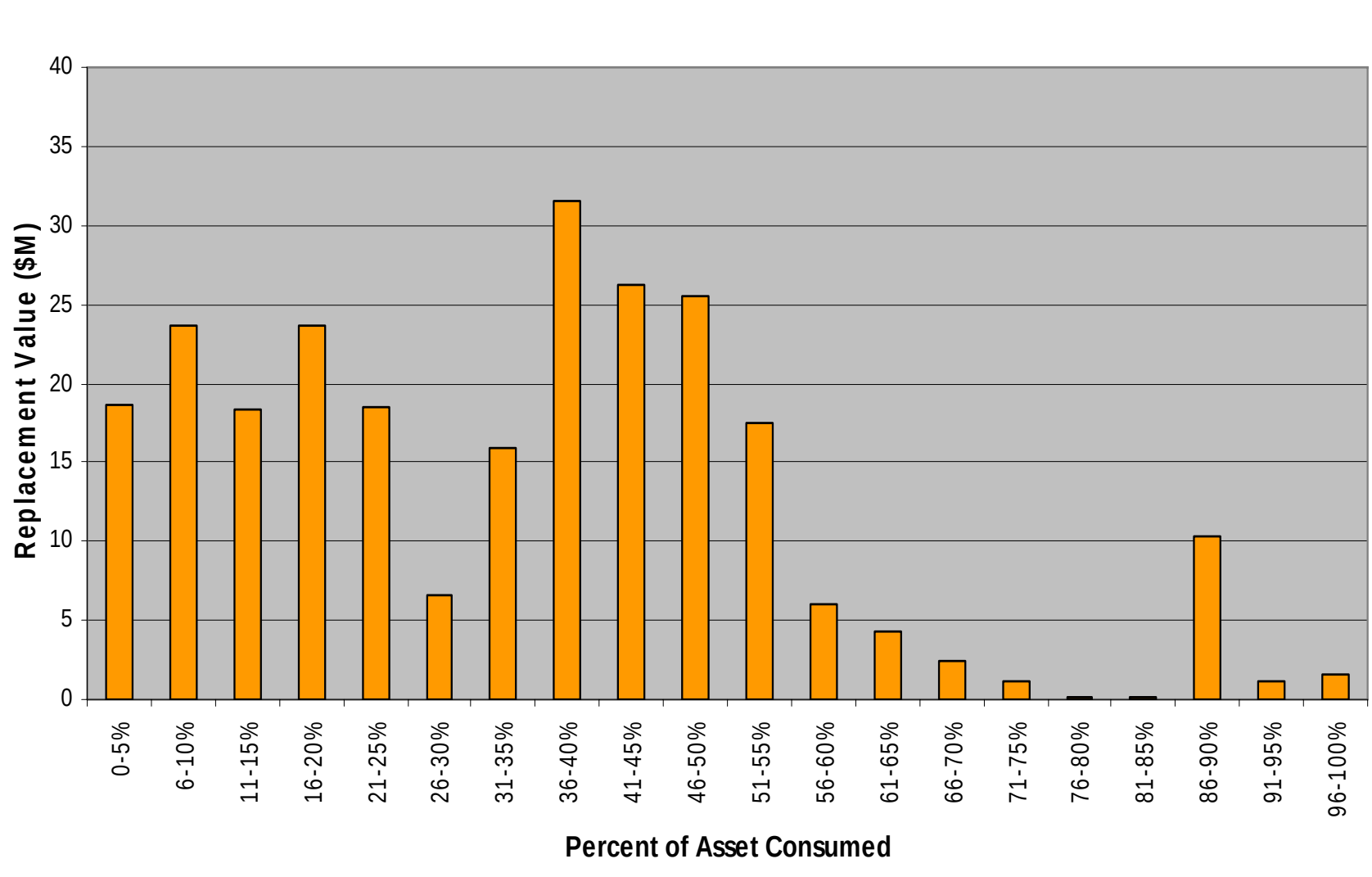


Value of Assets by Group



Copyright © GHD 2009

State of District's Assets



Copyright © GHD 2009

AM at Highline Water District

Managing Assets and Understanding Future Need

Copyright © GHD 2009

Failure Mode

Name the Movie:

Planes, Trains and Automobiles (a Hughes Entertainment Production)

Name the Year:

1987

Copyright © GHD 2009

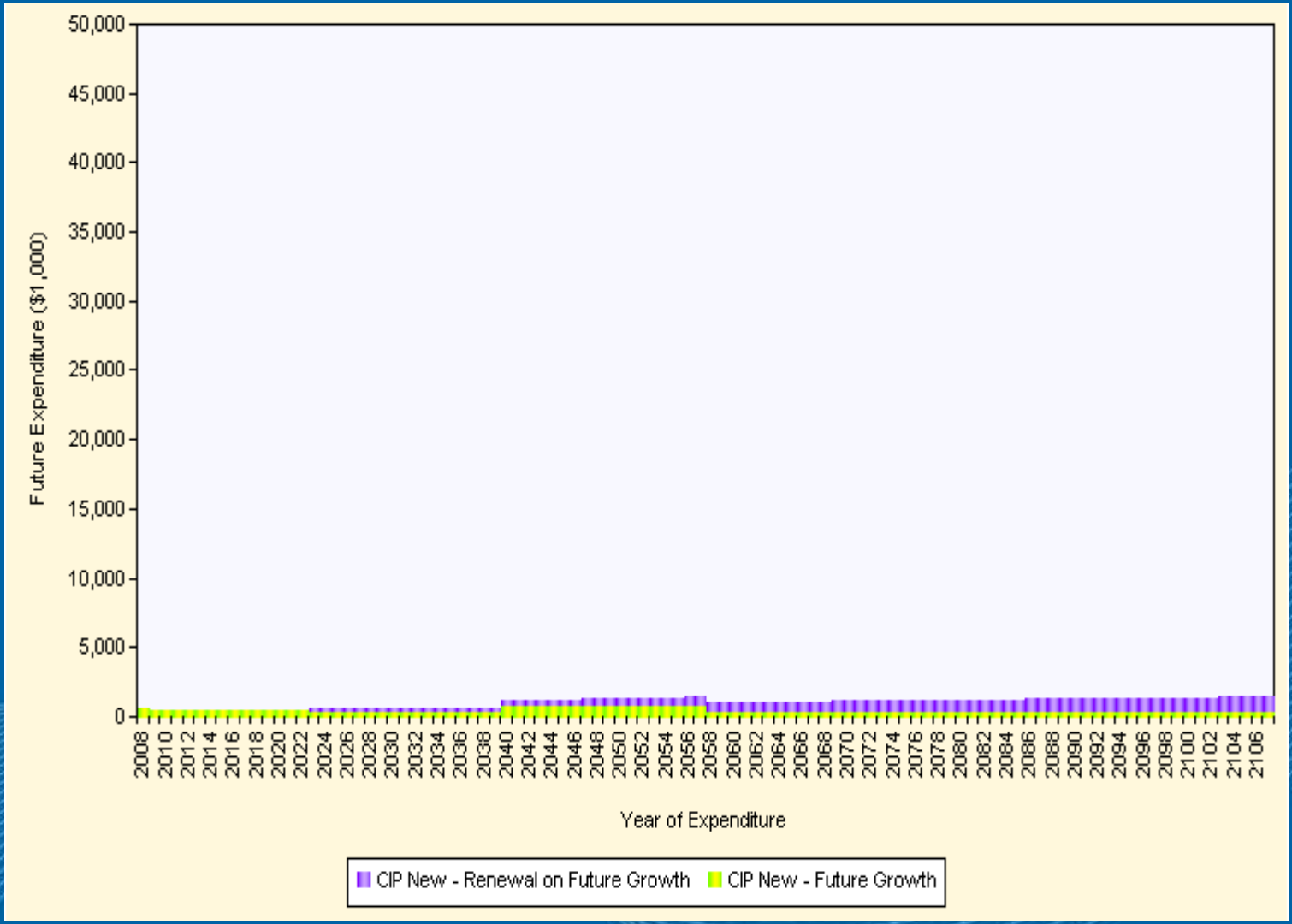
Understanding Failure Mode

- Levels of Service (4 Failure Modes)
  - Growth/Capacity
  - Remaining Useful Life / Mortality
  - Level of Service
  - Business Efficiency

- Highline's Data Sources
  1. Comp Plan – Growth/Capacity and LOS
  2. TEAMPlan – Remaining Useful Life
  3. Staff Input - Remaining Useful Life and LOS
  4. Past Studies - Efficiency

Copyright © GHD 2009

Growth and Demand



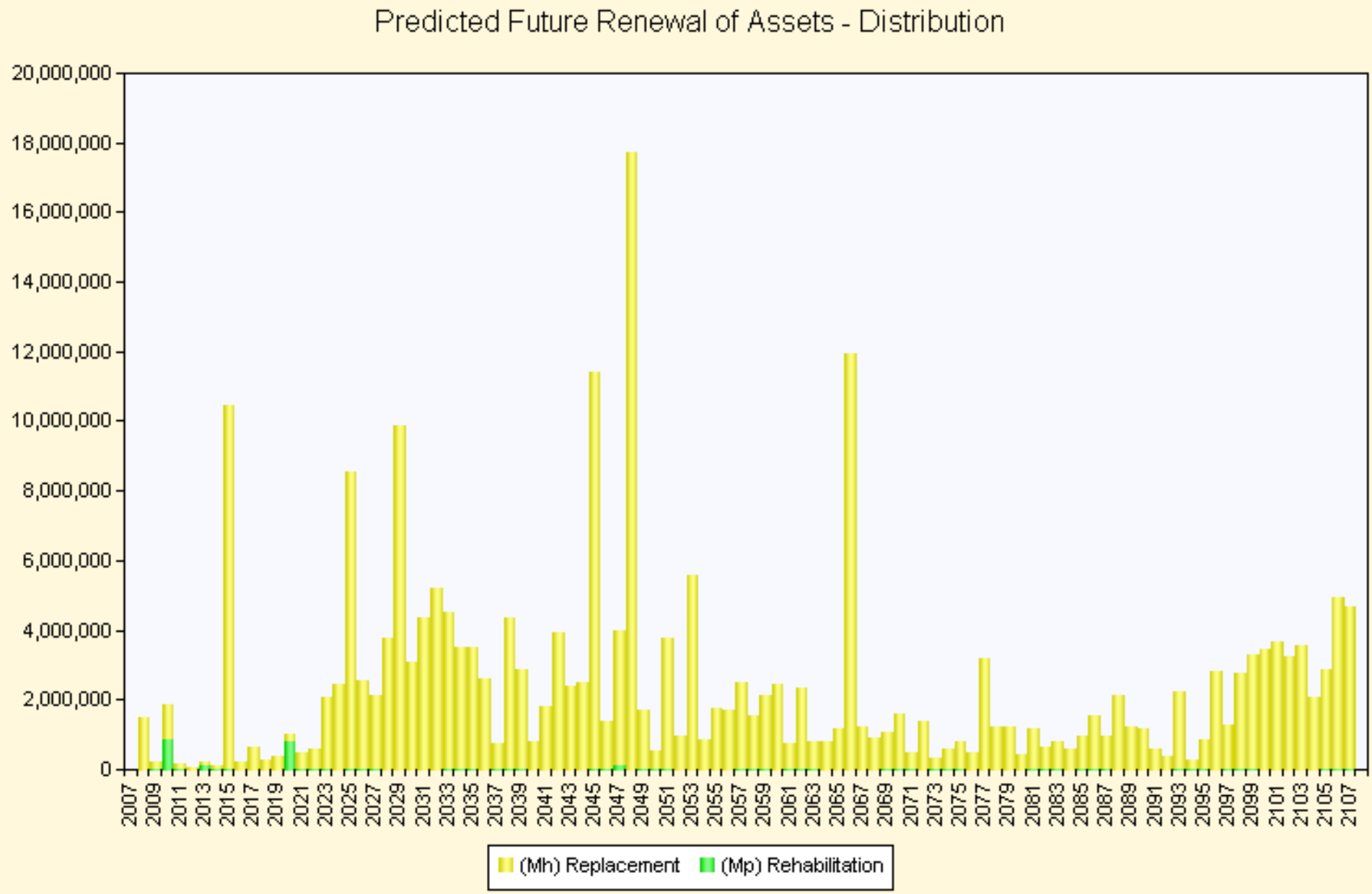
Copyright © GHD 2009

Remaining Useful Life

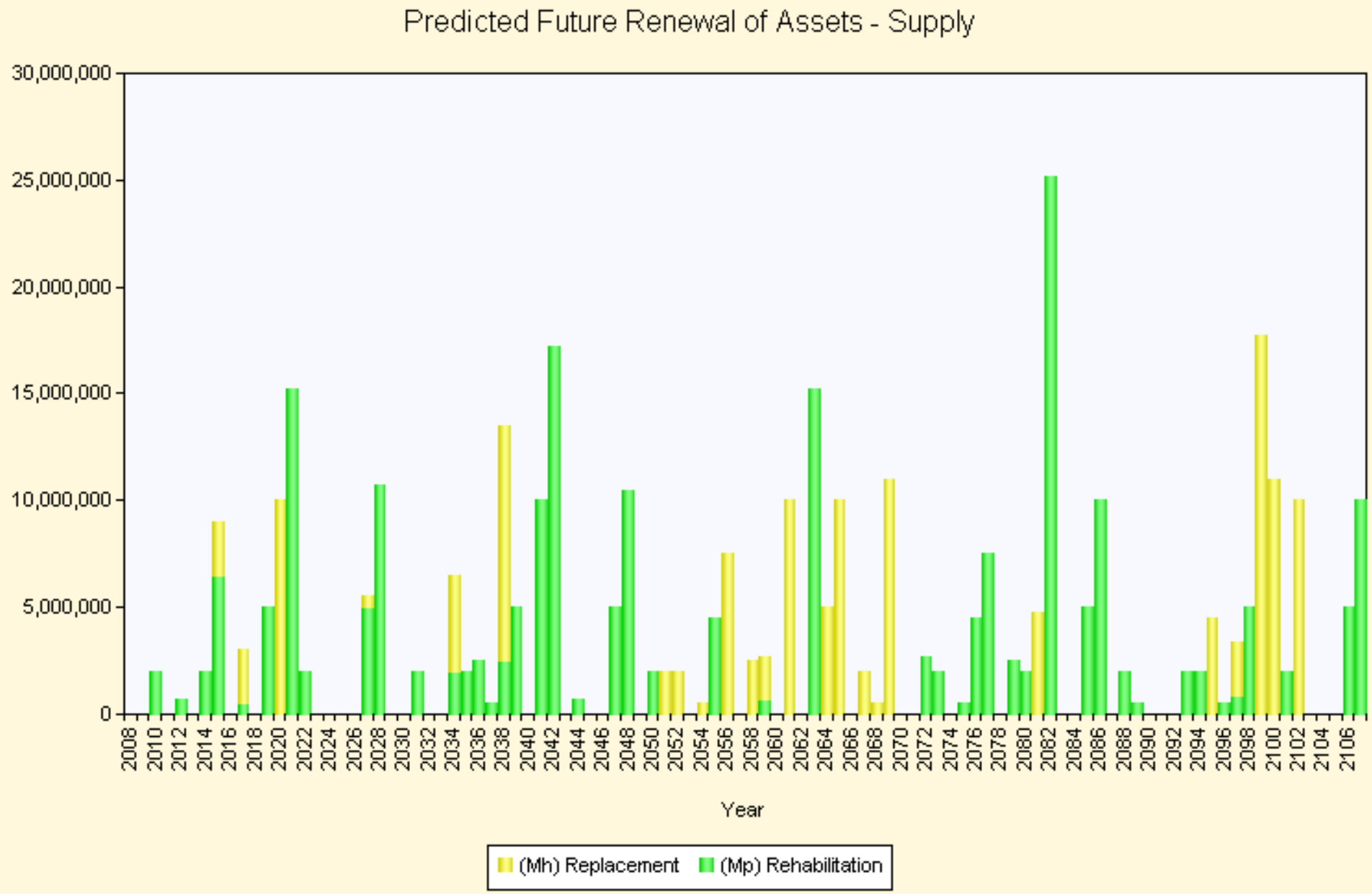
- Example Management Strategies used in TEAMPlan:
  - Pipe
    - PVC/HDPE/DI – 100 years
    - AC – 70 years
      - Small Diameter AC – 60 years
    - CI – 80 years
      - Small Diameter CI – 70 years
    - Note: No effective rehab for pressurized water mains.
  - Hydrants
    - Pre-1970 Hydrants not efficient to operate/rehab, so MS is 35 years of useful life.
    - Post -1970: Rehab every 10 years. Max Life = 50 years
  - Meters
    - Large Meters (>1”) – Minor PM every 2 years, Major PM every 20 years. Max Life = 60 years
    - Small Meters (1” and smaller) – 15 years, then toss.

Copyright © GHD 2009

Renewal Strategies - Distribution



Renewal Strategies - Supply



How Service Levels were set at Highline

- HWD has a long standing goal of providing excellent customer service.
- In recent years, in an effort to quantify this and technical/regulatory goals, the District embarked on creating Annual Goals to be used as a guide for staff.
- The Annual Goals are a representation of all aspects of the District's primary functions. They are distributed across the following District work groups:
  - Management
  - Accounting/Finance
  - Customer Service
  - IT/GIS
  - Planning/Engineering
  - Operations and Maintenance

Copyright © GHD 2009

LOS – Performance Measures

Community Outcome	Core Value	Activity Strategic Outcomes	Customer Levels of Service (CLOS)		Technical Levels of Service (TLOS)	
			Current Target (2008)	Proposed Target (2012)	Current Target (2008)	Proposed Target (2012)
Environmental						
Water sources are protected.	Water Quality	Protect water quality	Meet DOH requirements, and coordinate with local land use councils.	As per current	Well head program - time of travel zones are inspected biannually by staff looking for potential sources of contamination	As per current
The drinking water is safe.	Water Quality	HWD water quality is safe for drinking	75% of customers believe the drinking water is safe to drink 70% of customers believe the drinking water has a good taste	80% of customers believe the drinking water is safe to drink 75% of customers believe the drinking water has a good taste	Comply with 100% of DOH WAC 246.290 monitoring requirements. Maintain fluoride concentration between 0.8 – 1.3 mg/L in distribution system. Maintain pH concentration between 7.6 and 8.3 in distribution system.	As per current As per current As per current

Copyright © GHD 2009

LOS - Performance Measures

Performance Measure Procedure	Areas requiring further input/attention/agreement				
	Strategic Outcomes	Consultation	Customer LoS	Technical LoS	Performance Measure
• Annual CCR Report • WADOH Monthly Water Quality Reports		✓	✓		✓
• Annual CCR Report • WADOH Monthly Water Quality Reports • Prepare Customer Surveys to measure LOS		✓	✓		✓

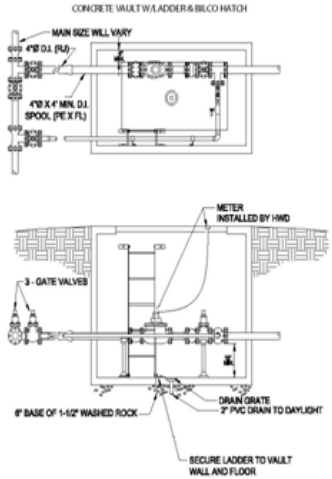
Copyright © GHD 2009

Highline Water Management Strategies

Asset System Summary - Distribution – Large Meters

1. Asset Profile

Diagram



New 3" & Larger Meter Installation

Description

Large meters include 3", 4", 6", 8" and 10" meters. Meters equal to or larger than 3" are contained in meter vaults (also called meter pits); There are 109 special meter vaults listed and there are 108 meters which are 3" and larger.

All of the large meters serve either the 490 Zone or the 560 Zone, which cover the main water service areas. Large water meters typically serve parks, schools, cemeteries, golf courses, commercial uses, and large buildings.

Large meter vaults are generally located in an easement or right-of-way. Large water meters are typically manufactured by Sensus. Large meters are primarily turbine or compound type meters.

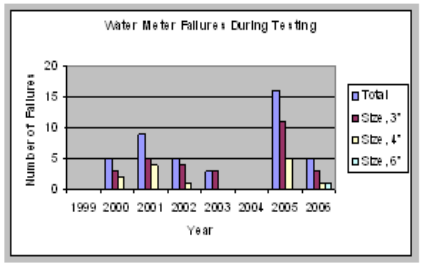
HWD staff runs tests on the accuracy of large water meters, to see if the meters measure actual flow data to within 2-3% of accuracy.

2. Demand Profile and Performance

Table 1 → Peak, Average and Standby Design Capacities

System Sub System(s)	Design Capacity (Min, max, peak and/or average)	Actual Performance
Asset Lives		
→ Physical Effective Life without rehabilitations	3	3
→ Maximum Potential Life between replacement	20	TBD

Failure data of testing large water meters is shown below:



3. Failure Mode

Table 2→ Failure Summary

Process	Area	Rating				
		Condition	Capacity	Function	Reliability	Efficiency
10" meters		1	1	3	2	2
8" meters		1	1	3	2	2
6" meters		3	1	3	2	2
4" meters		3	3	3	2	4
3" meters		3	4	3	2	4

Score Scale:→ 1 – good
→ → 5 – deficient

4. Key Issues for Further Investigation

Sometimes 3" meters are undersized and should be a 4" meter; and vice versa, some 4" meters should be 3" meters. There is a relatively large flow capacity difference between 3" and 4" meters.

HWD plans to inspect large meters every other year rather than every year as they do now.

Key issues to be set as goals for the future: The CMMS will be used to complete condition assessments in the next 2 years.

5. Current Program

Study

TBD

Planning

TBD

Design & Construction

TBD

Management Strategies

Inspect after 2 years

Rebuild every 4 years - typically some of the large meters will fail every 3 to 4 years.

Replace "guts" after 20 years

6. Investment Program

Table 3 → 5-Year Summary

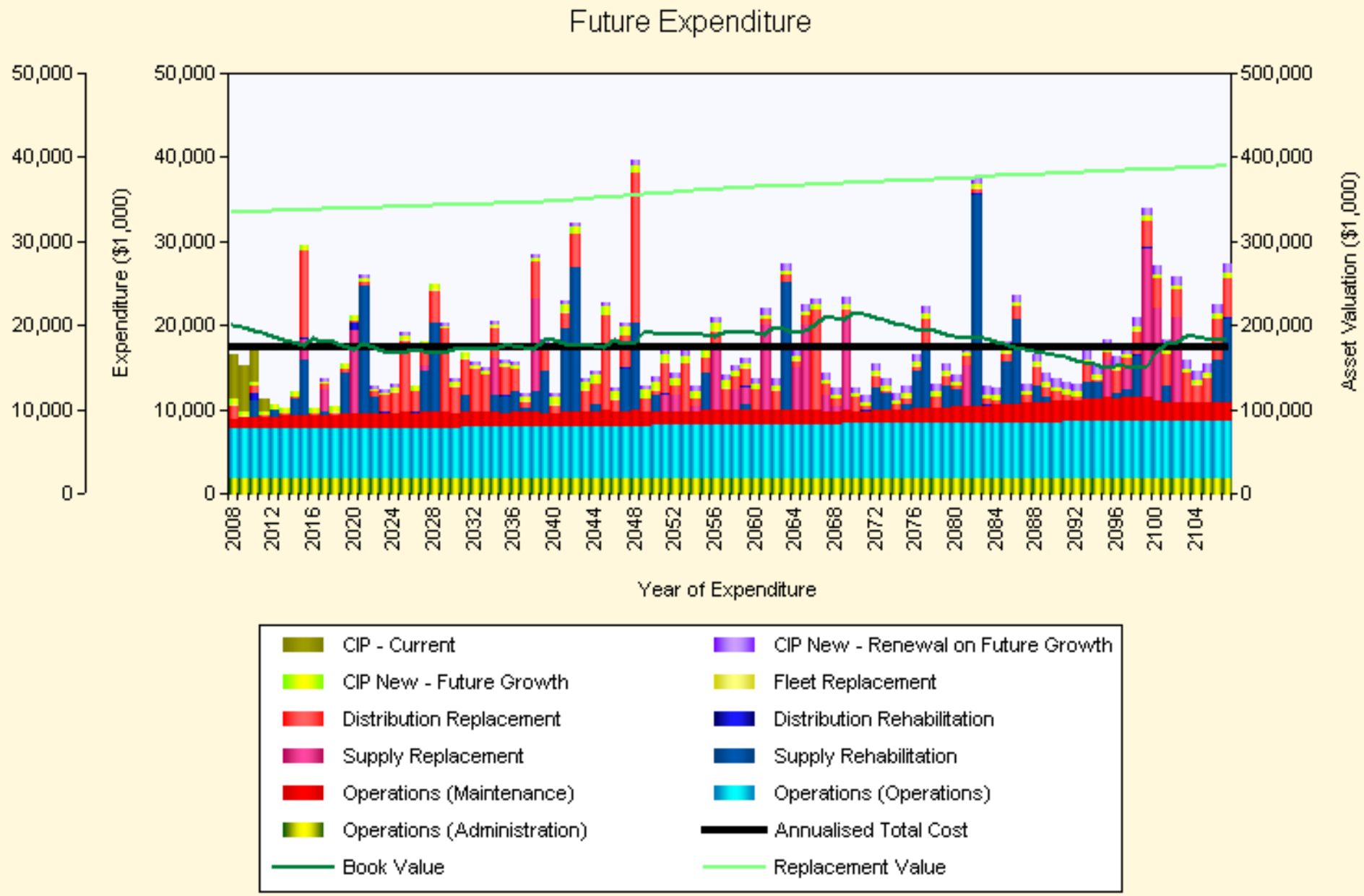
Investment (thousands)	Total Projected Budget	Prior Year	2008	2009	2010	2011
No breakdown on CIP projects		TBD	TBD	TBD	TBD	TBD
Total						

Table 4 → O&M Cost Summary

Cost (thousands)	Prior Year	2008	2009	2010	2011
Maintenance		TBD	TBD	TBD	TBD
Operations		TBD	TBD	TBD	TBD

Copyright © GHD 2009

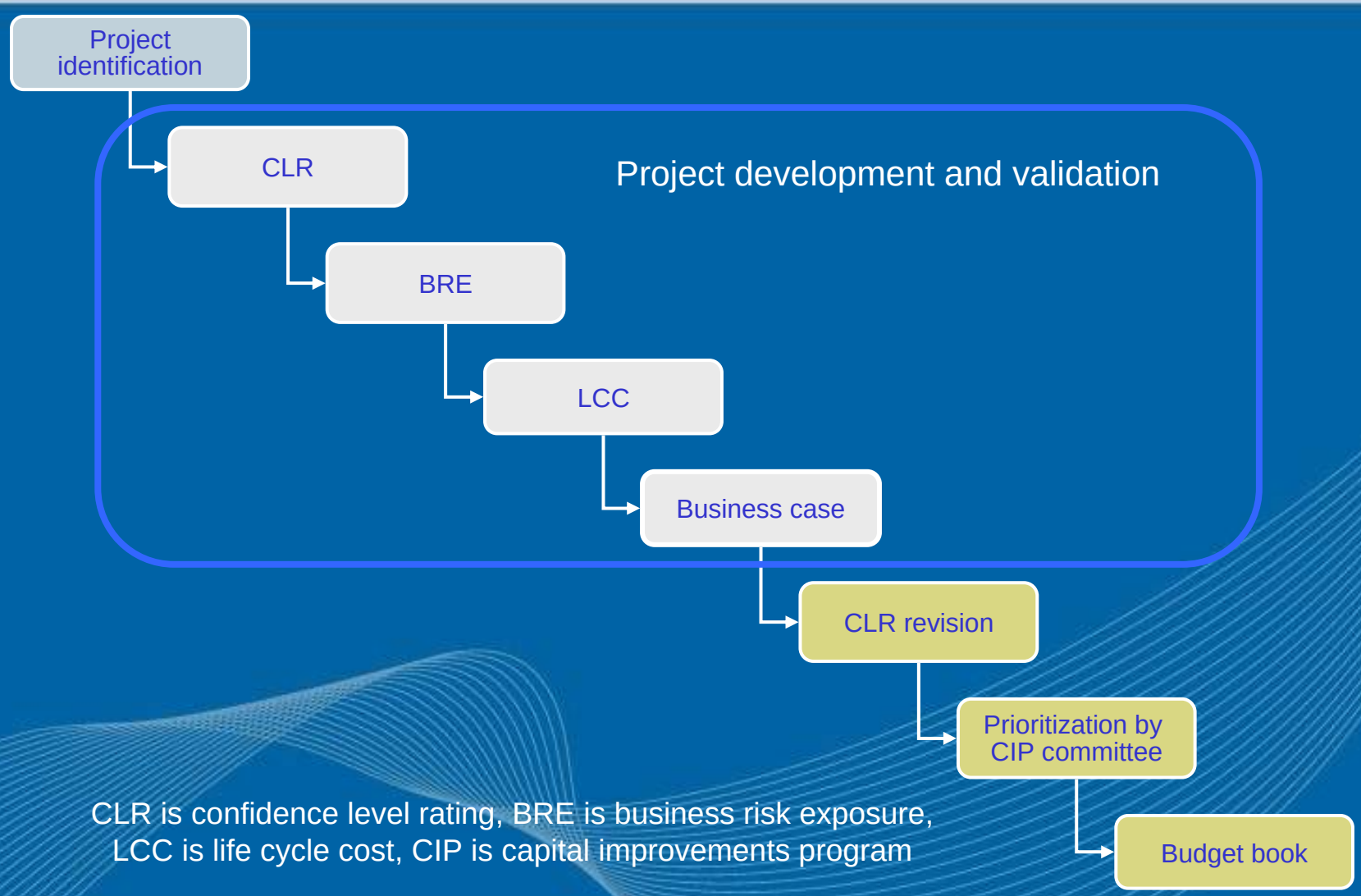
Future Investment Need



HWD's CIP Validation Process

Copyright © GHD 2009

CIP Validation Process



CLR is confidence level rating, BRE is business risk exposure, LCC is life cycle cost, CIP is capital improvements program

Copyright © GHD 2009

Confidence Level Ratings

Confidence Level Rating Tool (CLR) 2
*Licensed Client ** : Highline Water District*
2008/2009 CIP Validation Program
Version 4.10

Project Description: Lakehaven Utility District Source of Supply
Project No: CIP-2A(11-1)

Date: 10/1/2008
Name of Assessor: Thomas Keown

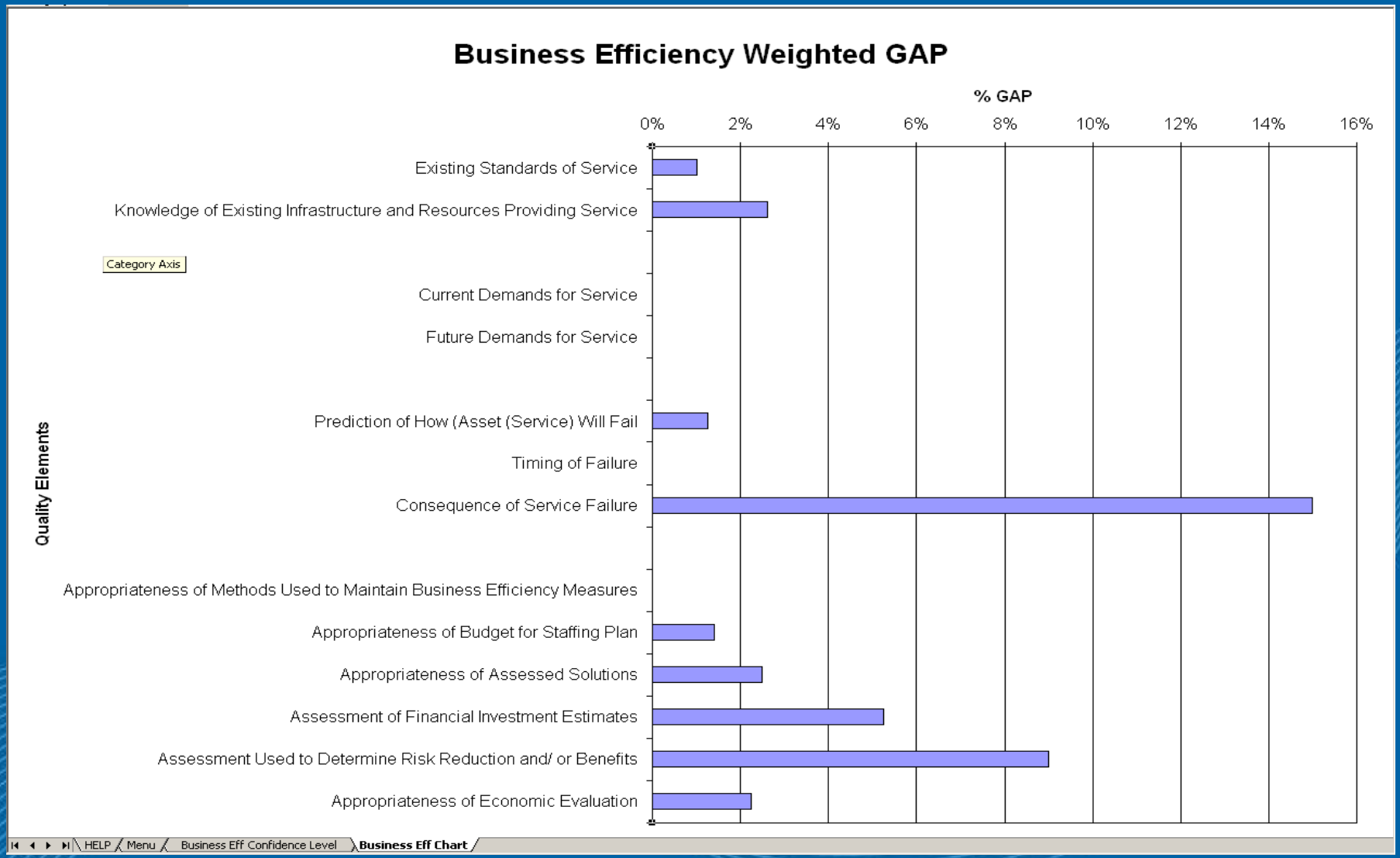
LEVEL 2: Overall Confidence Levels BUSINESS EFFICIENCY CIP Project

No.	Quality Element	Project Value Chain Civil Assets	Process Effectiveness	Data & Knowledge Quality	Process Effectiveness Score	Data Quality Score	Element Quality Rating	Project Confidence Level	The CLR Rating Gap
Understanding of Existing Service									
1	Existing Standards of Service	4%	Consultant Report on LOS	Consultant Report on LOS	75%	75%	75%	3%	1%
2	Knowledge of Existing Infrastructure and Resources Providing Service	15%	- Completed five BAP steps out of six	Data Prepared at Asset Level - CMMS Data	95%	70%	83%	12%	3%
Demands Placed on Service									
3	Current Demands for Service	5%	- Completed five BAP steps out of five	CLR 2/3 Manual (Section 3) Data Used	100%	100%	100%	5%	0%
4	Future Demands for Service	9%	- Completed five BAP steps out of five	CLR 2/3 Manual (Section 3) Data Used	100%	100%	100%	9%	0%
Service Failures									
5	Prediction of How (Asset (Service) Will Fail	10%	Consultant Report on Likely Failure Mode	CLR 2/3 Manual (Section 3) Data Used	75%	100%	88%	9%	1%
6	Timing of Failure	8%	Followed CLR 2/3 Manual (Section 3) Steps	CLR 2/3 Manual (Section 3) Data Used	100%	100%	100%	8%	0%
7	Consequence of Service Failure	20%	Other (Description Attached)	Other (Details Attached)	25%	25%	25%	5%	15%
Analysis Approach									
8	Appropriateness of Methods Used to Maintain Business Efficiency Measures	0%	No Process	No Information	0%	0%	0%	0%	0%
9	Appropriateness of Budget for Staffing Plan	2%	Current Practice	Based on 1 Example	50%	10%	30%	1%	1%
10	Appropriateness of Assessed Solutions	5%	Simple Analysis Done	Data as per Current Practice	50%	50%	50%	3%	3%
11	Assessment of Financial Investment Estimates	7%	Other (Description Attached)	Other (Details Attached)	25%	25%	25%	2%	5%
12	Assessment Used to Determine Risk Reduction and/ or Benefits	12%	Other (Description Attached)	Other (Details Attached)	25%	25%	25%	3%	9%
13	Appropriateness of Economic Evaluation	3%	Other (Description Attached)	Other (Details Attached)	25%	25%	25%	1%	2%
	TOTALS	**100%**						**60%**	40%

Note: Please adjust the value chain to suit the type of asset most predominant in the project by choosing the relevant one in the drop down menu (D11).
Please select the following sheet to review the Chart of CLR gaps. It shows the gap for each of the Secondary Quality Elements

Copyright © GHD 2009

Confidence Level Ratings



Copyright © GHD 2009

How Business Risk was Applied at Highline ?

Business Risk Exposure:

Consequence of Failure X Probability of Failure

X Redundancy = Business Risk Exposure ($$$)

Copyright © GHD 2009

Consequence of Failure

Business Risk Exposure Tool BRE 3.0 Model Version 1.0

*Licensed Client ** : Highline Water District*

2008/2009 CIP Validation Program

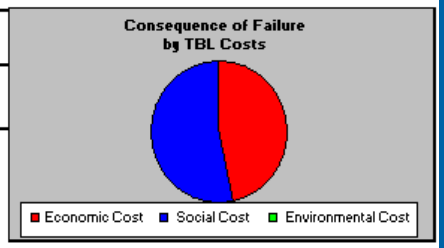
Project Title: Lakehaven
Project No:
Assessor(s): Group

Date (MM/DD/YYYY): 28-May-2008

Duration: Years: Months:

Capital Improvement Program

Failure Mode Level of Service



Consequence of Failure (CoF)

Triple Bottom Line	Consequences of Failure	Calculation				Overriding Value ($)	CoF
Economic	Damage to Failed HWD Assets	Cost of Repair ($)					$ -
		$0					
	Damage to Adjacent HWD Assets	Total Damage ($)					$ -
	Damage to Non-HWD Assets	Total Damage ($)					$ 2,000,000.00
		$2,000,000					
	Loss of HWD Asset Contents	Asset Contents	No. of Deliveries or Days				$ -
		Treated Potable Water					
	Value of Lost HWD Service	Avg. Water Loss (MG/D)	Duration (Days)				$ 253,200.00
		6	30				
	Value of Lost Non-HWD Service(s)	Service Type	Customer Type	No. of Customers	Duration		
		Sewer	Commercial	1000	1 Month		
		N/A	N/A	N/A	N/A		
		N/A	N/A	N/A	N/A		$ 270,000.00
	HWD Legal Costs	Total Costs					$ -
		N/A					
	Fines Levied on HWD	Fine	Number of Violations	Number of Days	Criminal Offense?		
		Clean Air Act			N/A		
		Clean Water Act	TOTAL GALLONS	0	N/A		
		WISHA	TYPE OF VIOLATION		N/A		
		Wash State Health Dep't			N/A		$ -
	Loss of HWD Public Image	HWD Event Magnitude	Duration	Does Emergency Plan Exist?			
		2 - Water Service Break	1 month	No			$ 80,000.00
	Subtotal						**$ 2,609,200.00**

Copyright © GHD 2009

Probability of Failure

Business Risk Exposure Tool BRE 3.0 Model Version 1.0
*Licensed Client ** : Highline Water District*
2008/2009 CIP Validation Program

Probability of Failure Before CIP Project (PoF_B)

Years to Expected Failure		Redundancy		PoF_B	BRE_B
4 Years	25%	50% Backup	50%	13%	$606,250

Probability of Failure After Project (PoF_A) and Total Business Risk Reduction (BRE_B - BRE_A)

	Project Option	Years to Expected Failure		Redundancy		PoF_A	BRE_A	Total Business Risk Reduction (BRE_B - BRE_A)
1.	Alternative Supply	21 - 50 Years	3%	50% Backup	50%	2%	$72,750	$533,500
2.	HWD Well	21 - 50 Years	3%	No Backup	100%	3%	$145,500	$460,750
3.		N/A	-	N/A	-			
4.		N/A	-	N/A	-			
5.		N/A	-	N/A	-			
6.		N/A	-	N/A	-			
7.		N/A	-	N/A	-			
8.		N/A	-	N/A	-			
9.		N/A	-	N/A	-			
10.		N/A	-	N/A	-			

Copyright © GHD 2009

Life Cycle Cost: Highline Example

Life Cycle Cost Comparison – New Source of Supply

Option	Business Risk Exposure ($)	Capital ($)	Annual Operation ($)	Annual Maintenance ($)	PV of Benefits ($)	NPV	Adjusted Annualized PV	Benefit Cost Ratio	Pay Back Period (years)	Total PV/ CLR
1. Maintain Status Quo	0	0	461,160	0	0	-12,576,152	-503,046	0.0	0	-20,960,254
2. Renegotiate Seattle Public Utility Supply Contract	0	0	0	0	0	0	0	0	0	-6,081,669
3. Augment Sources of Supply - Lakehaven Utility District	522,121	1,000,000	8,800	12,000	13,713,933	11,053,026	442,121	5.2	0	18,421,710
4. Augment Sources of Supply – New Well	244,577	3,000,000	100,000	0	13,354,371	8,778,638	292,621	2.9	5	14,631,064

Copyright © GHD 2009

Highline's AM Lessons Learned

- Pros
  1. Management can see how different management strategies impact risk of business operations
  2. Risks can be explained to different audience targets
  3. Better Understanding of Funding Needs

- Cons
  1. Need champions to continue the process
  2. Need better tools for staff to assess remaining useful life
  3. Need additional "exercising" of AM in the organization to change the culture

Copyright © GHD 2009

Highline Water District – Improvement Schedule

- Current Status:
  - HWD currently has a very good asset inventory for linear assets (mains, hydrants, meters, etc)
  - HWD staff currently updating and adding facility data (wells, pump stations, etc) and improving distribution asset data (service lines, valves, etc)
- 2010 Activities:
  - Staff will develop KPIs to measure social and environmental LOS criteria
  - Staff will use CIP Validation process to prioritize projects currently identified in 2011 – 2014
  - Improve Reliability Centered Maintenance (RCM) Program

Copyright © GHD 2009

Questions?

Copyright © GHD 2009

GHD