Protecting our environment - Serving our customers
Enhancing our communities

Managing Wastewater Collection System Risk and System Valuation

Johnson County Wastewater

Asset Management

- "A **business framework** built around core processes that focus on **minimizing** the **lifecycle cost** of ownership – **optimizing** the use of limited **resources** and management practices while **delivering** the established **level of service** to the customer at an **acceptable risk** to the organization and the community."

- Making the right decision, at the right time, for the right reason, at the right cost.

- Making good decisions!

Asset Management Plan (AMP)

- Consolidation of information for assets and service delivery
- Road map for future asset commitments
- Future asset requirements
- Risk identification
- Way to tell the story

Asset Management Process

Figure 1-1 Core Asset Management Process

Collection System Valuation

Valuation/Replacement Cost

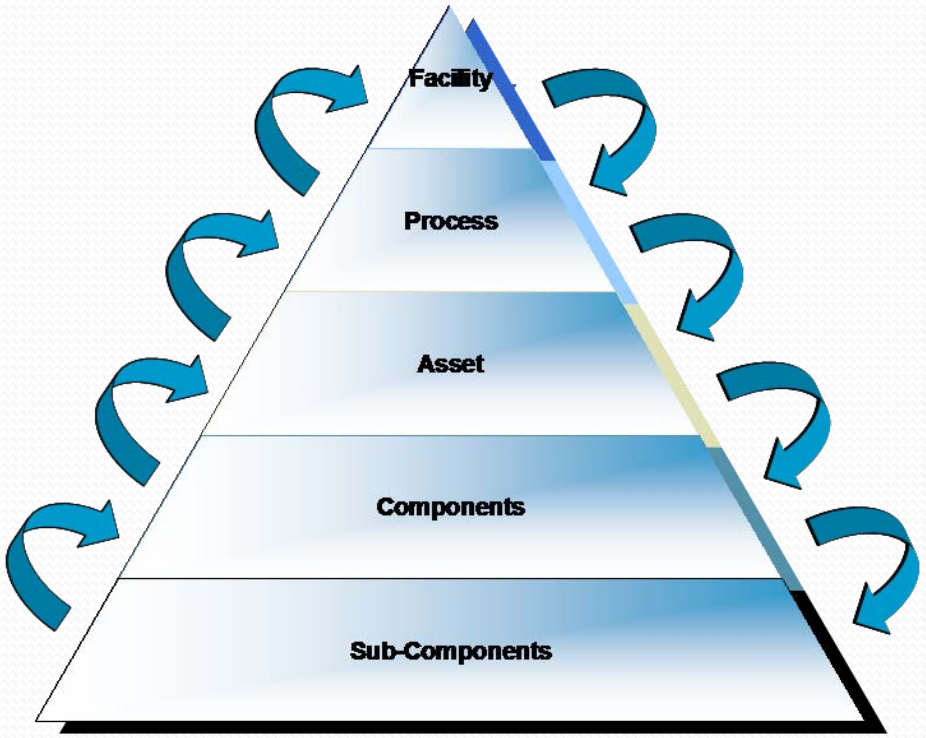
- Valuation provides the basis for future rehabilitation and replacement projections
- An initial valuation was conducted during the summer of 2007
- Initial valuation didn’t appear accurate likely due to incomplete asset registry

Valuation Process

- Reviewed existing data for accuracy and completeness
- Reviewed replacement costs established for each asset class
- Standardized asset classes and defined data standards to improve automation of asset valuation
- Included new assets built since 2007
- Performed Top Down and Bottom Up analysis

Bottom Up Valuation

The bottom up approach is an aggregation of all replacement costs for treatment plant and pump station assets for each asset class at each level in the asset hierarchy.



Asset Attributes and Cost Basis

Pumps

- Horsepower
- Flow Volume (GPM)
- Type (positive displacement, centrifugal, submersible)

Pipe

- Material
- Size
- Age

Top Down Valuation

- Valued the asset at the process level (e.g., extraneous flow processes, influent pumping, grit processes, etc) for replacement costs for pump stations.
- The basis of costs for process and facility valuation is from JCW record information and other facilities in the consultant's database.
- Full facility values were established for three pumping stations (small, medium and large) for extrapolation to the other pumping stations.

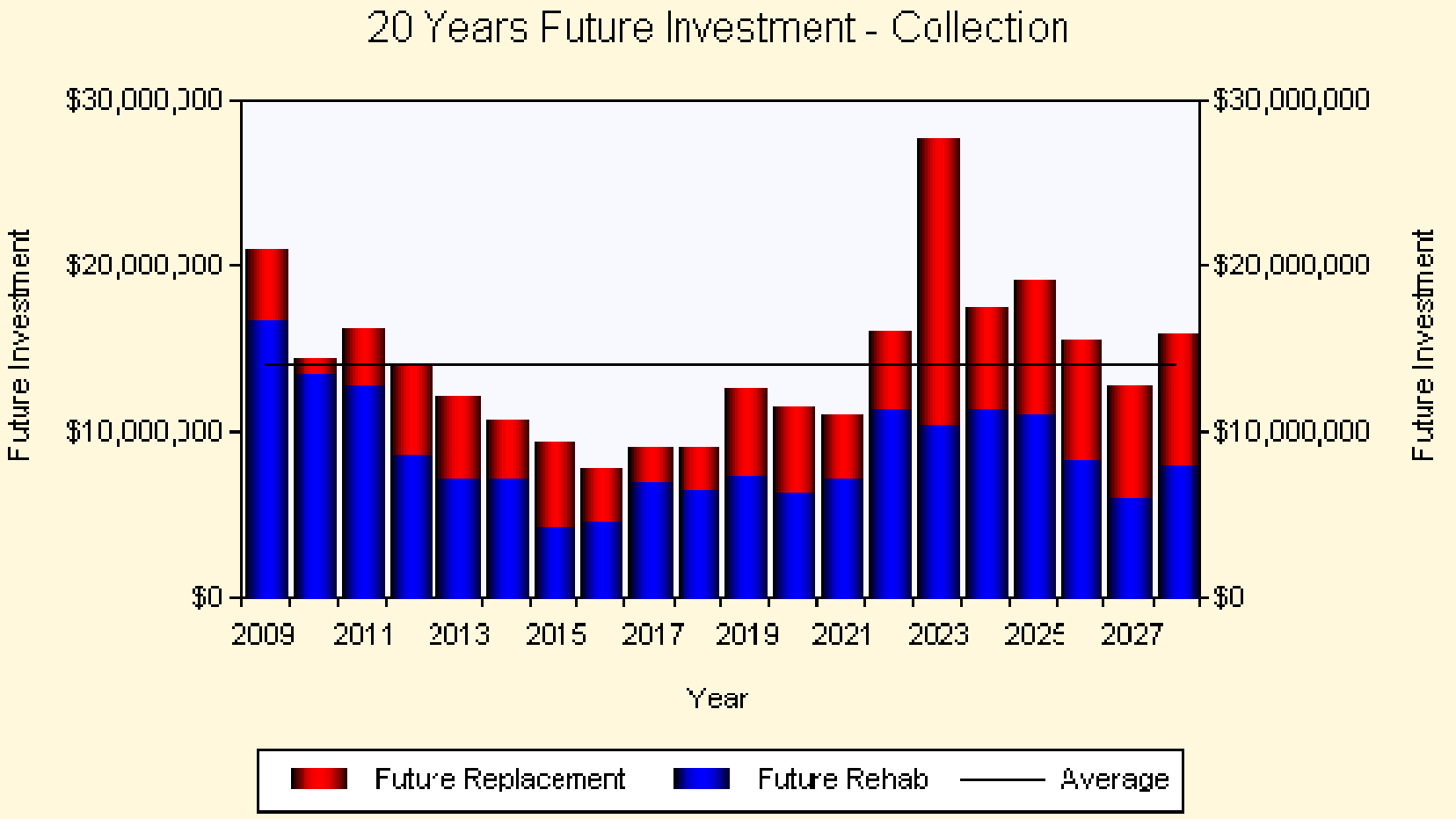
Top Down Valuation Results

		Blue River	Mill Creek
Influent Pumping			
	Structure		
	Sewage Pumping	**$3,477,000.00**	**$4,209,000.00**
	Channel Pipeline	**$114,000.00**	**$138,000.00**
	Screening	**$570,000.00**	**$690,000.00**
	Electrical	**$741,000.00**	**$897,000.00**
	HVAC	**$684,000.00**	**$828,000.00**
	Receiving		
	Instrumentation	**$114,000.00**	**$138,000.00**

Valuation Gap Analysis

- Results from the bottom up and top down valuation were summarized.
- Where the bottom up approach does not match the top down, an asset class was created as a place holder (e.g., grit process).
- The balance of the replacement cost (top down minus bottom up) will be held by the asset class until the inventory supports the bottom up approach.
- Where data is not available to support the bottom up approach, the valuation will be made at the highest level of data supported by the asset hierarchy.

Valuation Used for R&R Projections



Risk is the Heart of Asset Management

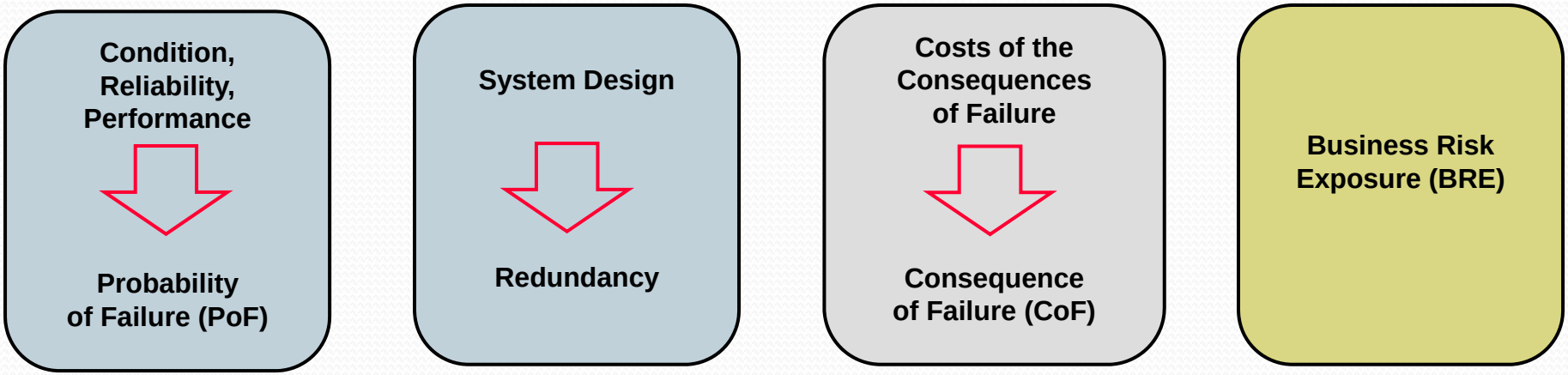
Collection System Business Risk Exposure

- Purpose
  - Identifies gravity sewers representing the greatest risk to the organization
- Benefits
  - Highlight pipe segments requiring condition assessment
  - Prioritize pipe inspection schedule
  - Develop and apply appropriate pipe management strategy based on condition and risk
  - Promote efficient use of staff and budget resources

Information Systems/Data Sources

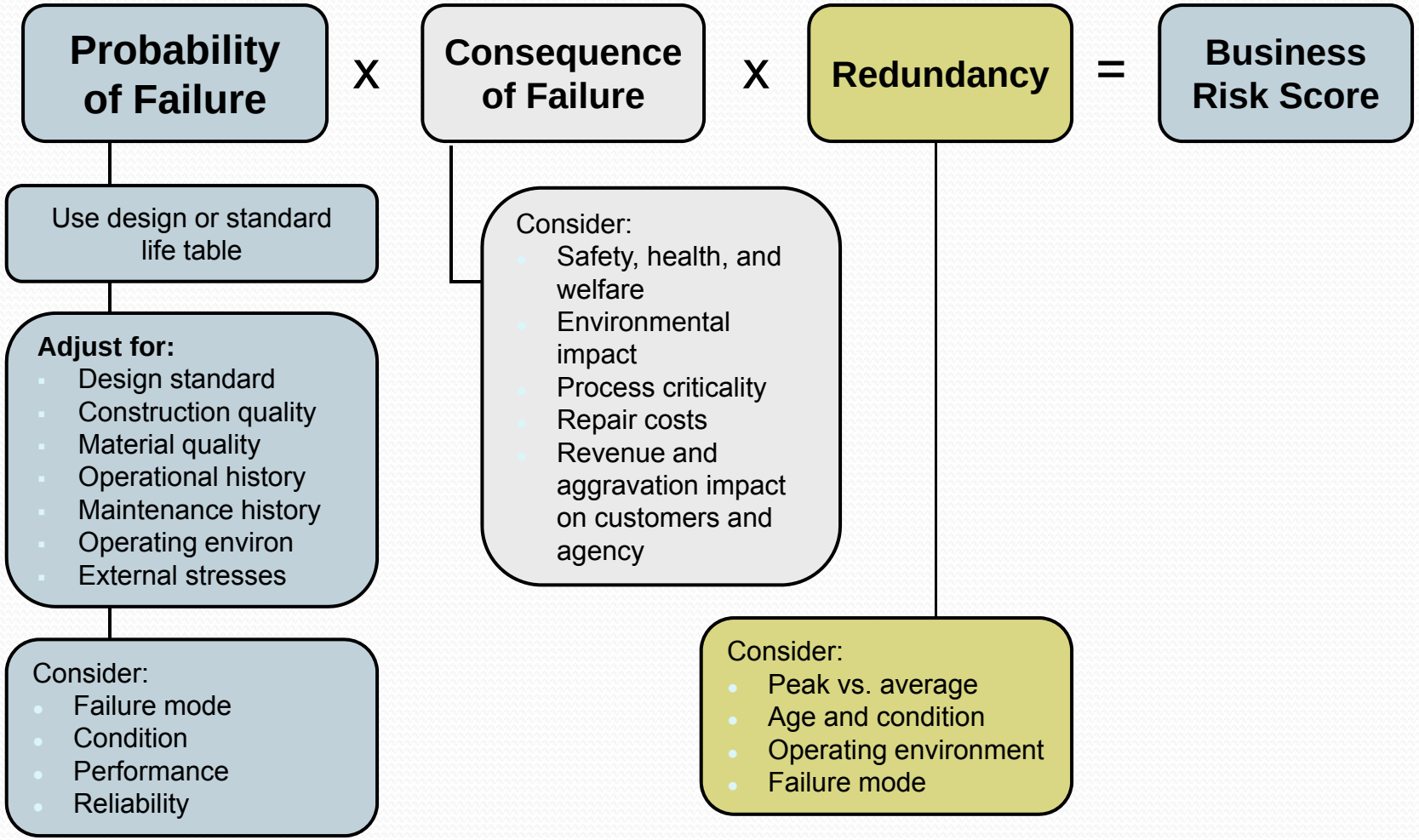
- Data Sources:
  - CMMS (GBA Master Series, RJN Cassworks)
    - Age
    - Material
    - Size
    - Maintenance/renewal data
  - GIS
    - Location
    - Zoning
    - Tree density
  - Record drawings
    - Location
    - Asset attributes
  - Condition assessment records
    - CCTV data
- Staff involvement
  - Delphi workshops
    - Asset attributes
    - Year of install
    - Condition
    - Maintenance history
    - Renewal history
  - *Hot Spot* identification
  - Result verification

Risk Calculation

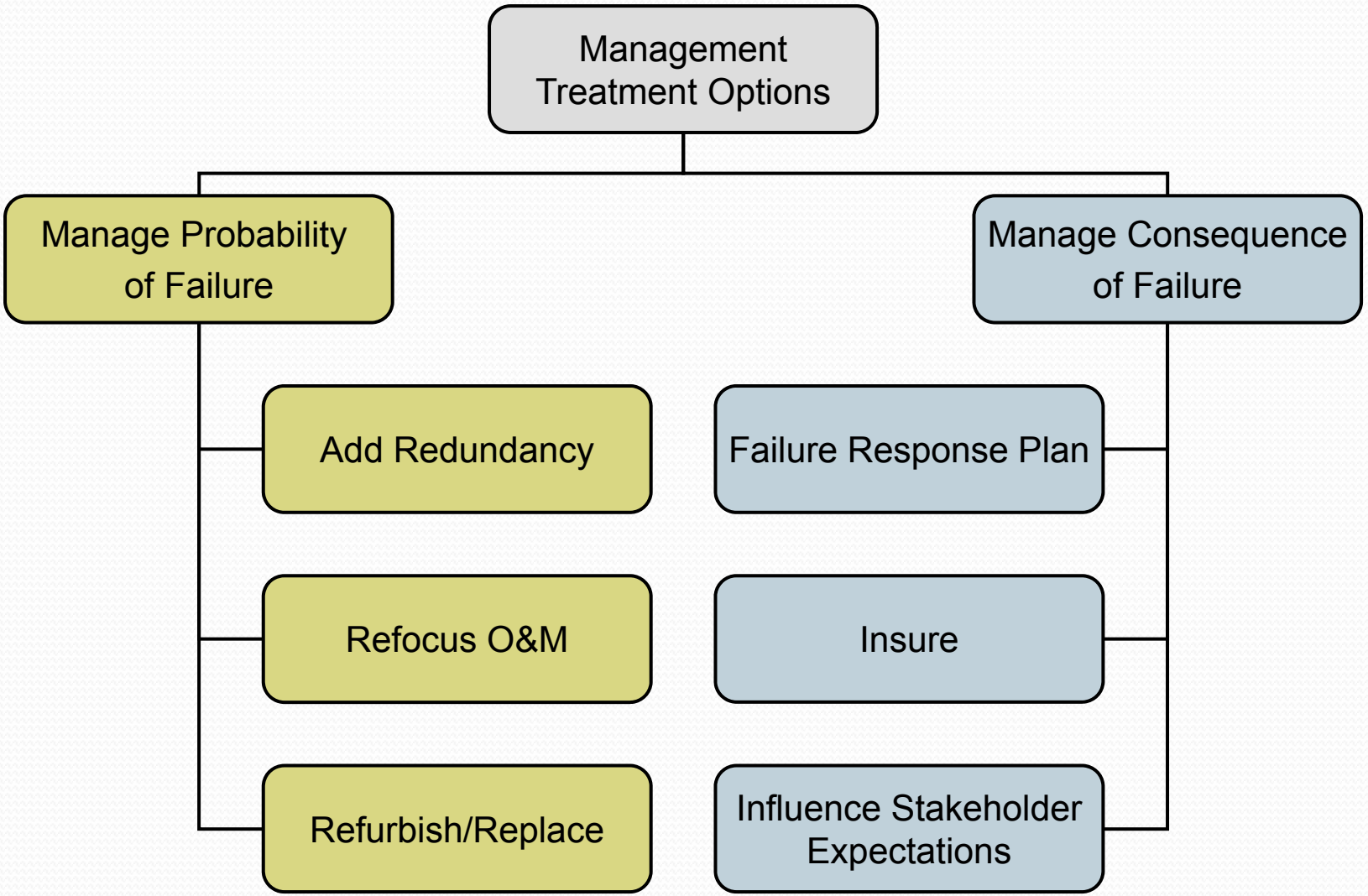


PoF x Redundancy x CoF = BRE

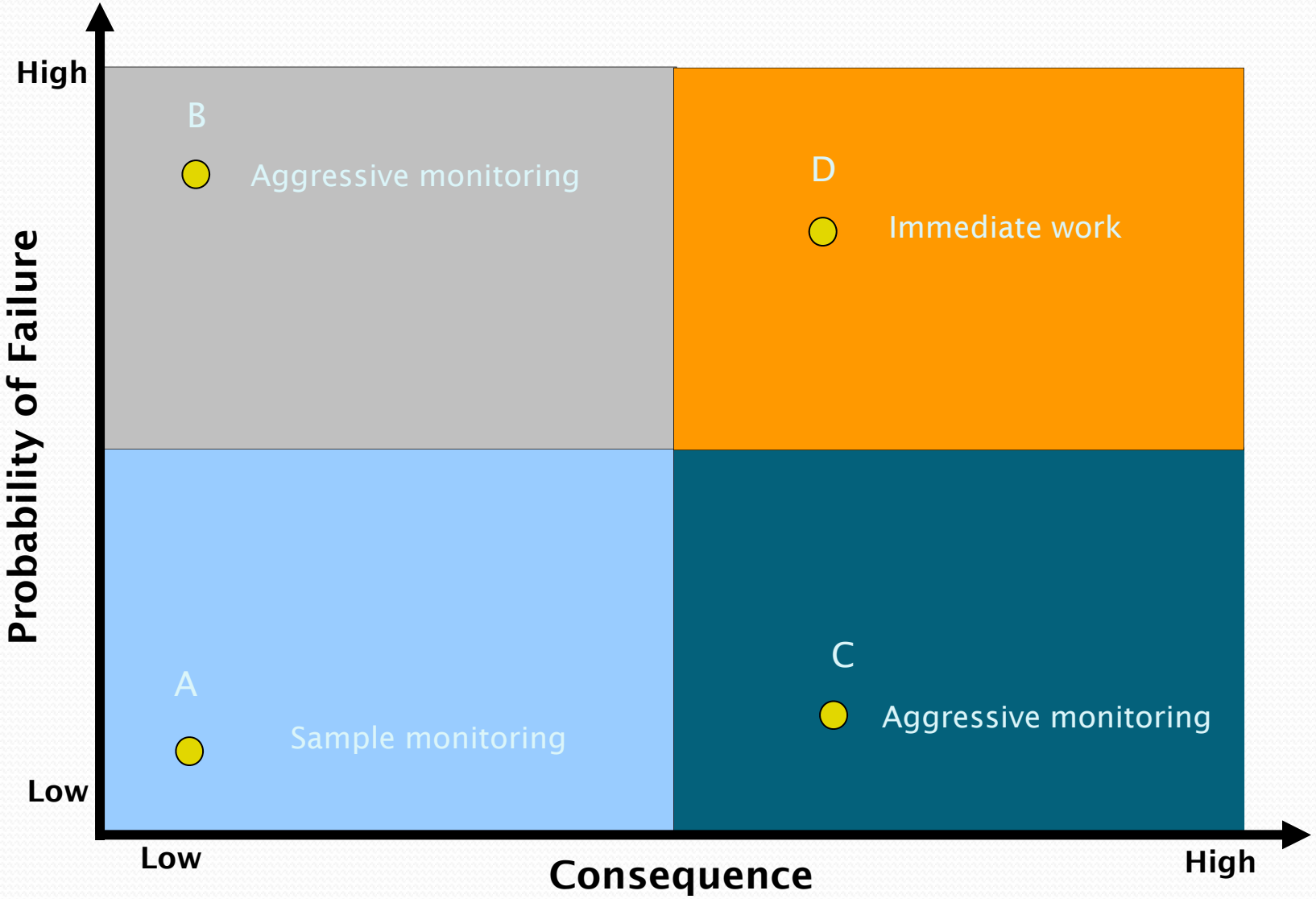
Calculation Factors of Business Risk



Managing Risk: Reduction Options



Business Risk Exposure Drives Work Program



Four Major *Failure Modes*

Failure Mode	*Definition*	*Tactical Aspects*	*Management Strategy*
Capacity	Volume of demand exceeds design capacity	Growth, system expansion	Redesign
Level of Service	Functional requirements exceed design capacity	Codes & permits: NPDES, CSOs, OSHA, noise, odor, life safety; service, etc.	O&M optimization, renewal
Mortality	Consumption of asset reduces performance below acceptable level	Physical deterioration due to age, usage (including operator error), acts of nature	O&M optimization, renewal
Financial Efficiency	Operations costs exceed that of feasible alternatives	Pay-back period	Replace

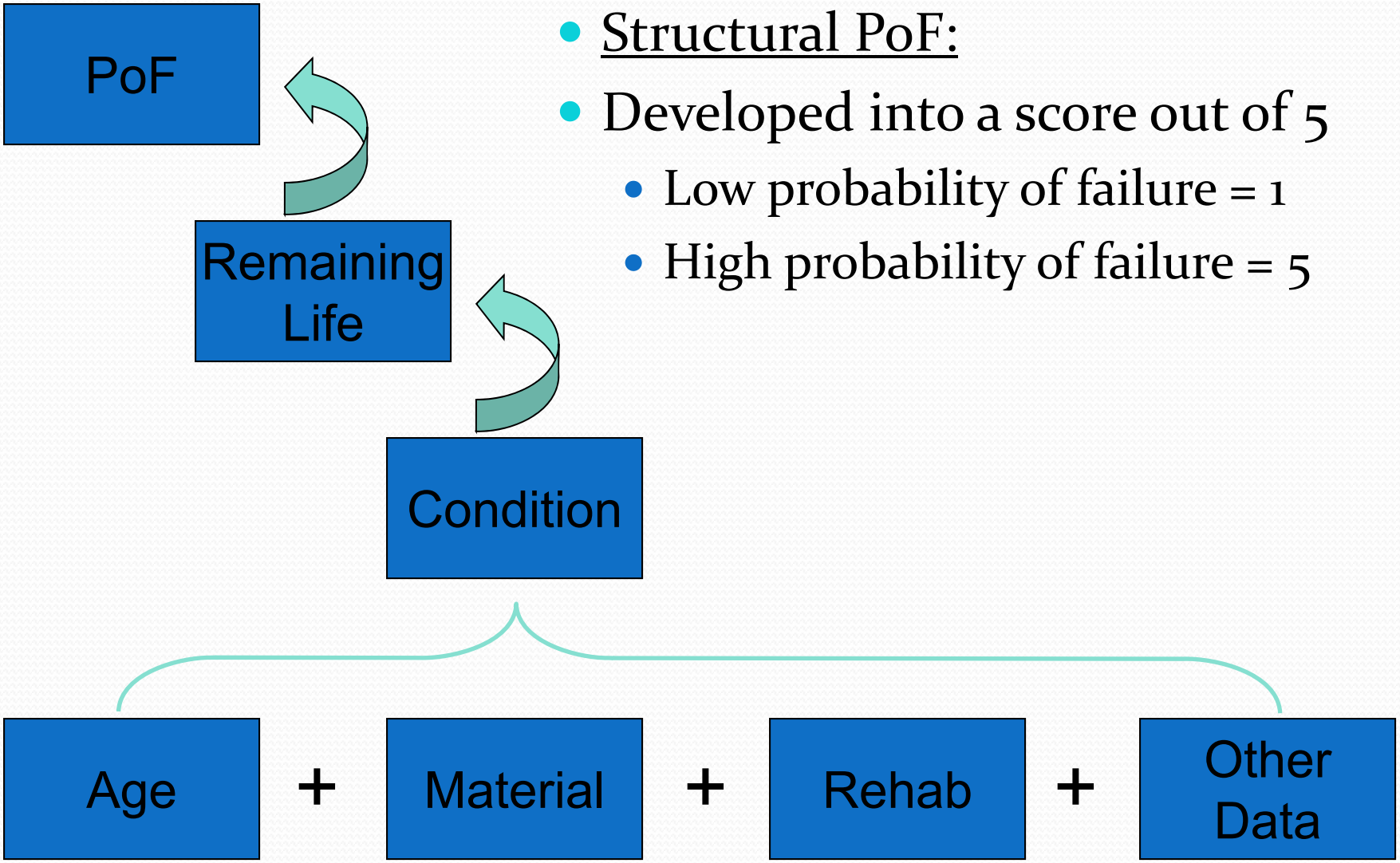
NPDES - National Pollutant Discharge Elimination System
CSO - Combined Sewer Overflows
OSHA - Occupational Safety and Health Administration

Collection System BRE Failure Modes

Failure Modes Considered

- **Structural (Mortality)**
  - **Pipe collapse**
  - **Hydrogen sulfide attack**
  - **Pipe offsets**
  - **Liner failures**
- **Operational (Level of Service/Capacity)**
  - **Partial or complete blockage**
  - **Fat, oil and grease**
  - **Hot spots**
  - **Tree roots**

Probability of Failure Mode - Structural



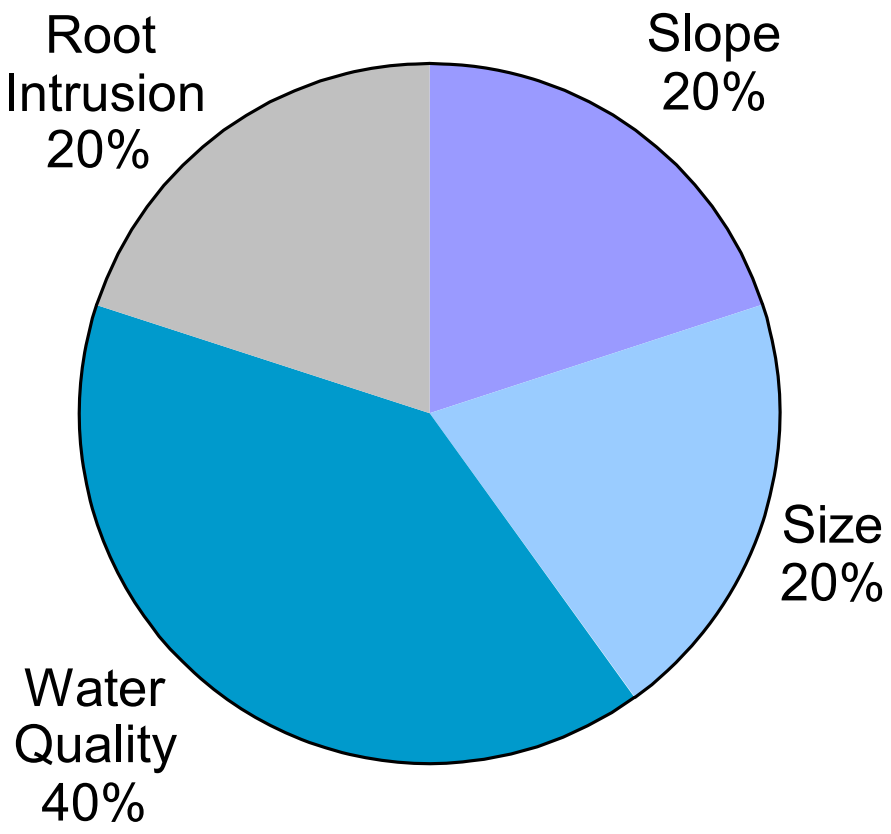
- Structural PoF:
- Developed into a score out of 5
  - Low probability of failure = 1
  - High probability of failure = 5

Probability of Failure Mode - Operational

- Operational PoF Elements:
- Slope
  - *The greater the slope, the less chance of a blockage due to increased velocity*
- Size
  - *The greater the diameter, the less chance debris being caught*
- Water quality (restaurant data in GIS)
  - *Known grease impact on line from cleaning history*
  - *The poorer the quality of the sewage, the greater potential for grit and FOG build up*
- Root Intrusion (tree data in GIS)
  - *Tree density - Count of trees within 10 ft from centerline*

- Operational PoF Scoring:
- Developed into a score out of 5 based on a weighting

Operational PoF – Weighting

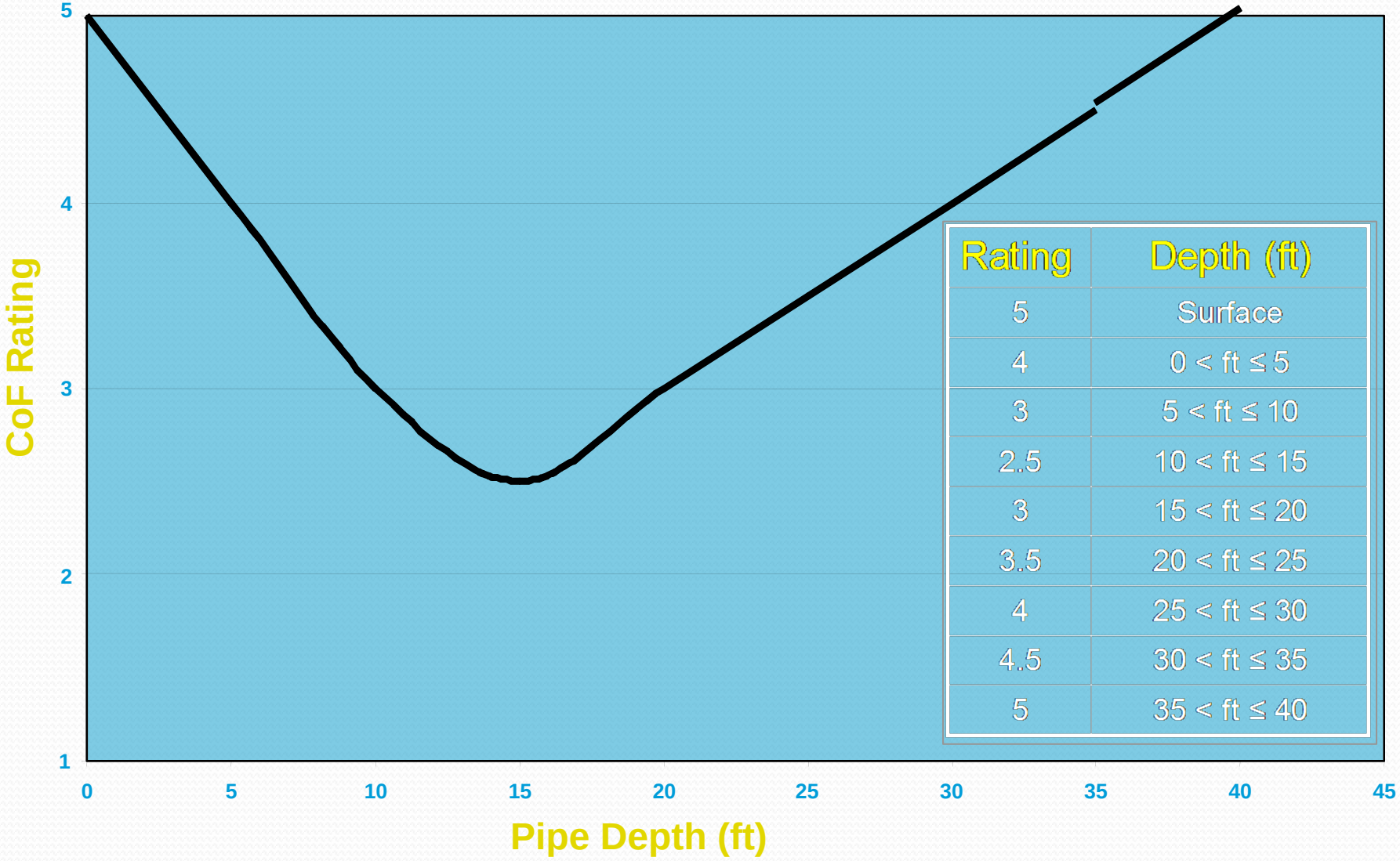


Consequence of Failure Elements

- <u>CoF Elements:</u>
- Capacity – Size
  - *The greater the flow, the greater the environmental damage, and the greater the cost to repair*
- Land Use
  - *The greater the density of use, the greater the cost to repair*
- Accessibility
  - *The harder the accessibility, the greater the cost to repair*
- Depth
  - *The greater the depth, the greater the cost to repair*

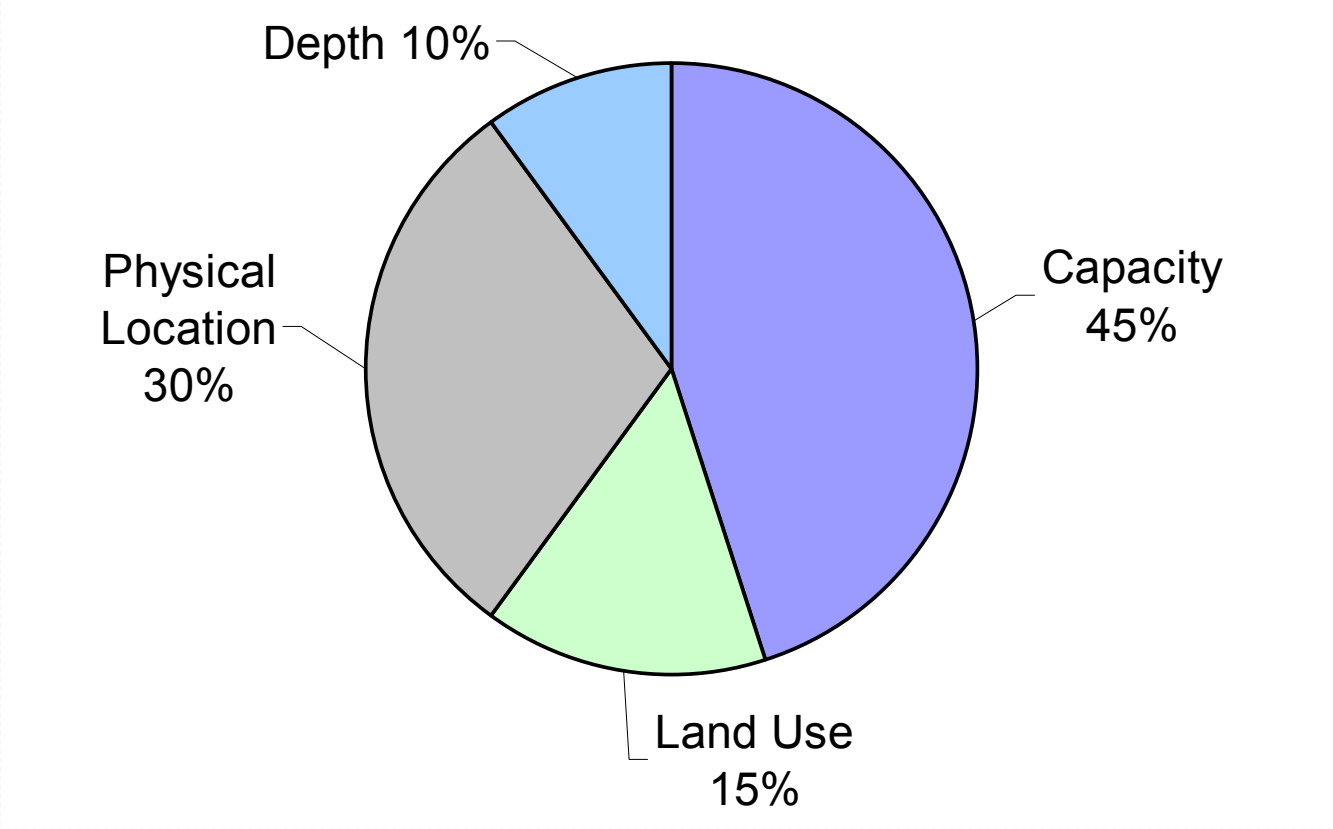
- <u>CoF Scoring:</u>
- Each given a score out of 5 weighted by above

Consequence of Failure - Pipe Depth

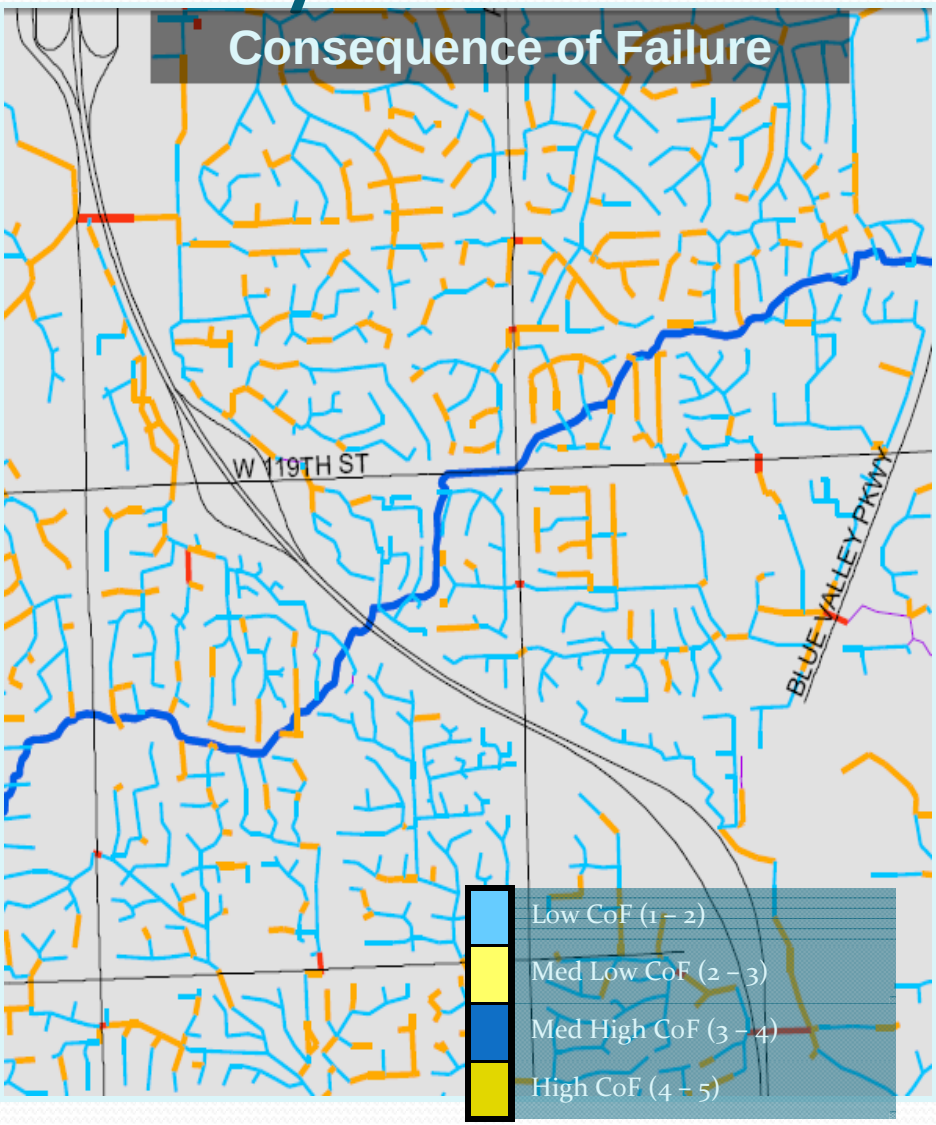


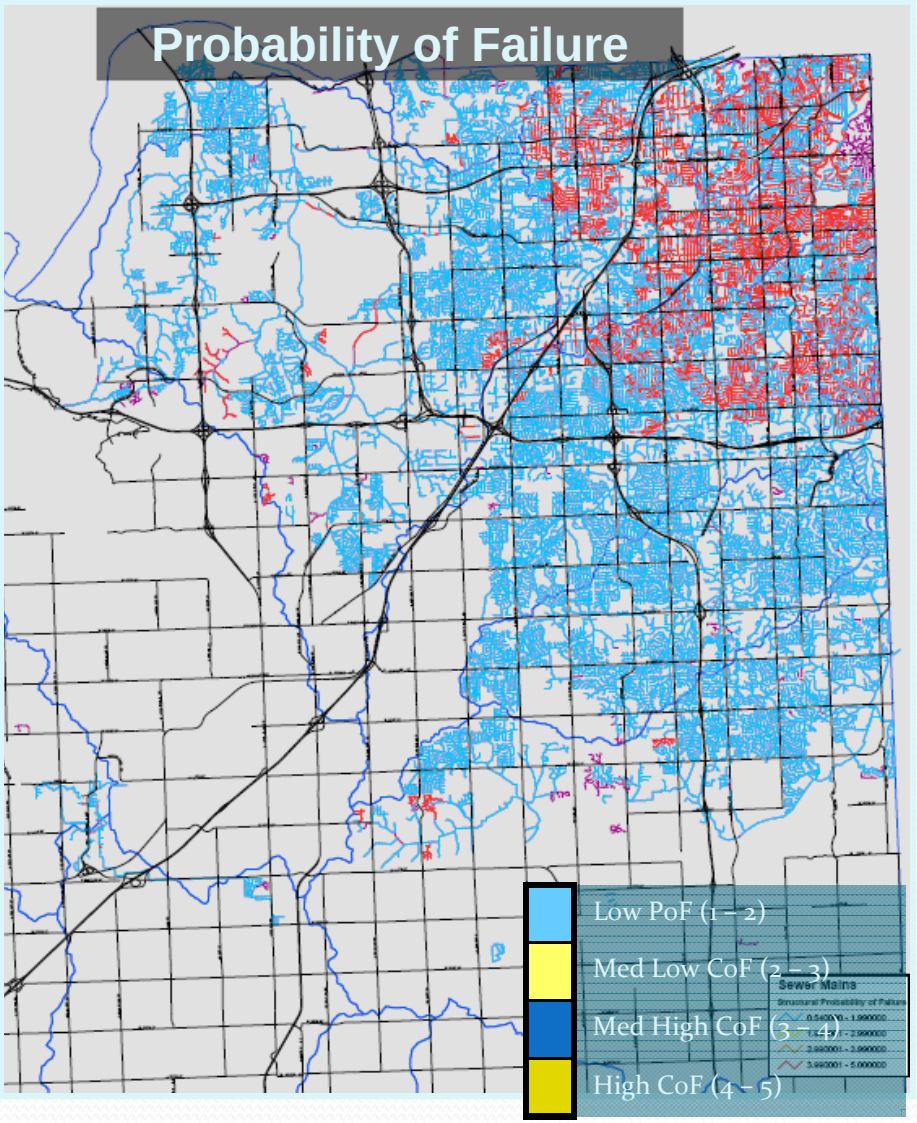
Rating	Depth (ft)
5	Surface
4	0 < ft ≤ 5
3	5 < ft ≤ 10
2.5	10 < ft ≤ 15
3	15 < ft ≤ 20
3.5	20 < ft ≤ 25
4	25 < ft ≤ 30
4.5	30 < ft ≤ 35
5	35 < ft ≤ 40

Consequence of Failure Weights



Analysis Results





Risk Based Management Strategy

Risk Rating	Probability of Failure		Consequence of Failure
	Structural	Operational	
High	• Verify the structural condition with field data • Consider capital project development – Replacement – Rehabilitation • Non-asset solution	• Verify the condition with field data • Implement the appropriate operational option	• Develop an emergency response program with appropriate mitigation measures
Medium	• Monitor the structural condition • Consider future capital project options	• Monitor the operational condition • Consider long-term capital options	• Develop appropriate mitigation measures
Low	• Sample monitoring of similar pipe segments	• Sample monitoring	• Develop appropriate mitigation measures

Changed Management Decisions

Initial Steps

- Structural - Condition assessment
  - Only CCTV those that represent greatest risk
  - Perform detailed condition assessment for poor condition pipes with high BRE score
  - Develop CCTV schedule based on risk
- Operational - Cleaning
  - Prioritize cleaning of pipes based on risk
  - Develop cleaning schedule based on results and risk

Do not CCTV/clean every pipe segment !!!

Next Steps

- Refine BRE model to reflect new data
  - Use historical condition data to generate deterioration curves

- Assign treatment option to every pipe based on risk
- Repeat process and refine data on regular basis

QUESTIONS?

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