"Water - A Critical Issue for Sustainability"

by Tim Finley

Overview

- Case for Change
- Preparing for Future Success/Sustainability
- The Path Forward…. Culture Change
- Our Successes to Date

Water Management Today

…Conventional Thinking

Water is…

… Abundant

… “Cheap” or “Free”

… Not a Public Concern

… Non-strategic for Growth

… Not a Potential Barrier to Operations

… Not Significant in Decision Processes

Headline News

- **Water Crisis** Facing Entire Nation
- American Water Resources Association Claims **Looming Water Crisis**
- UN Embarks on International Year of Freshwater 2003
- Multinationals Ride Wave of **Water Privatization**, Investigation Finds
- Water Everywhere...And **Not a Drop to Drink**?
- Nature Group Wade Into **Water War**

Future Water Management Priorities

...*"Wake up Call"*

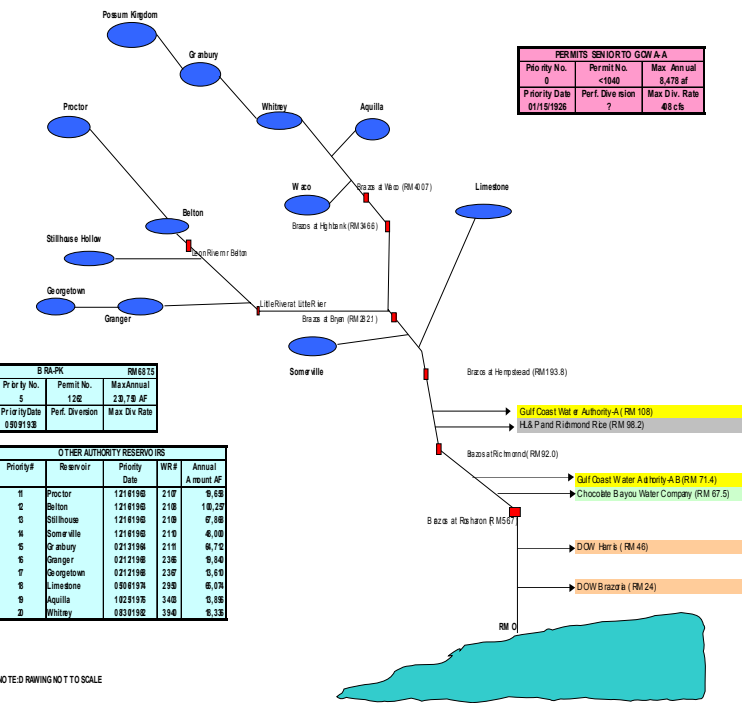
Trends

- ***Availability*** - Declining 4 - 5% Per Year
- ***Priorities*** - Society & Regulatory
- ***Costs*** - Assets, Treatment, Infrastructure, Taxes, ...
- ***Quality*** - Source Water Deterioration,, High Quality Process Water, Discharge Regulations, Drinking Water, ...

Preparing for Future Success/Sustainability

- Water Supply/Rights Assessment
- Advocacy Issues Assessment
- Organizational Structure Assessment
- Economics of Conservation vs. Waste
    - TCA

Supply and Demand Assessment



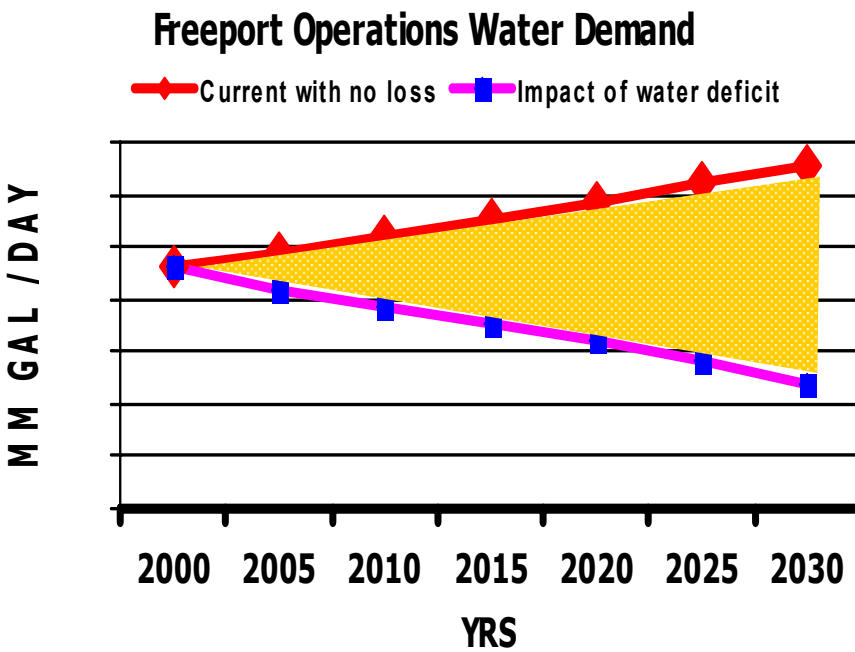
PERMITS SENIOR TO GOWA-A		
Priority No. 0	Permit No. <1040	Max Annual 8,478 af
Priority Date 01/15/1926	Perf. Diversion ?	Max Div. Rate 408 cfs

BRA-PK		RM 68.75
Priority No. 5	Permit No. 1282	Max Annual 23,750 AF
Priority Date 05/09/1938	Perf. Diversion	Max Div Rate

OTHER AUTHORITY RESERVOIRS				
Priority#	Reservoir	Priority Date	WR#	Annual Amount AF
11	Proctor	12/16/1938	2107	19,650
12	Belton	12/16/1938	2108	100,237
13	Stillhouse	12/16/1938	2109	67,880
14	Somerville	12/16/1938	2110	46,000
15	Granbury	02/13/1964	2111	68,710
16	Granger	02/12/1938	2356	19,540
17	Georgetown	02/12/1938	2357	13,610
18	Limestone	05/06/1974	2950	65,074
19	Aquilla	10/25/1976	3400	13,856
20	Whitney	08/30/1962	3940	18,330

NOTE: DRAWING NOT TO SCALE

GOWA-A		RM 108
Priority No. 1	Permit No. 1040	Max Annual 99,982 AF
Priority Date 01/15/1926	Perf. Diversion 444 cfs	Max Div. Rate 6655 cfs
HL&P Richmond		RM 98.2
Priority No. 2	Permit No. 1041	Max Annual 28,000 AF
Priority Date 10/23/1926	Perf. Diversion 300 cfs	Max Div. Rate 355 cfs
GOWA-B		RM 71.4
Priority No. 6	Permit No. 1299	Max Annual 75,000 AF
Priority Date 02/01/1939	Perf. Diversion 467 cfs	Max Div. Rate 800 cfs
GOWA-B		RM 71.4
Priority No. 8	Permit No. 1299	Max Annual 50,000 AF
Priority Date 01/15/1950	Perf. Diversion 467 cfs	Max Div. Rate 800 cfs
CHOCOLATE BAYOU		RM 67.5
Priority No. 3	Permit No. 1145	Max Annual 40,000 AF
Priority Date 02/08/1929	Perf. Diversion 400 cfs	Max Div. Rate 400 cfs
CHOCOLATE BAYOU		RM 67.5
Priority No. 9	Permit No. 1145	Max Annual 40,000 AF
Priority Date 03/03/1955	Perf. Diversion 280 cfs	Max Div. Rate 288 cfs
CHOCOLATE BAYOU		RM 67.5
Priority No. 21	Permit No. 1145	Max Annual 75,000 AF
Priority Date 07/25/1983	Perf. Diversion 668 cfs	Max Div. Rate 900 cfs
DOW		RM 46
Priority No. 4	Permit No. 1145	Max Annual 20,000 AF
Priority Date 02/28/1929	Perf. Diversion 102 cfs	Max Div. Rate 102 cfs
DOW		RM 46
Priority No. 7	Permit No. 1945/1631	Max Annual 150,000 AF
Priority Date 02/14/1942	Perf. Diversion 244 cfs	Max Div. Rate 600 cfs
DOW		RM 46
Priority No. 10	Permit No. 1964	Max Annual 65,000 AF
Priority Date 04/04/1960	Perf. Diversion 244 cfs	Max Div. Rate 600 cfs



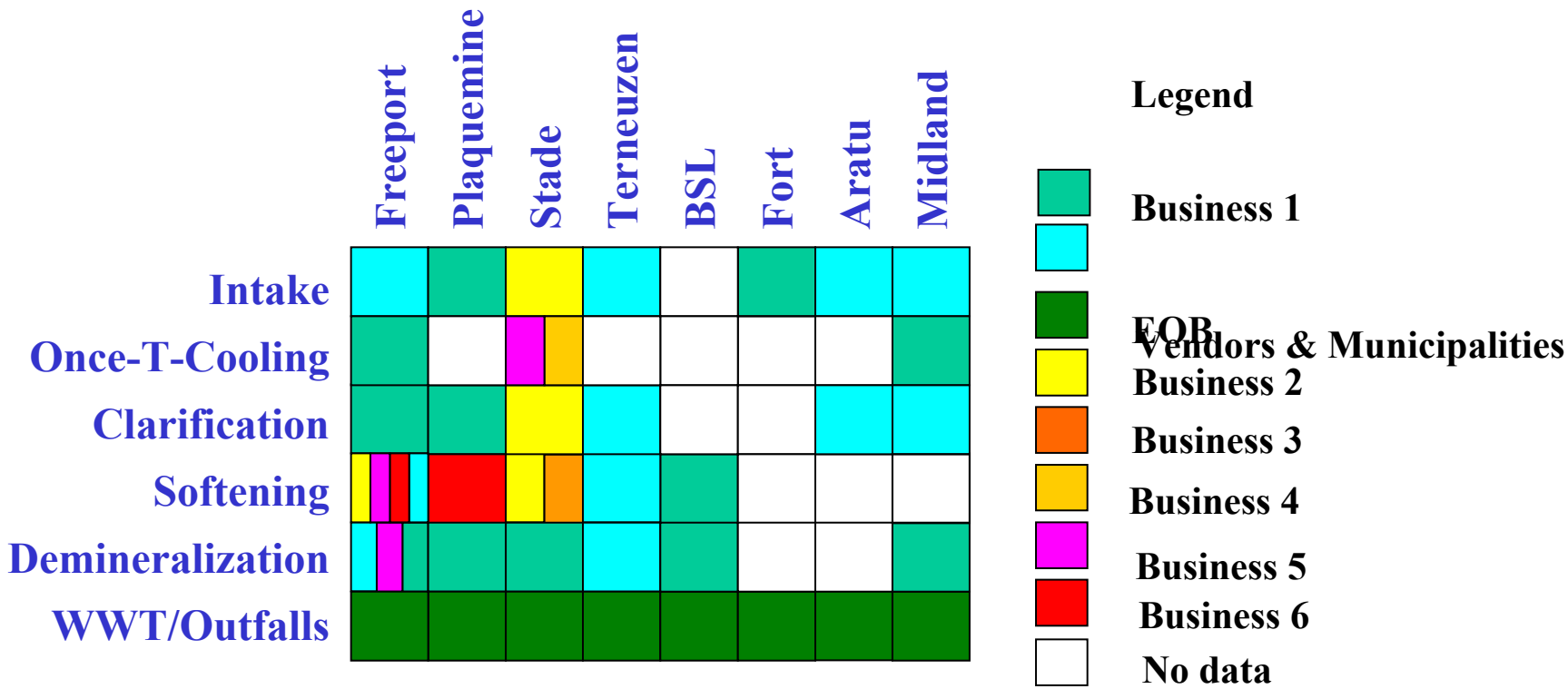
Rights and Contracts Assessment

...Consider Limitations

Brazos River Major Rights

Priority #		Reservoir	Priority Date	WR #	Annual Amount AF	Annual Amount AF	Preference Diversion	Maximum Diversion	Rvier Mile
	Permits Senior to GCWA-A		< 01/15/1926		8,478 AF	8,478			
1	GCWA-A		01/15/1926	1040	99,932 AF	99,932	444 cfs	685 cfs	RM 108
2	HP&L		10/23/1926	1041	28,000 AF	28,000	310 cfs	365 cfs	RM 98.2
3	Chocolate Bayou		02/08/1929	1145	40,000 AF	40,000	400 cfs	400 cfs	RM 67.5
4	Dow		02/28/1929	1145	20,000 AF	20,000	132 cfs	132 cfs	RM 46
5	BRA	Possum Kingdom	05/09/1938	1262	230,750 AF	230,750			
6	GCWA-B		02/01/1939	1299	75,000 AF	75,000	467 cfs	600 cfs	RM 71.4
7	Dow		02/14/1942	1345/1631	150,000 AF	150,000	244 cfs	630 cfs	RM 46
8	GCWA-B		01/15/1950	1299	50,000 AF	50,000	467 cfs	600 cfs	RM 71.4
9	Chocolate Bayou		03/03/1955	1145	40,000 AF	40,000	268cfs	268 cfs	RM 67.5
10	Dow		04/04/1960	1964	65,000 AF	65,000	244 cfs	630 cfs	RM 46
11	BRA	Proctor	12/16/1963	2107	19658 AF	19,658			
12	BRA	Belton	12/16/1963	2108	100257 AF	100,257			
13	BRA	Stillhouse	12/16/1963	2109	67868 AF	67,868			
14	BRA	Somerville	12/16/1963	2110	48000 AF	48,000			
15	BRA	Granbury	02/13/1964	2111	64712 AF	64,712			
16	BRA	Granger	02/12/1968	2366	19840 AF	19,840			
17	BRA	Georgetown	02/12/1968	2367	13610 AF	13,610			
18	BRA	Limestone	05/06/1974	2950	65074 AF	65,074			
19	BRA	Aquilla	10/25/1976	3403	13896 AF	13,896			
20	BRA	Whitney	08/30/1982	3940	18336 AF	18,336			
21	Chocolate Bayou		07/25/1983	1145	75,000 AF	75,000	668 cfs	900 cfs	RM 67.5
	BRA	Allens Creek				220,000	2200 cfs		RM 129.5

Organizational Structure Assessment



Variability of Water Supply Asset Ownership

...Reorganization Required

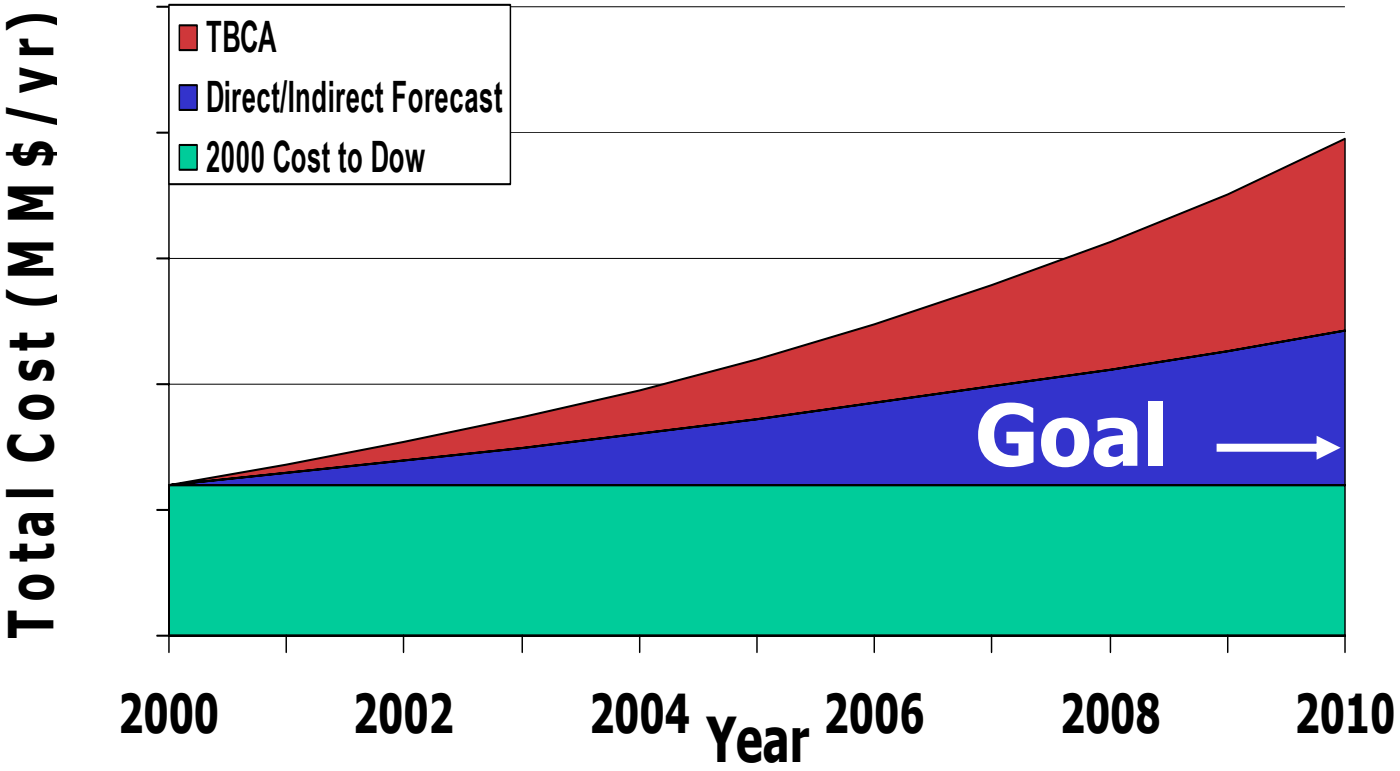
Advocacy Issues Assessment

- Potential for Water Supply Conflict
- Water Use Impacts and Costs
  - Water Treatment
  - Waste Water Treatment
  - Solids Management
- Environmental Impacts
  - Subsidence
  - Discharge Management and Receiving Streams Issue

Economics of Conservation vs. Waste

- Total Cost Assessment
  - Supply Risks and Potential Supply Conflicts
  - Business Demand Trend and Impact on Infrastructure
  - Infrastructure Rehabilitation Costs
  - Discharge Management Costs and Risks
  - Future Compliance Upgrades
  - Liability Management
- It pays to fund waste reduction and avoidance at higher cost than previously understood

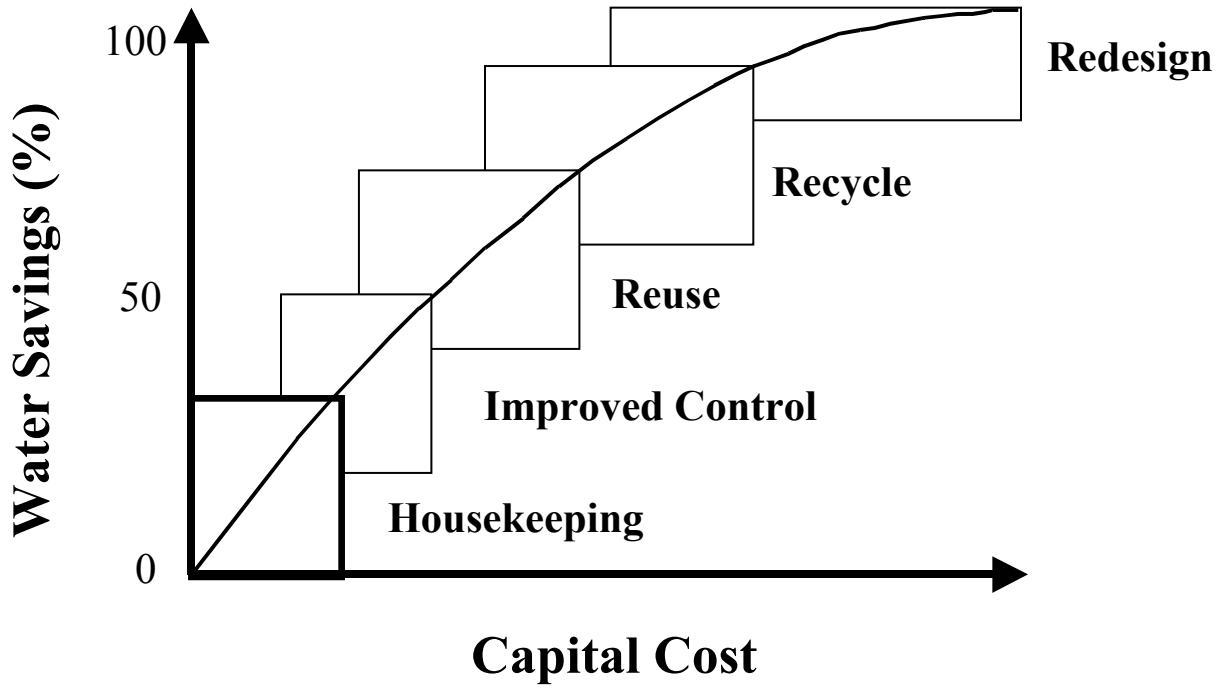
Water Envelope…*Case for Change*



The Path Forward … Culture Change

- Setting Expectations
- Value Based Management
  - Water Cost that reflect “True Value”
- Metering and Accountability
- Prioritization of Opportunities
- New Design = New Design Approaches
- Six Sigma…. Driving Culture Change

Setting Expectations for...
Reducing Water Consumption



Value Base Management

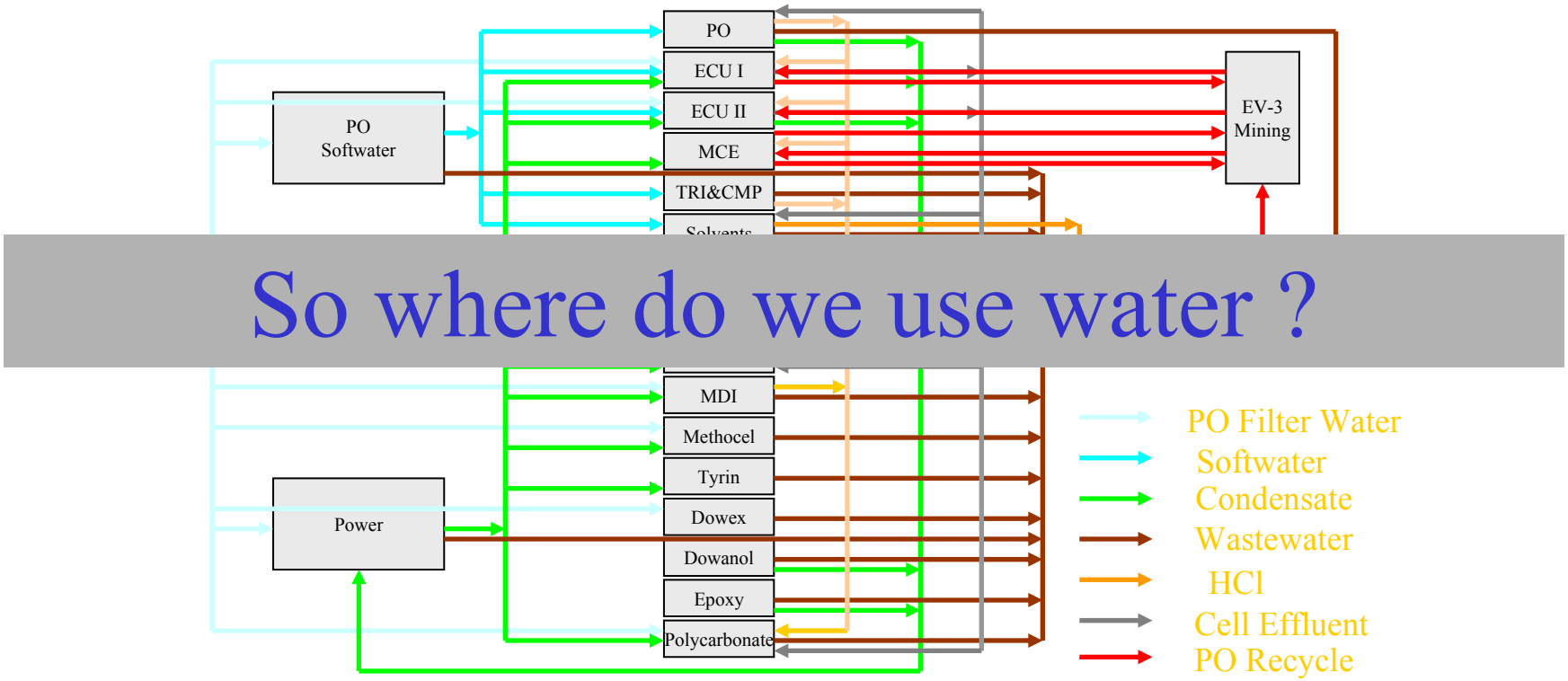
- **Water Cost that Reflect "True Value"**
  - What is the value of a water right?
  - Has need for future capital been considered?

Is conserving that water worth $.02 or $1.40/1000 gallons?

$ 0.02 vs. $0.25-0.70 for Raw Water
$0.09 vs. $0.70-1.40 for Clarified Process Water
$0.80 vs. $1.50 -3.50 for Potable Drinking Water

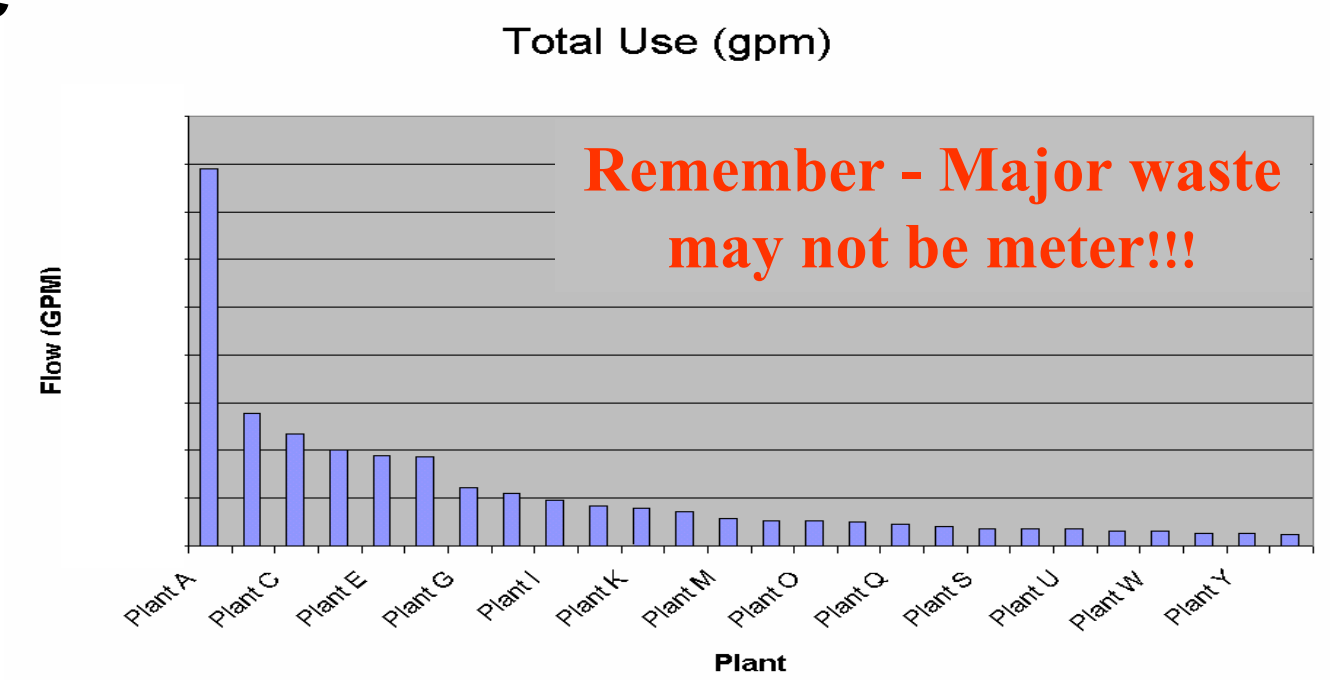
Metering and Accountability

Complexities of the Water Envelope



Prioritization of Opportunities

- Mass Balance
- Water Quality Requirements
- Paredo Use



New Design =

… New Design Approaches

- Thermal Pinch
- Water Pinch
- Water Conservation Devices
- Alternative Cooling Technology
    - Seawater when available
    - Air Cooling for High Delta T Systems

Six Sigma …

Driving Culture Change

- Data Mining
- Defect Elimination
- Envelop Projects
- MAIC Projects
- DFFSS

> 20 Water Envelop Related Project Complete or In Progress

Water Conservation

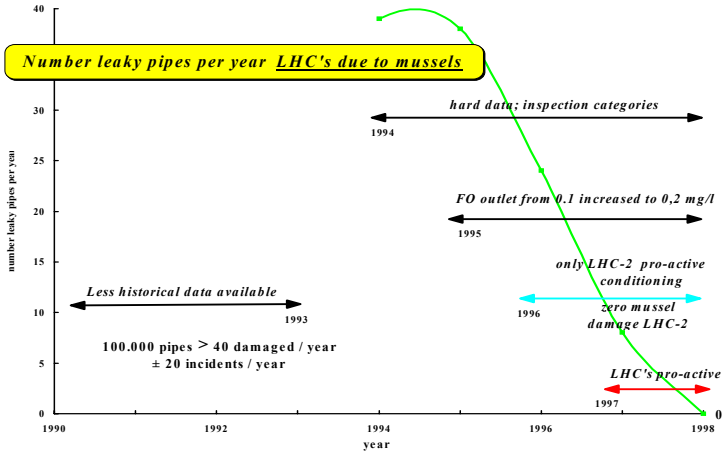
… Successes to Date

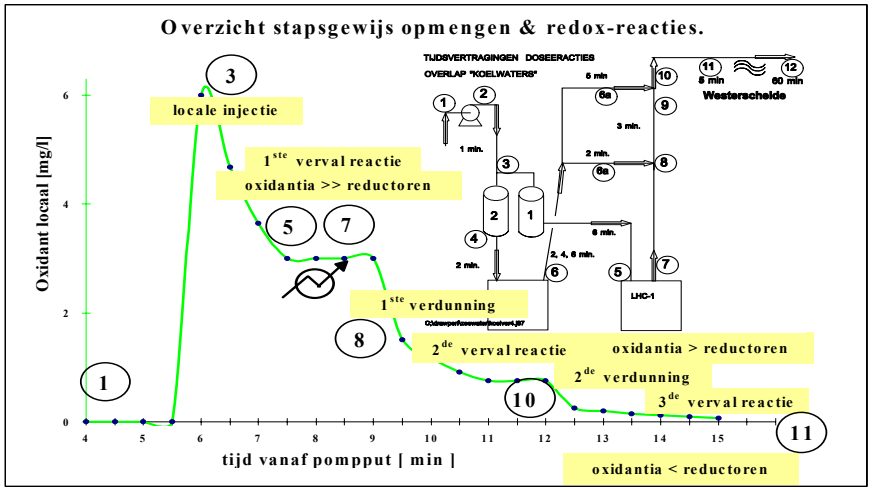
- Fresh Water Spillage Minimization
- Once-Through Cooling Elimination
- Cooling Tower Optimization
- Shift to Seawater Cooling
- Waste Water Effluent for Mining
- Waste Water Effluent for Cooling
- Recovery of Water Manufacturing Waste Stream
- Condensate Recovery
- "Drought" Planning

Estimated 15 Billion Gallons Per Year Saved Globally

Seawater Cooling

- Evaluated on Partially Loaded 110 MW Plant
- Break Even Capital
- Saves 3000 GPM of Fresh Water
- Most Probable 10 Year NPV Savings $ 3 MM
- Most Probable 20 Year NPV Savings $ 5 MM





Freeport Freshwater Reduce Once -T Cooling

Financial

Hard Savings = $189,000/yr

Water Savings = 4000 gpm

Based on reduction in treated freshwater production cost:

5600 gpm spillage X 70% reduction = 4000 gpm reduction target

4000 gpm X 60 min/hr X 24 hrs/day X 365 days/yr. X $0.09/1000 gal.
=$189,200/yr. hard savings for once-through cooling reduction

Total anticipated hard dollar savings = $189,000/yr.

ref. Linda Moody

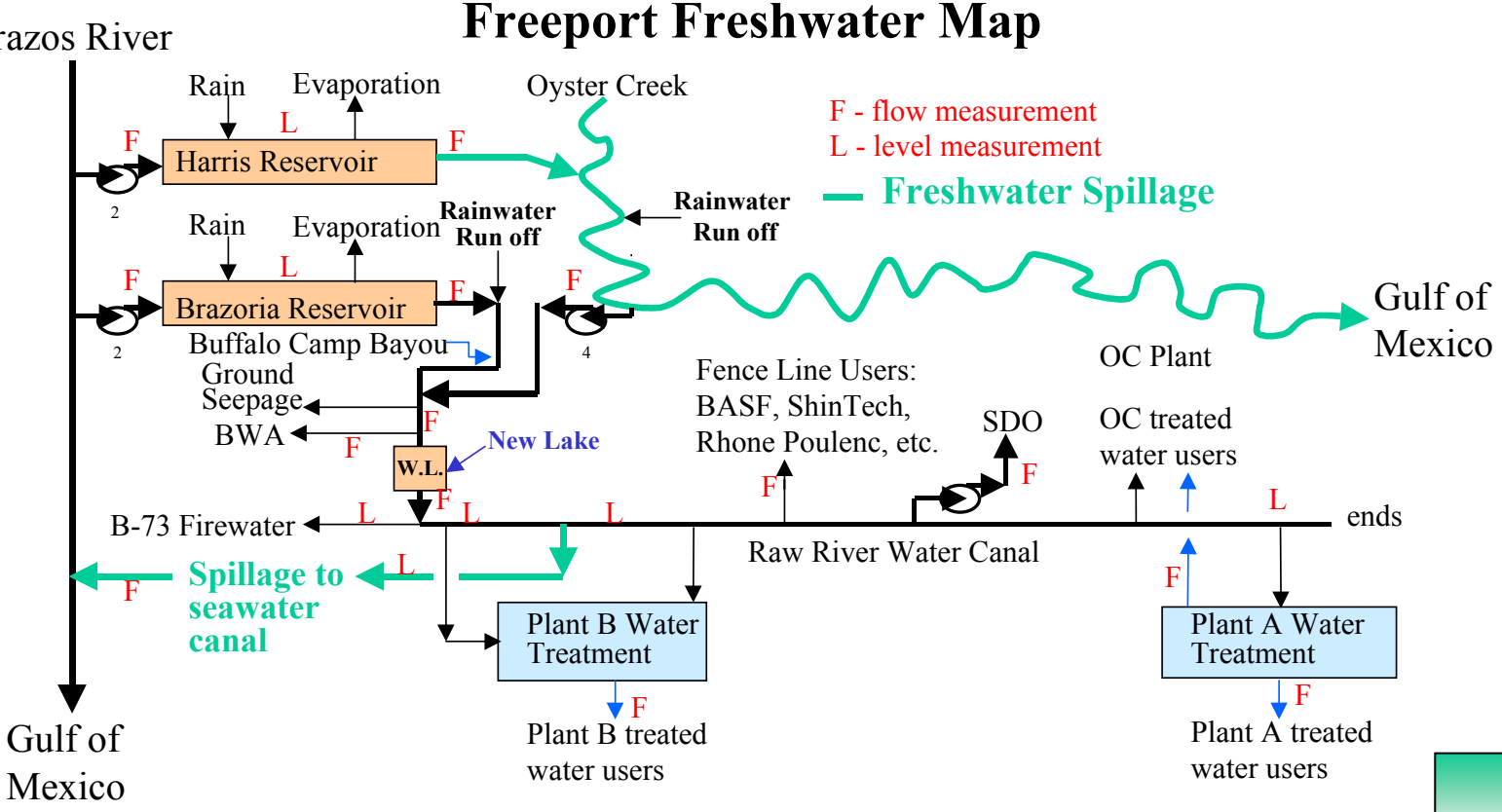
Freeport Freshwater Spillage Reduction

Financial

Hard Savings = $135,000/yr

Water Savings = 10100 gpm

Freeport Freshwater Map



FOB Six Sigma

"We will only know the worth of water when the well is dry."

- BENJAMIN FRANKLIN