Fundamentals of Asset Management
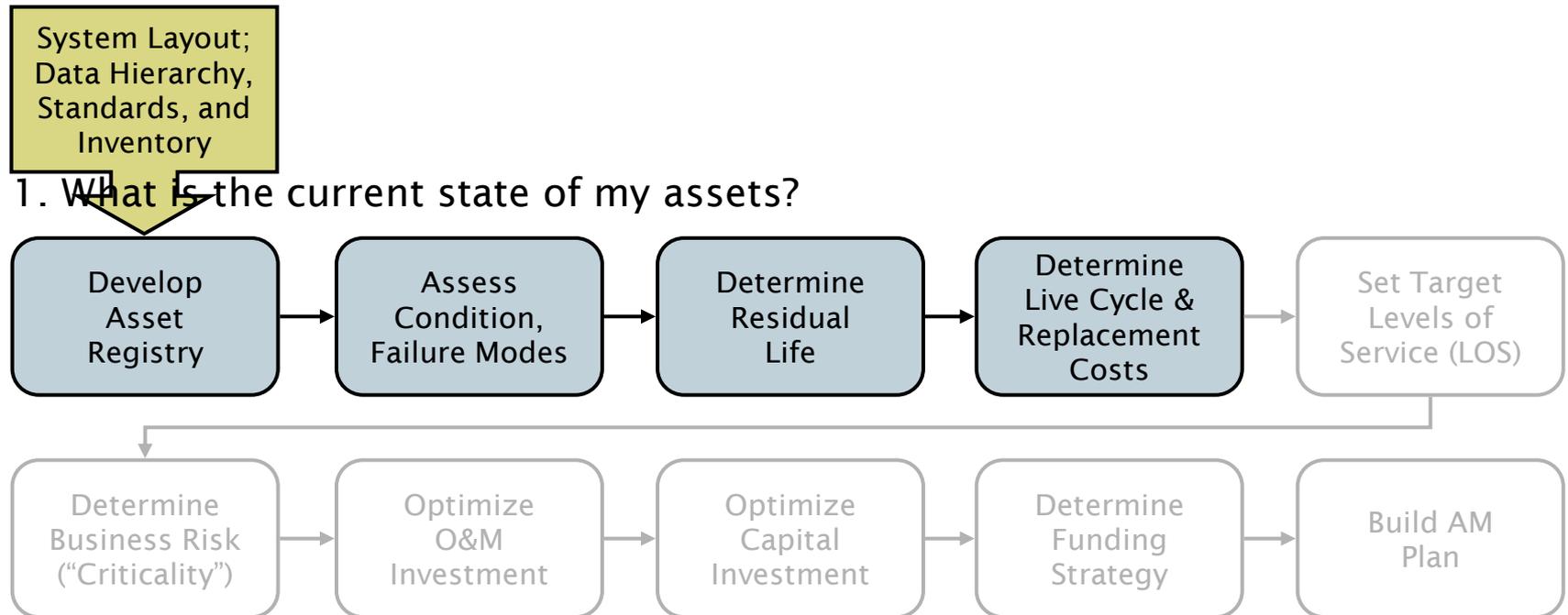
Step 1. Develop Asset Registry
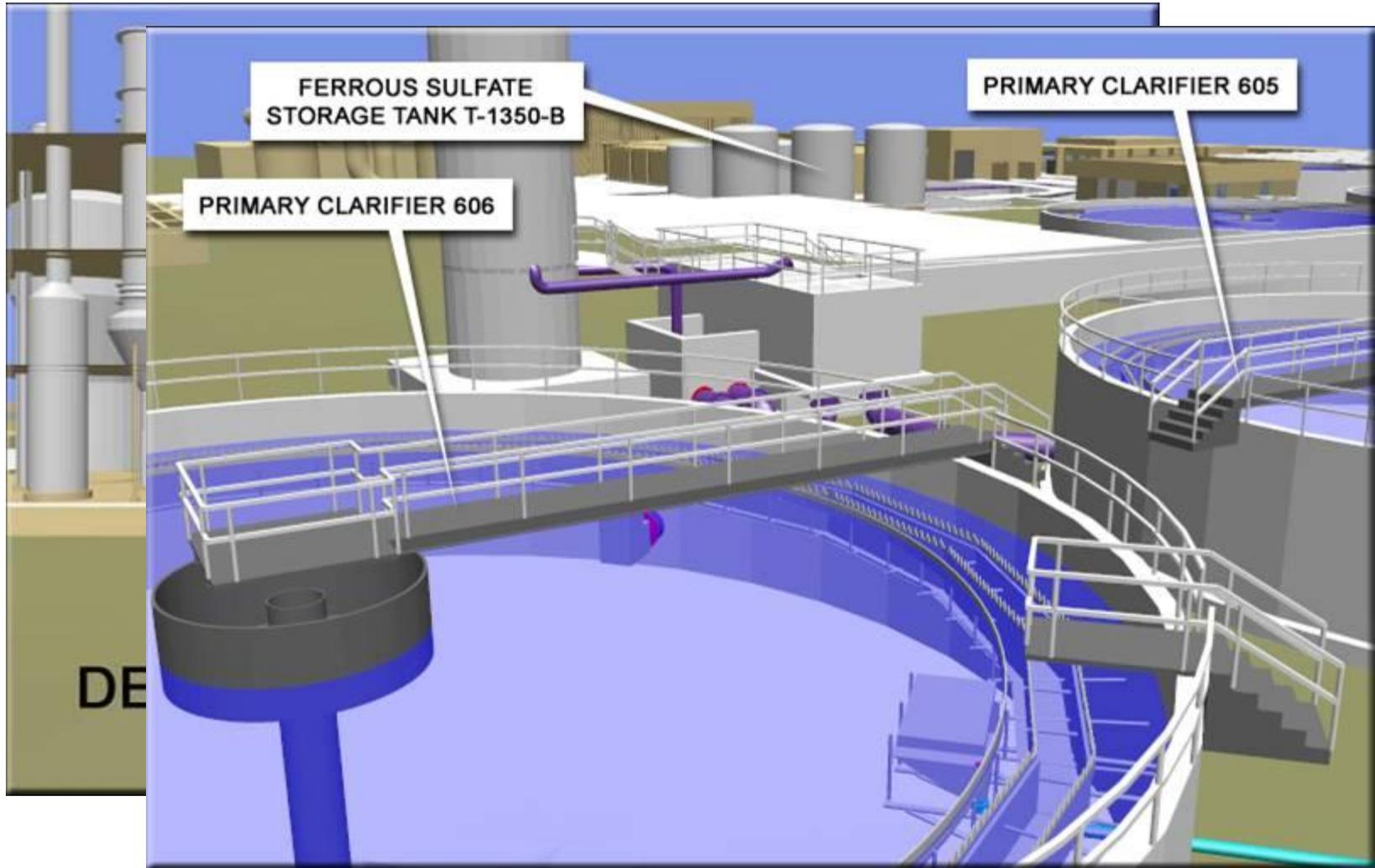
A Hands-On Approach

First of 5 core questions

1. What is the current state of my assets?
   - *What* do I own?
   - *Where* is it?
   - What *condition* is it in?
   - What is its *remaining useful life*?
   - What is its *remaining economic value*?

AM plan 10-step process

System Layout; Data Hierarchy, Standards, and Inventory

1. What is the current state of my assets?

```
┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────────┐   ┌──────────┐
│ Develop  │   │ Assess   │   │ Determine│   │ Determine    │   │ Set Target│
│ Asset    │→  │ Condition,│→ │ Residual │→  │ Live Cycle & │→  │ Levels of │
│ Registry │   │ Failure   │  │ Life     │   │ Replacement  │   │ Service   │
│          │   │ Modes     │  │          │   │ Costs        │   │ (LOS)     │
└──────────┘   └──────────┘   └──────────┘   └──────────────┘   └──────────┘
```

```
┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐
│ Determine│   │ Optimize │   │ Optimize │   │ Determine│   │ Build AM │
│ Business │→  │ O&M      │→  │ Capital  │→  │ Funding  │→  │ Plan     │
│ Risk     │   │ Investment│  │ Investment│  │ Strategy │   │          │
│("Criticality")│          │  │          │   │          │   │          │
└──────────┘   └──────────┘   └──────────┘   └──────────┘   └──────────┘
```

What exactly is an asset?

FERROUS SULFATE STORAGE TANK T-1350-B

PRIMARY CLARIFIER 606

PRIMARY CLARIFIER 605

What is an asset register?

- *Systematic recording* of all assets an organization owns or for which it has responsibility
- Uses *asset identification numbers* to which attribute information can be linked

Sources of data

- As-built drawings
- Design drawings
- Manufacturers' manuals
- Bid documents
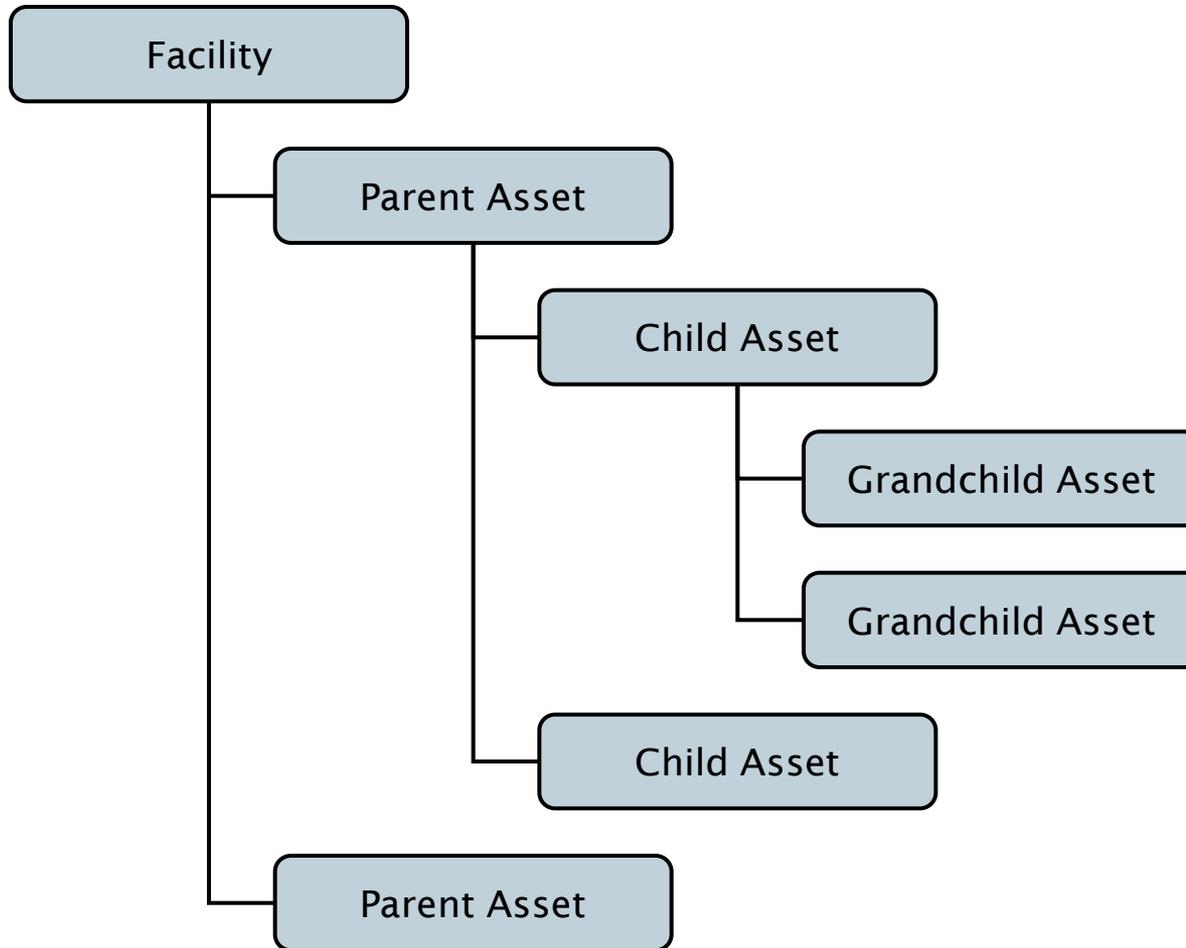- Schedules of quantities
- Staff—current and previous
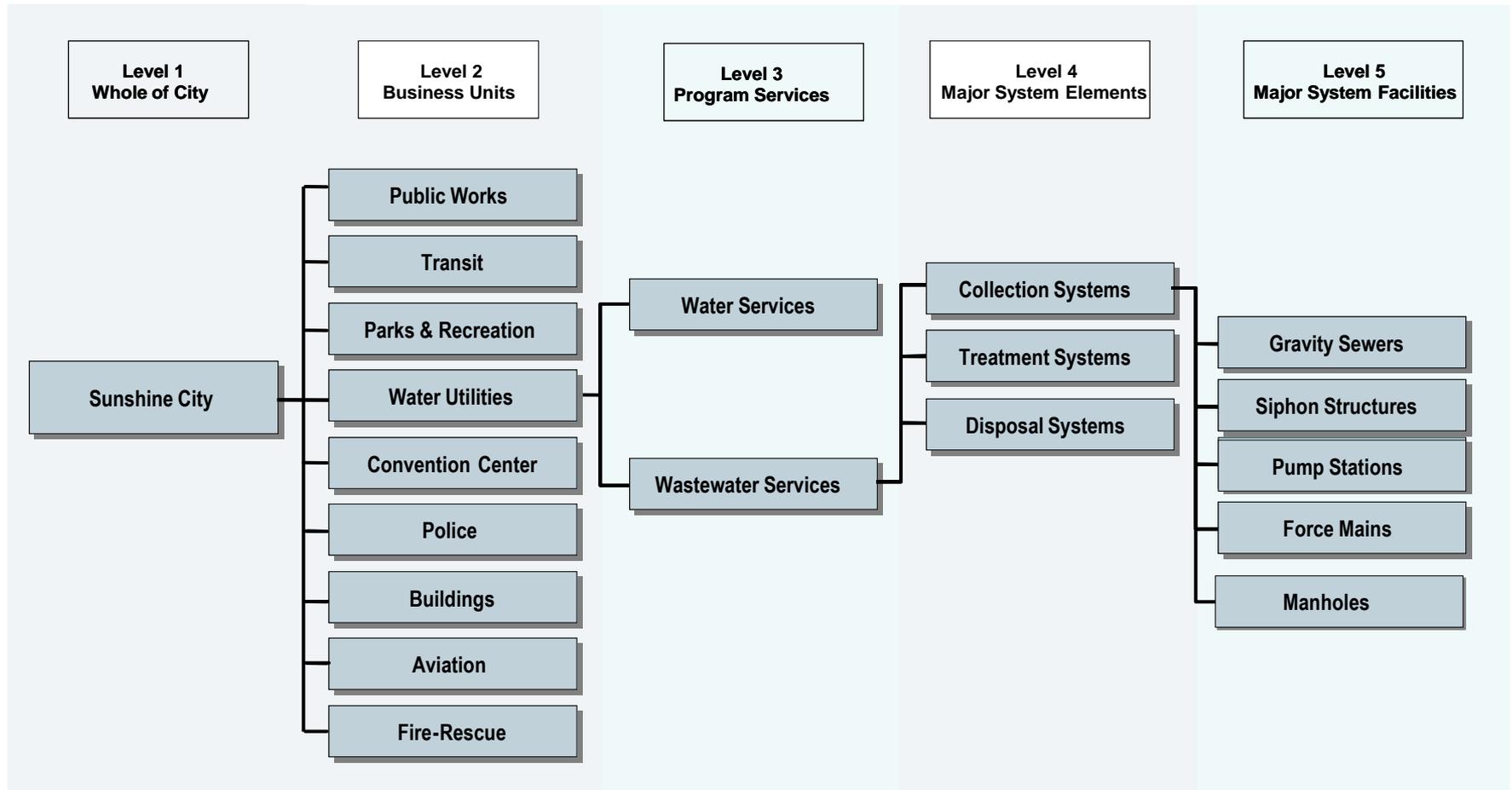- Photos and videos
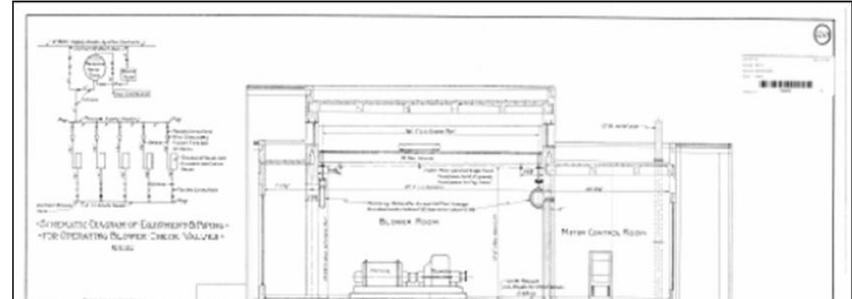
Types of asset registers

- Hierarchical—parent, child

- Category-based

- Process loops

- Spatial relationships—GPS-generated

- Business unit responsibilities

- Service provisions
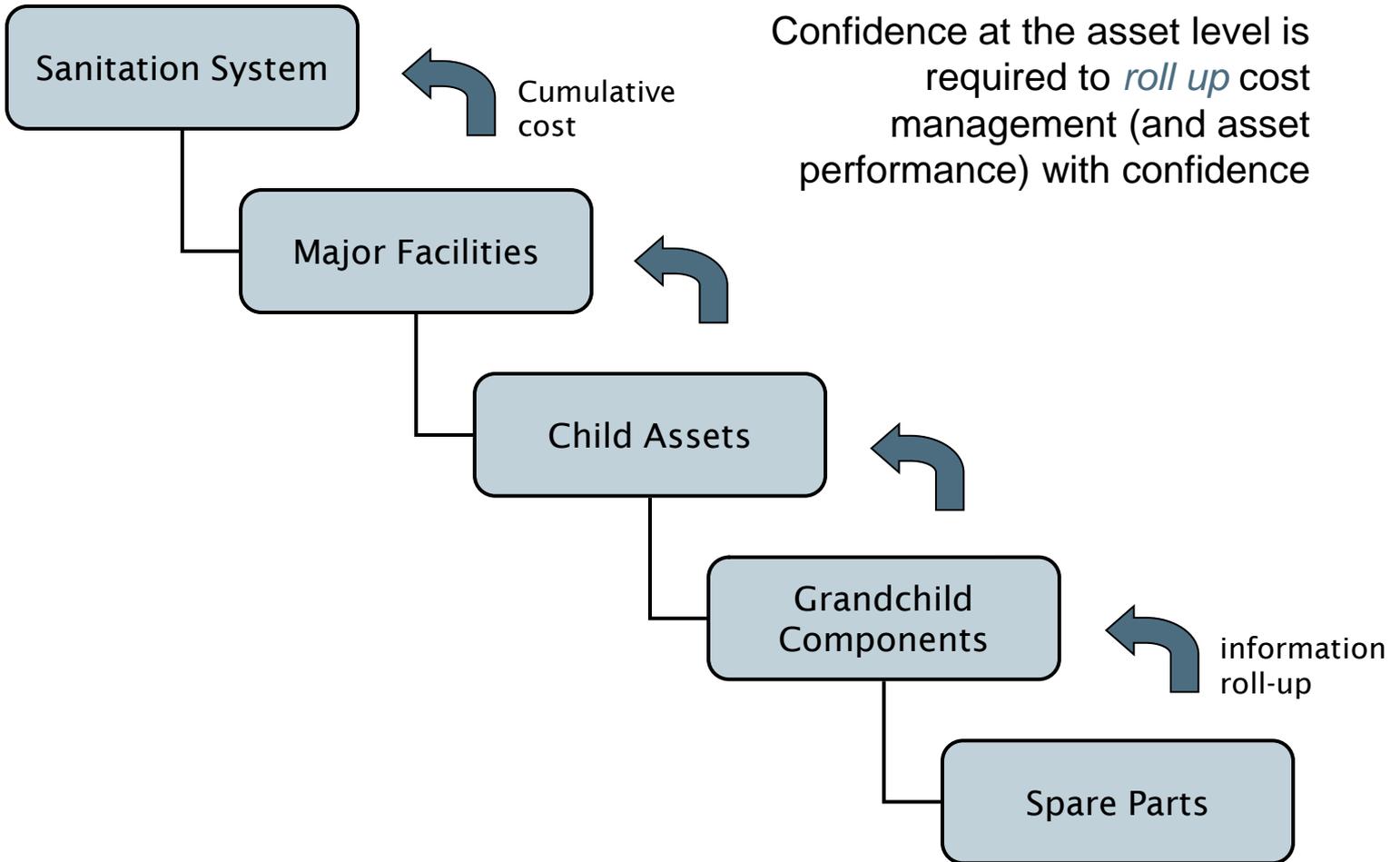
GPS is global positioning system

Asset hierarchy

```
┌─────────────┐
│  Facility   │
└─────────────┘
   │
   │   ┌──────────────┐
   ├───│ Parent Asset │
   │   └──────────────┘
   │      │
   │      │   ┌─────────────┐
   │      ├───│ Child Asset │
   │      │   └─────────────┘
   │      │      │
   │      │      │   ┌──────────────────┐
   │      │      ├───│ Grandchild Asset │
   │      │      │   └──────────────────┘
   │      │      │
   │      │      │   ┌──────────────────┐
   │      │      └───│ Grandchild Asset │
   │      │          └──────────────────┘
   │      │
   │      │   ┌─────────────┐
   │      └───│ Child Asset │
   │          └─────────────┘
   │
   │   ┌──────────────┐
   └───│ Parent Asset │
       └──────────────┘
```
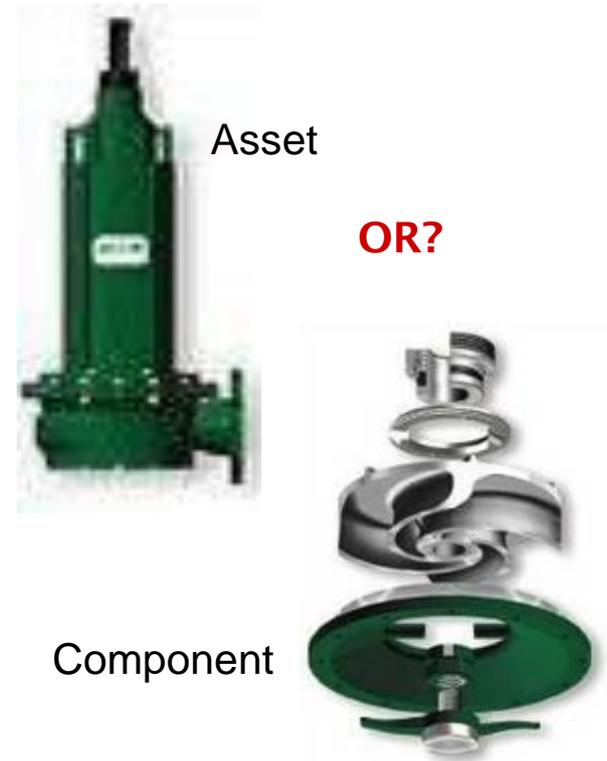
"Whole of government" asset hierarchy

Roll up concept

Sanitation System

Major Facilities

Child Assets

Grandchild Components

Spare Parts

Cumulative cost

information roll-up

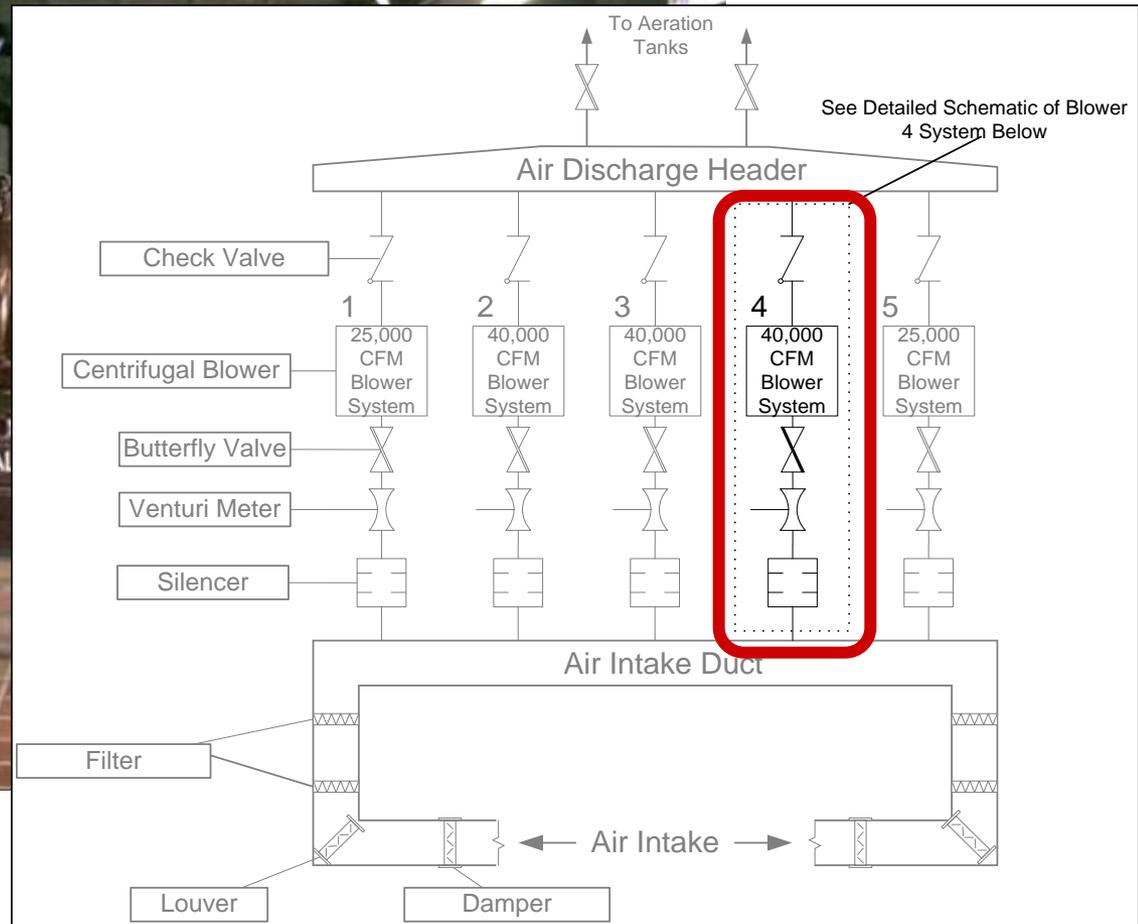Confidence at the asset level is required to *roll up* cost management (and asset performance) with confidence

Maintenance managed item

- *Maintenance managed item* (MMI) is an item at the lowest level—*the smallest subdivision*—of an asset registry composed as a nested hierarchy

- Typically, it is the level at which an asset is *maintained* (for example, parts are identified), or *decisions* are made to repair, refurbish, or replace

Asset

OR?

Component

Think "work order"

Using process layout with asset registry

To Aeration Tanks

See Detailed Schematic of Blower 4 System Below

Air Discharge Header

Check Valve

| 1 | 2 | 3 | 4 | 5 |

Centrifugal Blower — 25,000 CFM Blower System | 40,000 CFM Blower System | 40,000 CFM Blower System | 40,000 CFM Blower System | 25,000 CFM Blower System

Butterfly Valve

Venturi Meter

Silencer

Air Intake Duct

Filter

Air Intake

Louver   Damper

Using process layout with asset registry
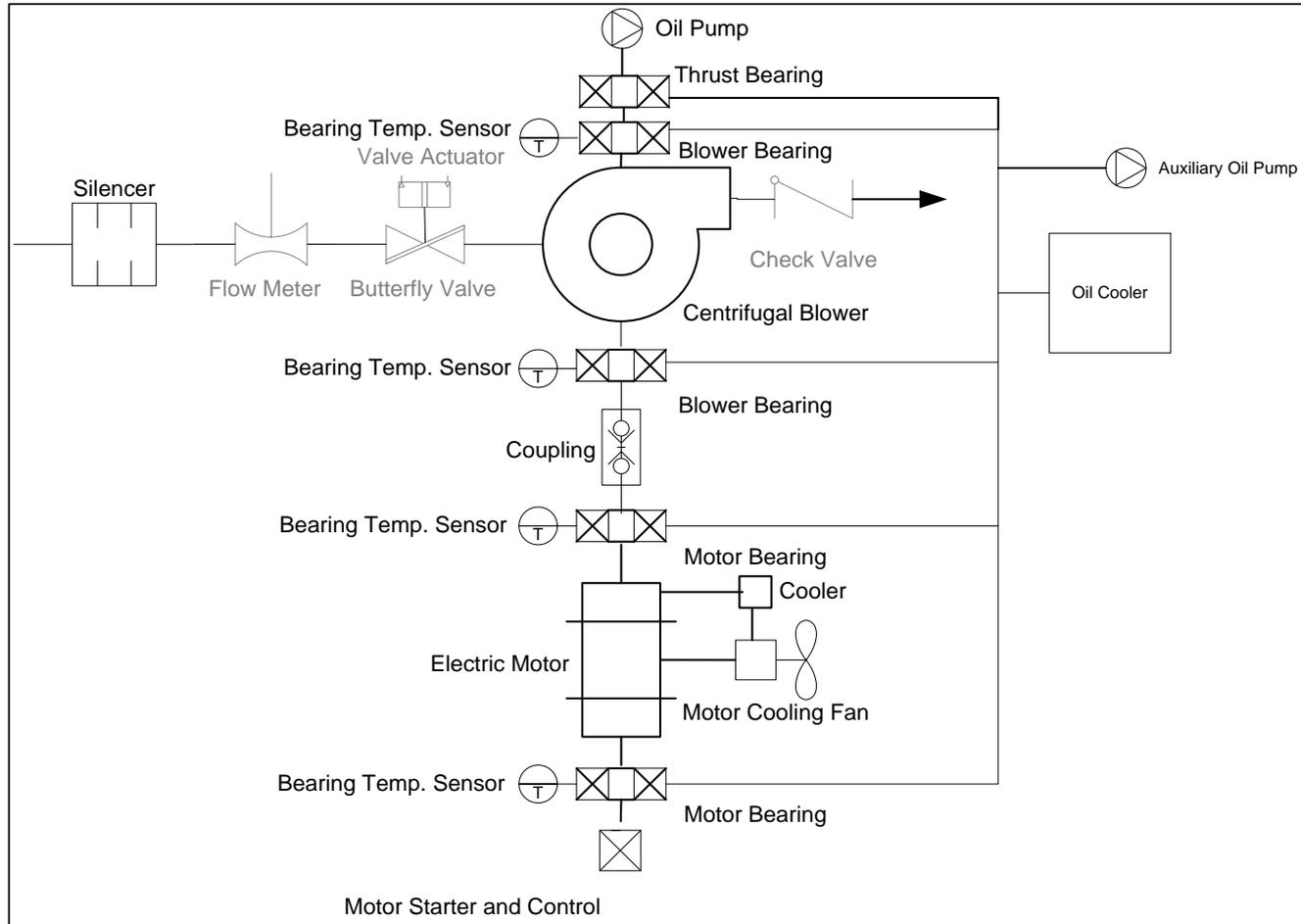
Data confidence levels within asset hierarchy

Confidence Level
40%

Facility

Parent Asset   55%

Child Asset   70%

Grandchild   85%

Component   95%
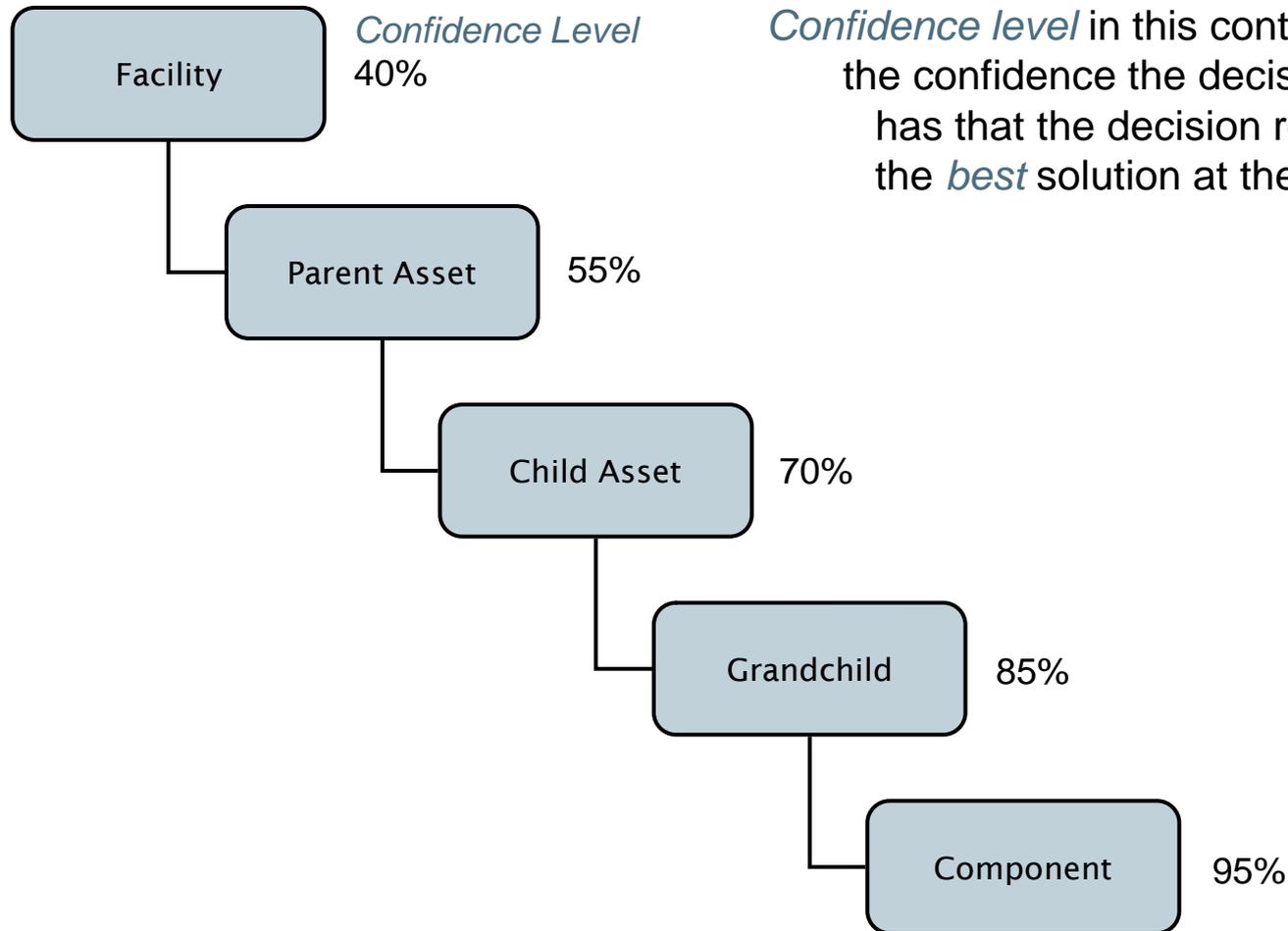
Confidence level in this context means the confidence the decision-maker has that the decision rendered is the *best* solution at the *right* time

Data costs within asset hierarchy

Facility

Parent Asset

Child Asset

Cost factor for obtaining asset data
increases with increasing
depth in the asset hierarchy

Cost Factor
x 1.0   (Facility, Parent Asset, Child Asset)

Component   x 1.7

Subcomponent   x 2.5

Spare   x 4.5
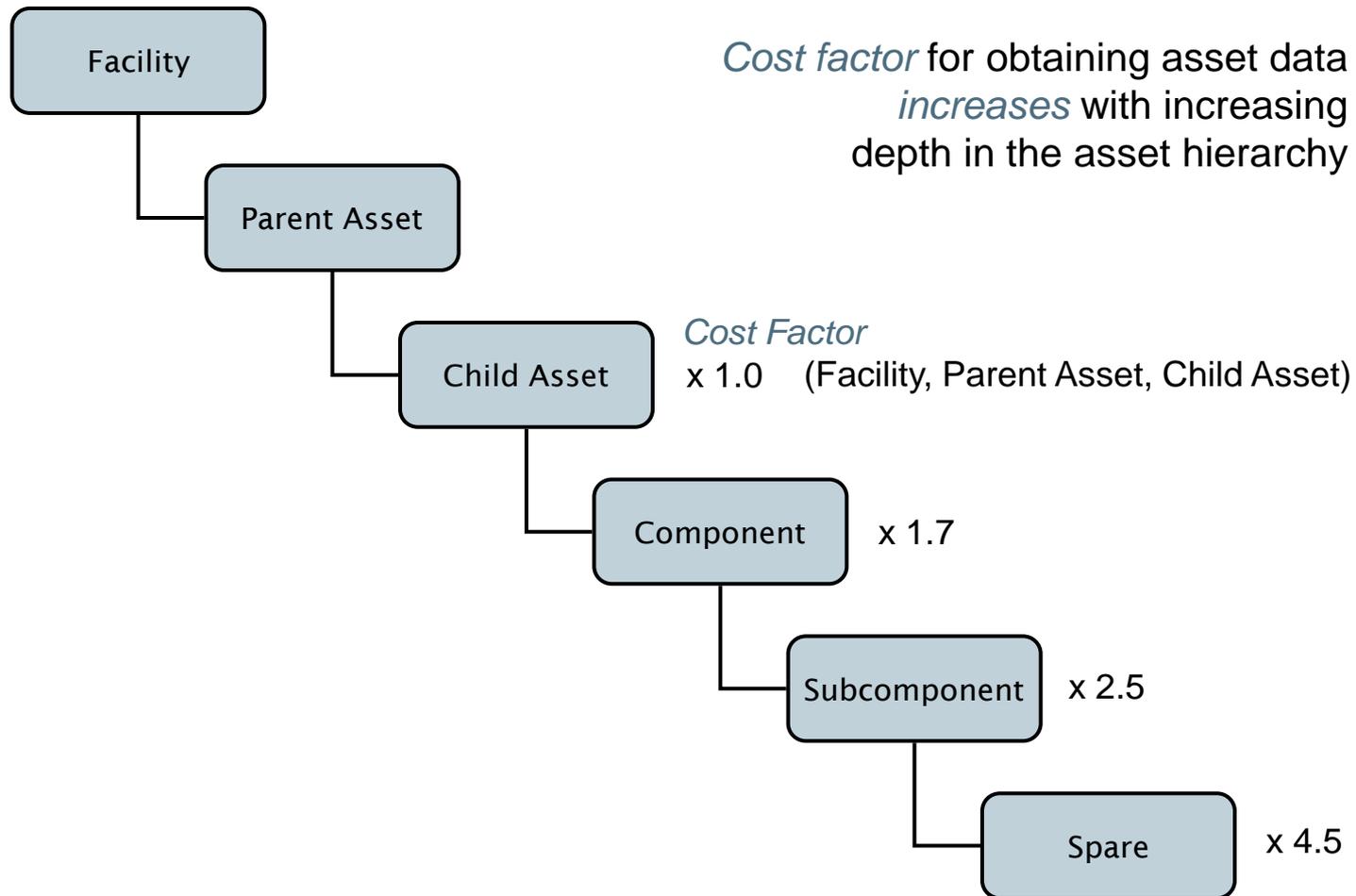
Examples of tree-style asset hierarchy

Data standard

Written record:

- Asset identification naming convention
- Attributes
- Record layouts
- Database architecture and protocols
- Data collection protocols

Asset ID naming convention issues

- What is an asset? (What gets a unique ID?)
- Linear (pipe) vs. vertical (plant) assets
  - Geo-reference
  - CAD versus GIS
- Active vs. passive
  - Lock-out/tag-out
  - Asset ID vs. asset location for mobile assets

CAD is computer-aided design, GIS is geographic information system

Data collection strategy

| ATTRIBUTE	SOURCE	LEVEL	USE
Asset List	SPL / Drawings	Asset	All
Asset Hierarchical	SPL / Drawings	Asset	All
Asset ID / Number	SPL / Data Standard	Asset	All
Asset Status	Field Inspection, Staff Interviews	Asset	All
Asset Type	SPL / Data Standard	Asset	See Level Column
Installation Date	Drawings / Staff Interviews	Asset	Renewal Timing
Last Rehab Date	Staff Interviews	Asset	Renewal Timing
Size	Drawings / Field Inspection	Asset	CoF, Valuation
Size Unit	Drawings / Field Inspection	Asset	CoF, Valuation
Length	Drawings / Field Inspection	Asset	CoF, Valuation
Length Unit	Drawings / Field Inspection	Asset	CoF, Valuation
Capacity	Drawings / Field Inspection	Asset	CoF, Valuation
Capacity Unit	Drawings / Field Inspection	Asset	CoF, Valuation
Condition	Inspection, Staff Interviews	Asset	Renew Timing, PoF

■
■
■

Etc.

Major components of asset data

Tied to the *asset ID*…

- Physical attributes
- Geo-reference
- O&M manuals
- Drawings and photos
- Life cycle costs
- Knowledge and strategy

ATTRIBUTE	SOURCE	LEVEL	USE
Asset List	SPL / Drawings	Asset	All
Asset Hierarchical	SPL / Drawings	Asset	All
Asset ID / Number			All
Asset Status			All
Asset Type			See Level Column
Installation Date			Renewal Timing
Last Rehab Date			Renewal Timing
Size			oF, Valuation
Size Unit			oF, Valuation
Length			
Length Unit			
Capacity			
Capacity Unit			
Condition			
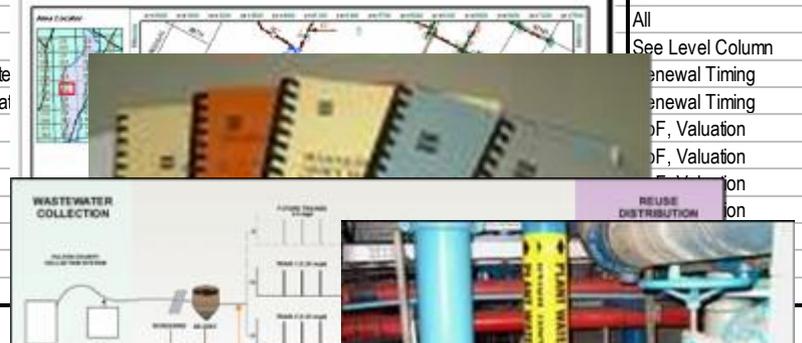
Primary Cost Unit	Minor code	Number of Units	$/Unit	Allocated Cost
Direct Labor				
	Direct Pay	2.5 hours	$42.00	$105.00
	Overhead			
	Benefit Burden			
	FICA, etc			
Materials				
	Vehicle			
	Pipe			
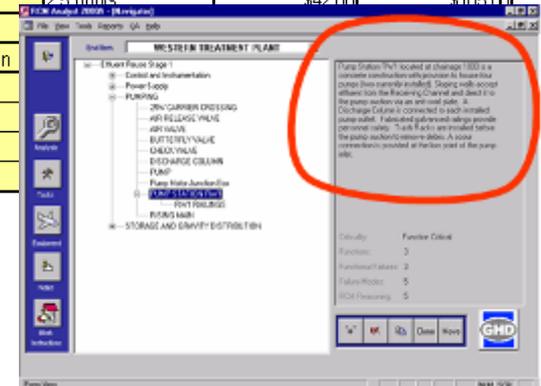
Two approaches to generating registry data

What we already have—retrospective

- *Critical first*
- Use existing crews as they respond to Work Orders
- Use engineering students

What we are about to acquire—prospective

- Tie to commissioning or handover process
- Use contract details to retain control

Recording data—new technology

Ricoh Caplio Pro G3

Data responsibilities

Data Task	Organization Group
Asset details	Operations
Condition assessment	Maintenance
Asset values	Engineering
Residual physical lives	Engineering
Probability of failure	Maintenance
Consequence of failure	Engineering
Business risk exposure	Engineering
Optimal renewal strategy	Maintenance or Engineering

Key points from this session

What do I own and where is it?

Key Points:

- We have to know what we have before we can manage appropriately what residual life is left.

- Everything in AM starts with the Asset Registry.

- The "data standard" is the key building block for AM asset registries.

Associated Techniques:

- Asset registry/inventory

- Data standards, asset hierarchy

- System maps

- Delphi approach to locating other sources of data

- Process diagrams

- "Handover" procedures