CONTINUATION OF RECONCILIATION STRATEGIES FOR ALL TOWNS

Training on Integrated Water Resource Management:

Water Infrastructure Asset Management: Concepts

Structure of the programme

- Overview
- Development of Asset Registers
  - Sources of data & information
  - Methods used in asset verification
- Asset Valuation
  - Principles of asset valuation
  - Methods
  - Useful life
  - Depreciation methods
- Condition & Performance Assessment
  - Identification of critical assets
  - Methods of assessment
- Asset Management Plan
  - Timing of investments

Introduction

- Definition of asset management
  - *"The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required levels of service to customers and the environment at acceptable levels of risk and in the most efficient manner"*
  - (it does not refer to allocating investments among stocks, bonds & cash),
- Four key drivers for the adoption of formal asset management approaches:
  - Changes in demands placed on infrastructure and budgets.
  - Changes in public perception relating to asset management.
  - Changes in regulatory requirements.
  - Availability of new technology

Asset Management: The way to do business

- The Water Sector has a significantly higher level of capital intensity than any other industry
  - Clear need to optimise the assets in the industry
  - Existing investment is optimally utilised
- The replacement value of this fixed asset base is very high
  - replacement will be necessary as time takes its toll and assets wear out.
- Use of asset management practices in water sector
  - to grow over next five years






Asset Management: The way to do business

- ***"SA needs to invest R573bn in water infrastructure, services in the next 10 years"***
- Adoption of asset has significant benefits
  - Helps to manage the entire life of assets to receive the best return on investments
  - ability to explain and defend budgets and investments
  - saves ratepayers money,
  - improving system reliability and reducing risk, and
  - helping water authorities increase service levels

Asset Management: The way to do business

- In many water authorities – realisation of the need to concentrate efforts on
  - optimizing the replacement cycle of these assets in order to provide maximum financial leverage for the future.
  - develop a strategy which maximizes the useful life of existing assets, and
  - also allow them to prioritize the asset renewal on a uniform basis.

Regulatory Requirements for AM

- Need to comply with accounting practices & reporting
  - PFMA, Act No. 1 of 1999, as amended
  - The ASB is required in terms of the PFMA, to determine generally recognised accounting practice referred to as Standards of Generally Recognised Accounting Practice (GRAP)
- Comply with legislative requirements as prescribed in GRAP 17
  - for implementation by constitutional institutions and Schedule 3A and 3C public entities
- Basic Financial Statements for National & Local Governments are governed by ASB, 2012
  - to produce financial reports in a manner more consistent with that used by private sector companies

Regulatory Requirements for AM

- In particular, ASB 34 requires
  - infrastructure to be reported at its historical value and then depreciated based on its useful life and condition.
- However, the ASB 34 requirements also allow for a modified approach for infrastructure assets that are part of a network or subsystem of a network
  - Capital Replacement Valuation

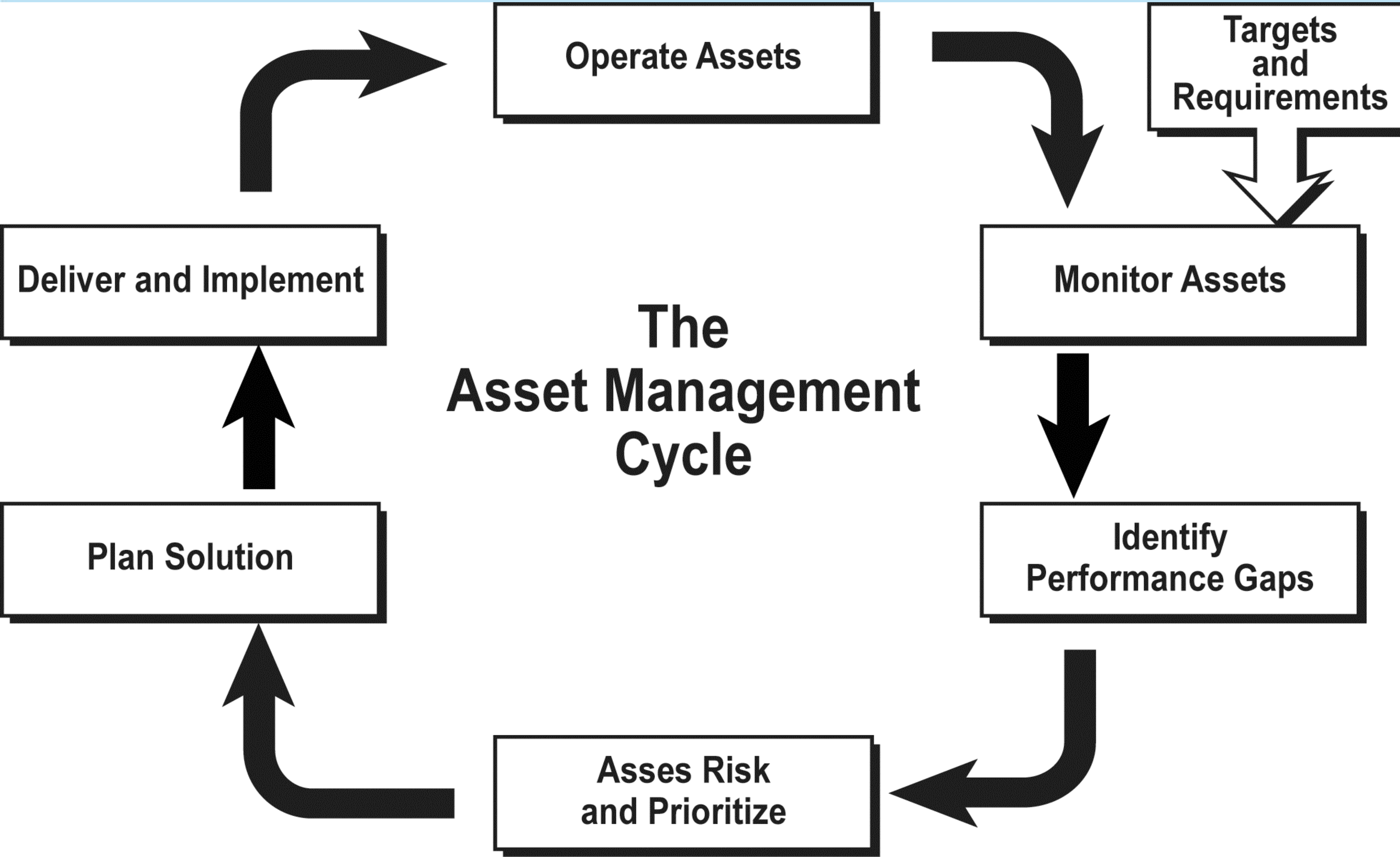
Accounting for Infrastructure

- The cost to deliver the service. This includes the full lifecycle cost, which includes the costs of:
  - acquisition;
  - maintenance;
  - operation;
  - renewal;
  - upgrade; and
  - disposal.

Accounting for Infrastructure

- Accountability and performance measurement. These are provided via the financial statements as:
  - valuation;
  - depreciation; and
  - disclosures.
- The source of funding (revenue). Examples include:
  - grants;
  - rates and taxes;
  - fees and charges; and
  - internal reserves.

Asset Management



AM Framework

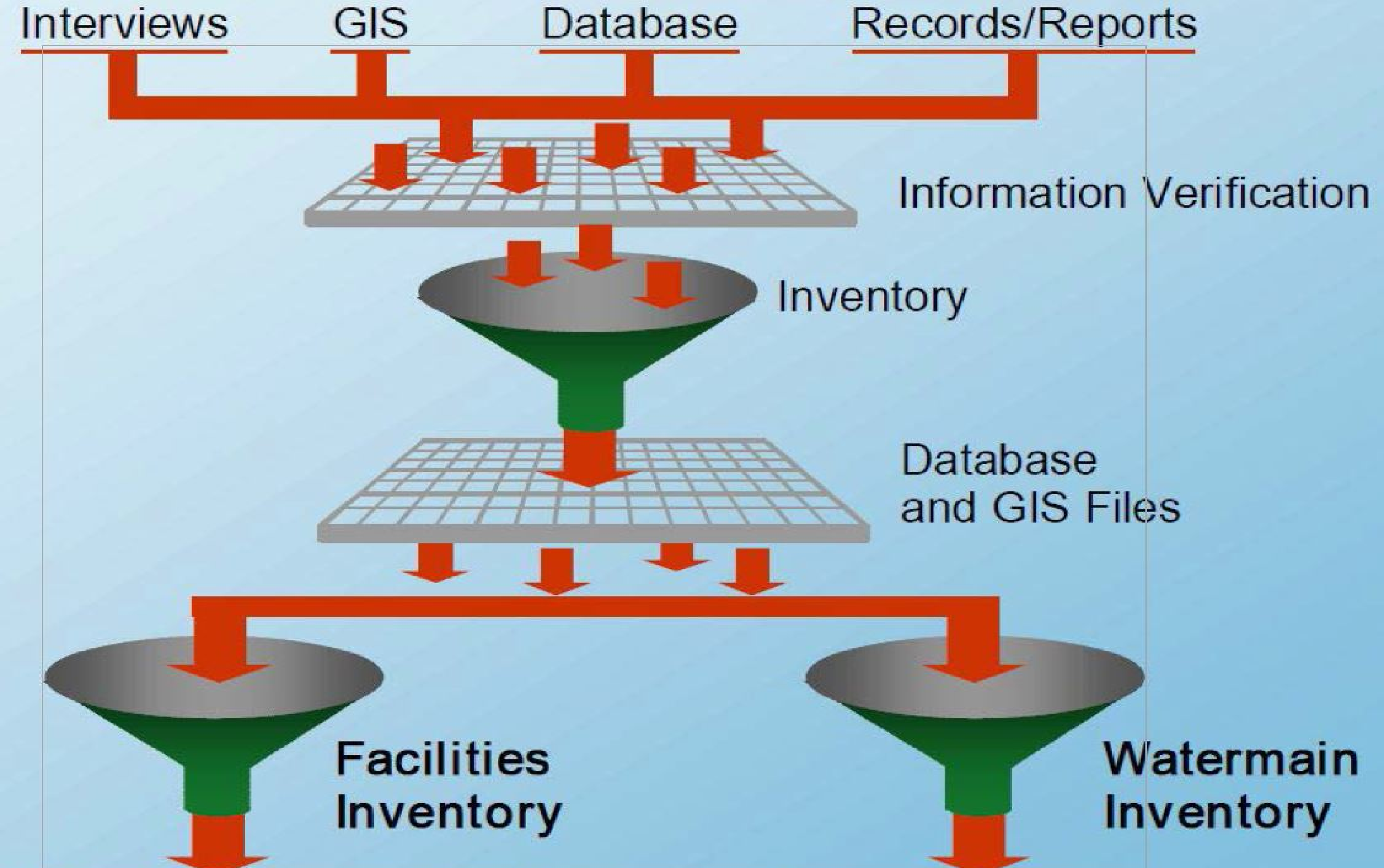
- What assets are owned?
  - Critical for management including WC/WDM interventions
  - Inventory of an accurate register of assets
- What are they worth?
  - Value of the assets based on the age & condition
  - Remaining useful life based on consumption pattern
- What is the deferred maintenance?
  - In this context, deferred maintenance is taken to be an overview of the amount of expenditure required to bring the maintenance and repair under control, rather than being a measure of renewal backlog
- What condition are the assets in?
  - Bases for planning to refurbish or renew
  - Determine what should be fixed first?

Development of Asset Register

Asset Register

- The cornerstone of effective asset management is a fixed asset register (FAR) of all owned/controlled assets
- Tangible items that:
  - (a) are held for use in the production or supply of goods or services, for rental to others, or for administrative purposes, **and**
  - (b) are expected to be used during more than one reporting period.

Framework for an asset inventory



Asset Hierarchy

Facility	Asset Category	Asset Type	Components	Component Units
Water treatment plant	Water treatment	Clarifier	Basin	Access hatches, ladders, rungs, stairs
				Coating system
				Drain
				Floor
				Foundation
				Gratings
				Handrail
				Launder supports
				Launders
				Tray
				Walls; baffle
				Walls; structural
				Weirs
			Gates/actuators	Actuator
				Body
				Frame
				Seals/seats
				Stem/operator (manual)
				Trim
			Clarifier Mechanism	High torque cutouts/controls
				Associated electrical support system
				Baffles
				Corner sweeps
				Drive

Asset Register Information

- Asset ID.
  - A unique identification number that is consistently used across the organization is crucial to ensure that all information, including remaining effective life generated can be tracked and used in other applications.
- Asset Name.
  - A short description of the asset.
- Asset Class.
  - Grouping of assets based on predetermined classification used by the organization, usually based on the type of asset, e.g. “valves”, - can be further classified by diameter, etc.

Asset Register Information

- Install Year.
  - The year of asset being installed. Age will be calculated by subtracting the year of installation from the year of analysis.
- Refurb Year.
  - The year in which a substantial refurbishment of the asset occurred. If no refurbishment has been performed on the asset, leave blank.
- Condition Rating.
  - The score of condition rating, e.g. in the scale 1 (new) to 5 (failed).

IPS2: 3d Mobile Mapping of Assets

3D Point Cloud of Assets at Witbank Water Treatment Works

Each dot represents x,y,z position of entity surveyed

IPS2: 3d Mobile Mapping of Assets

Assets at Witbank Water Treatment Works

360° Panoramic Photographs taken every 4 meters

IPS2: 3d Mobile Mapping of Assets

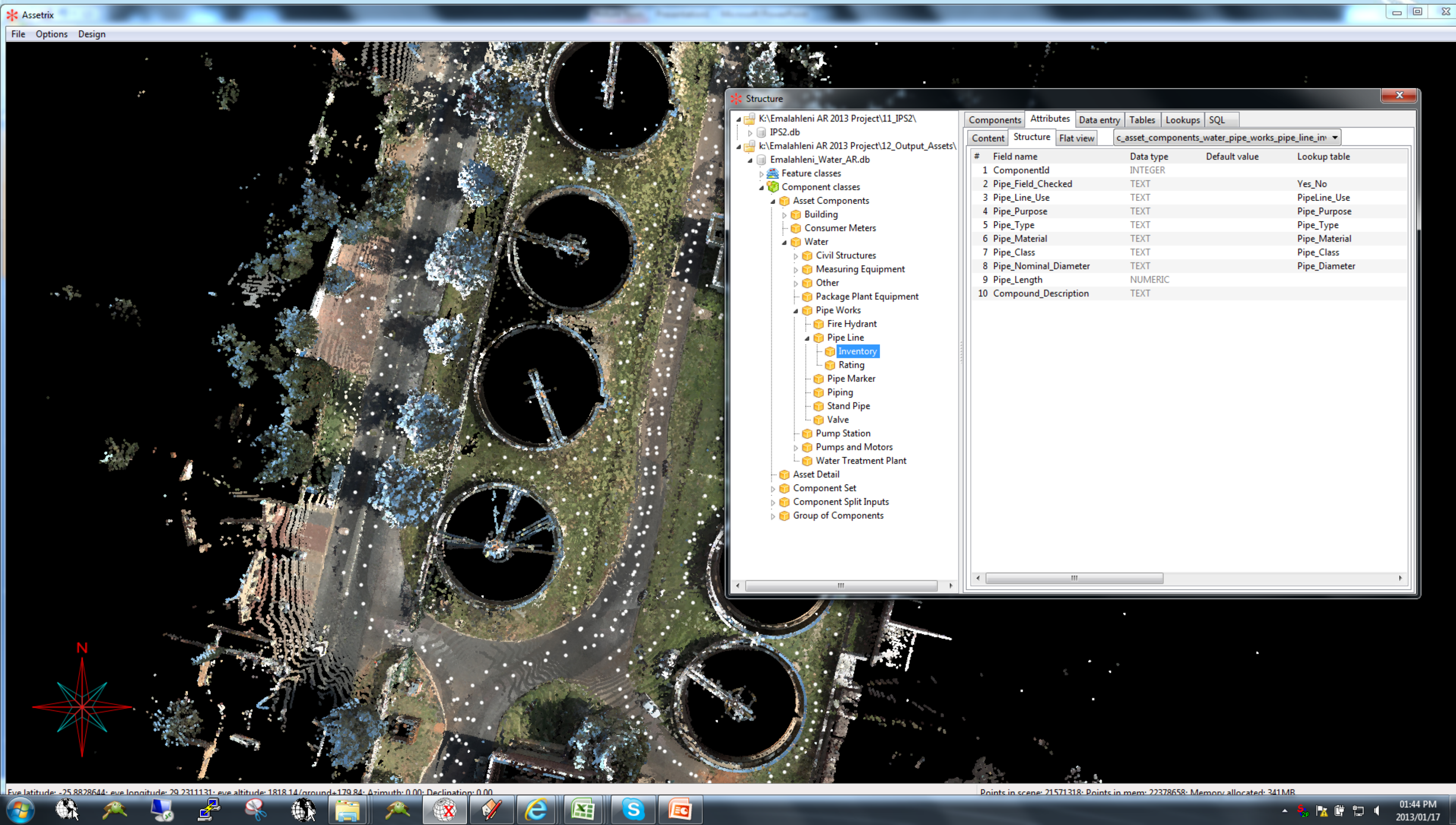
Assets at Witbank Water Treatment Works

360° Panoramic Photographs taken every 4 meters

IPS2: 3d Mobile Mapping of Assets

Assets at Witbank Water Treatment Works

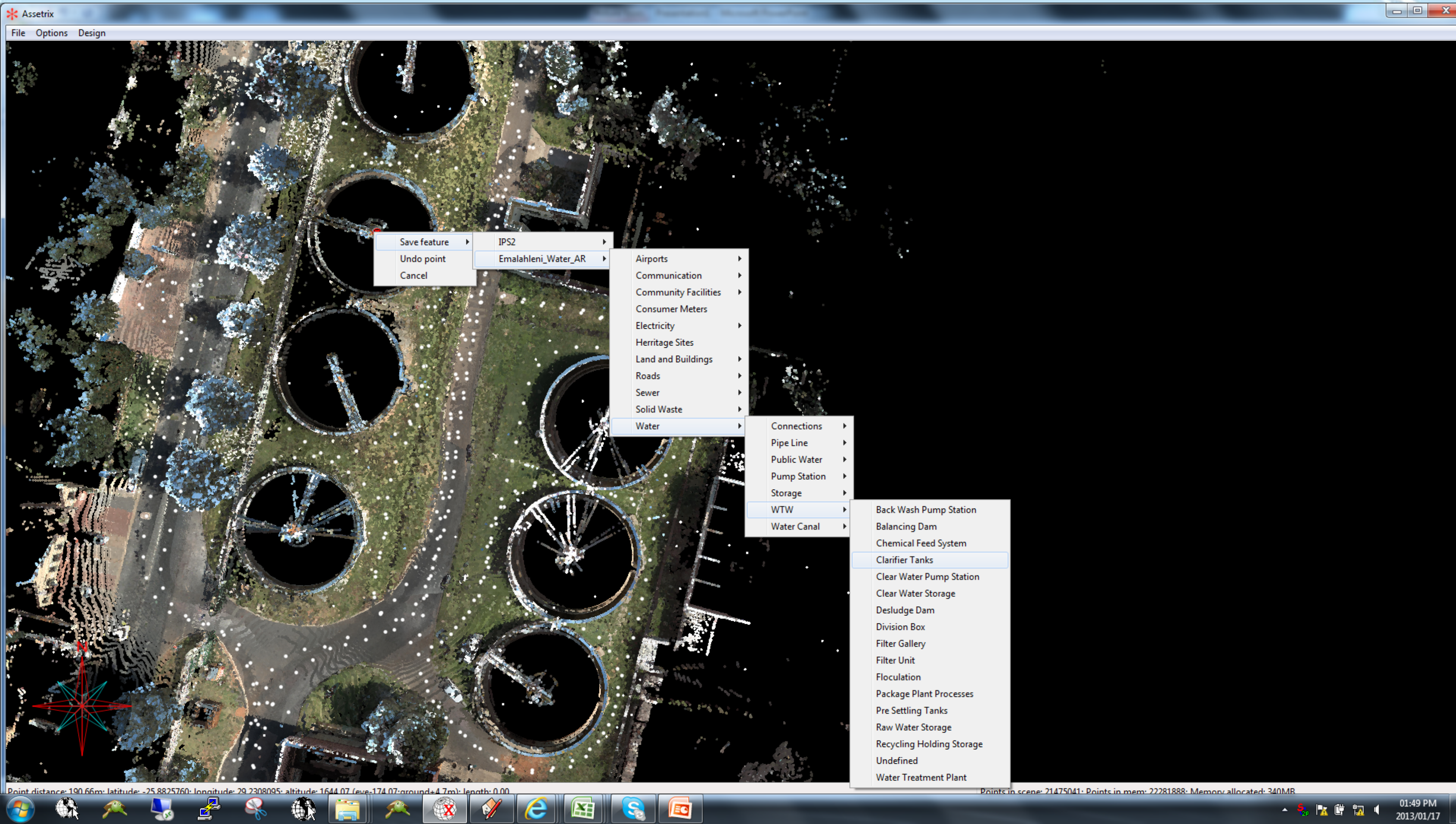
Designing Database of Asset Components to capture



IPS2: 3d Mobile Mapping of Assets

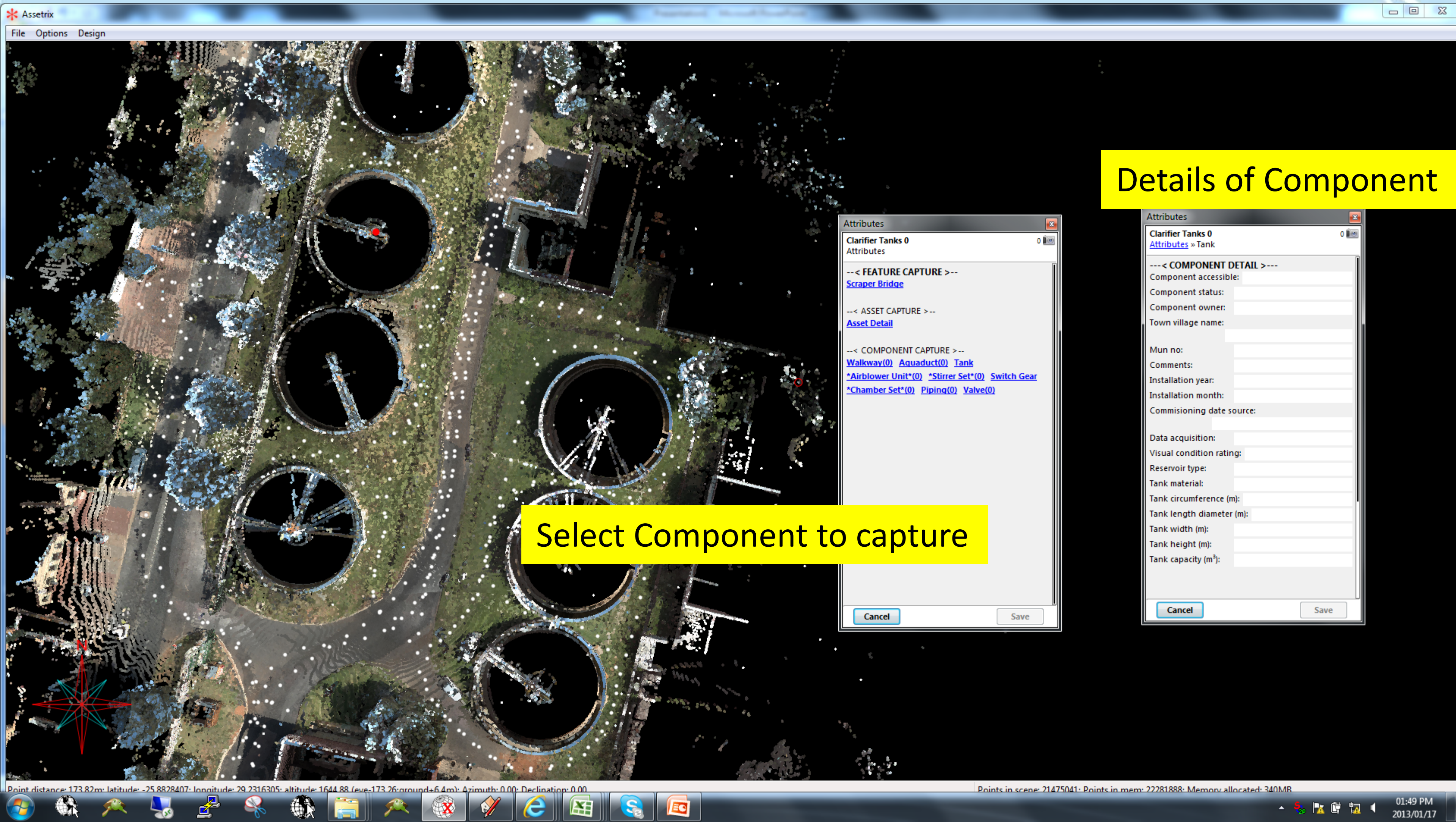
Assets at Witbank Water Treatment Works

Capture Clarifier Basin as component in Water Treatment Works

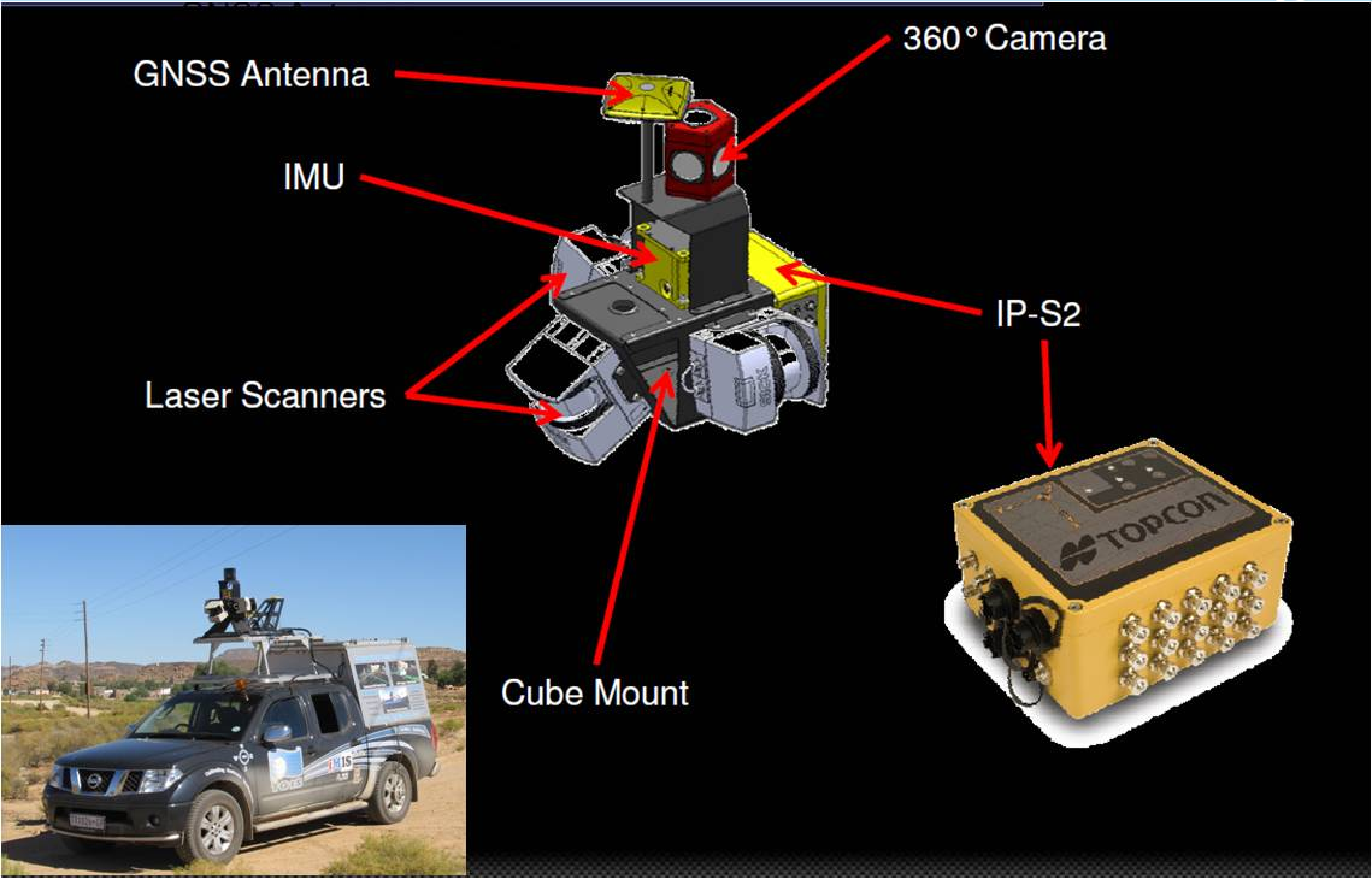


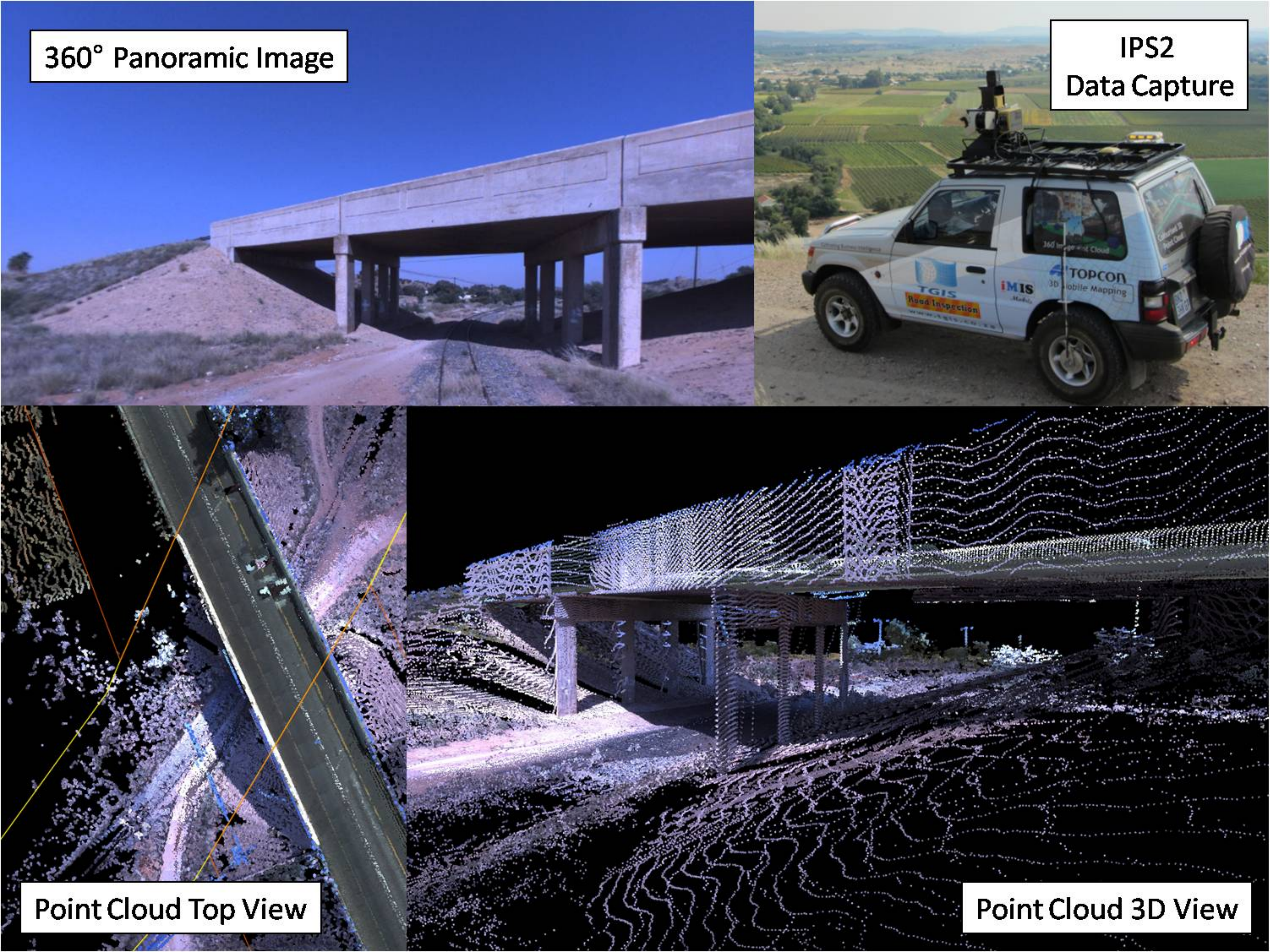
IPS2: 3d Mobile Mapping of Assets

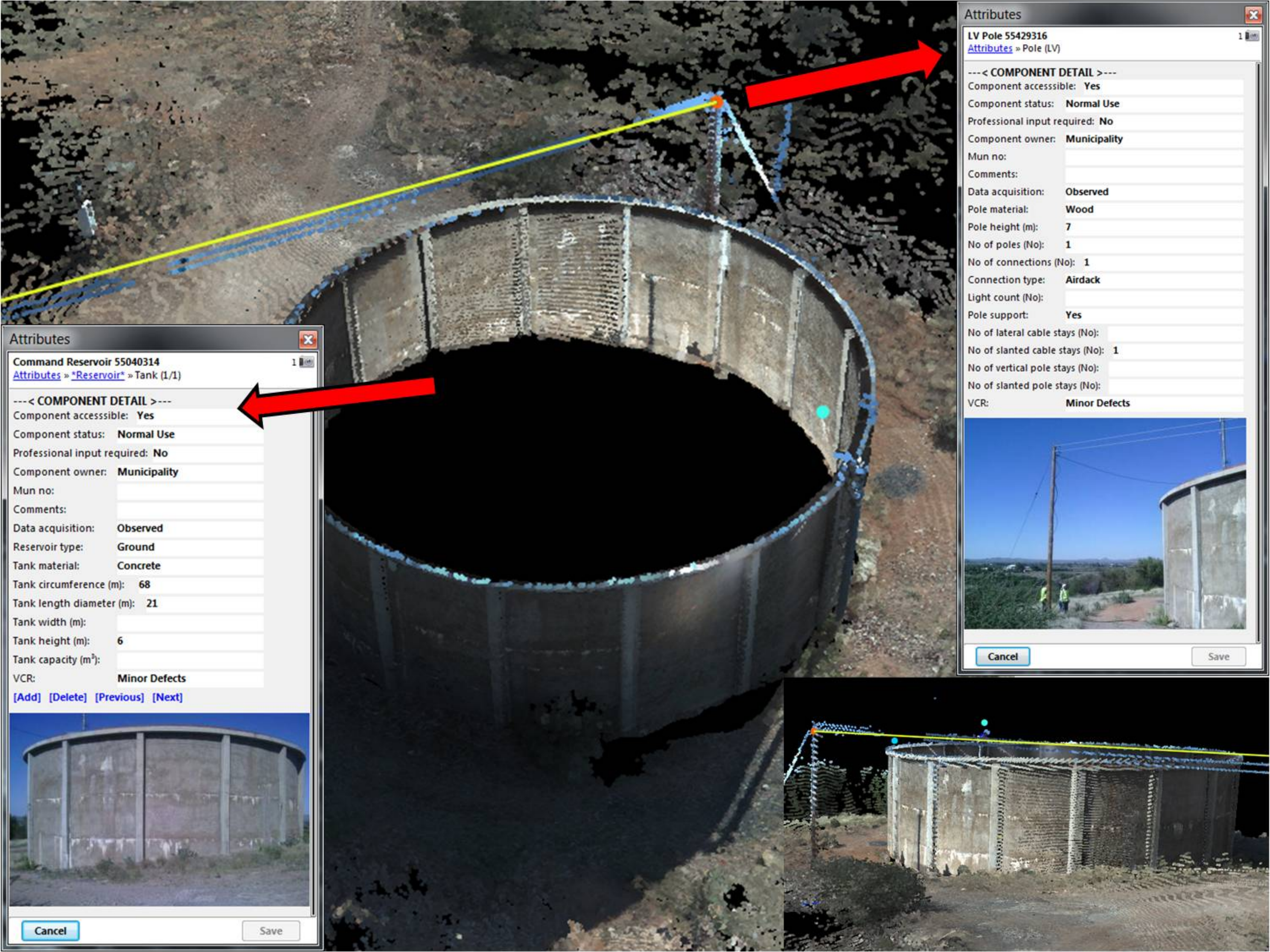
Assets at Witbank Water Treatment Works

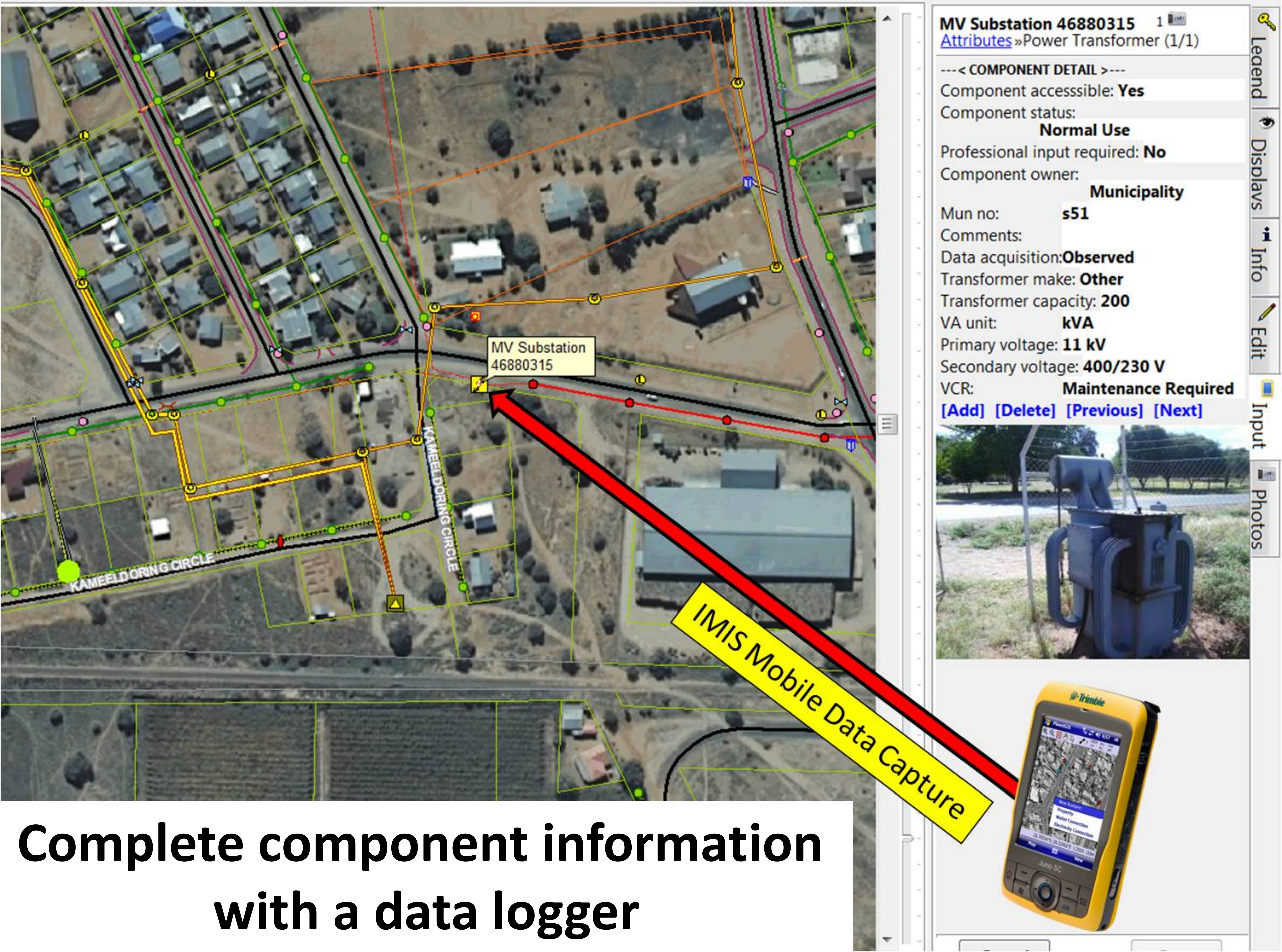


IPS2: 3d Mobile Mapping of Assets



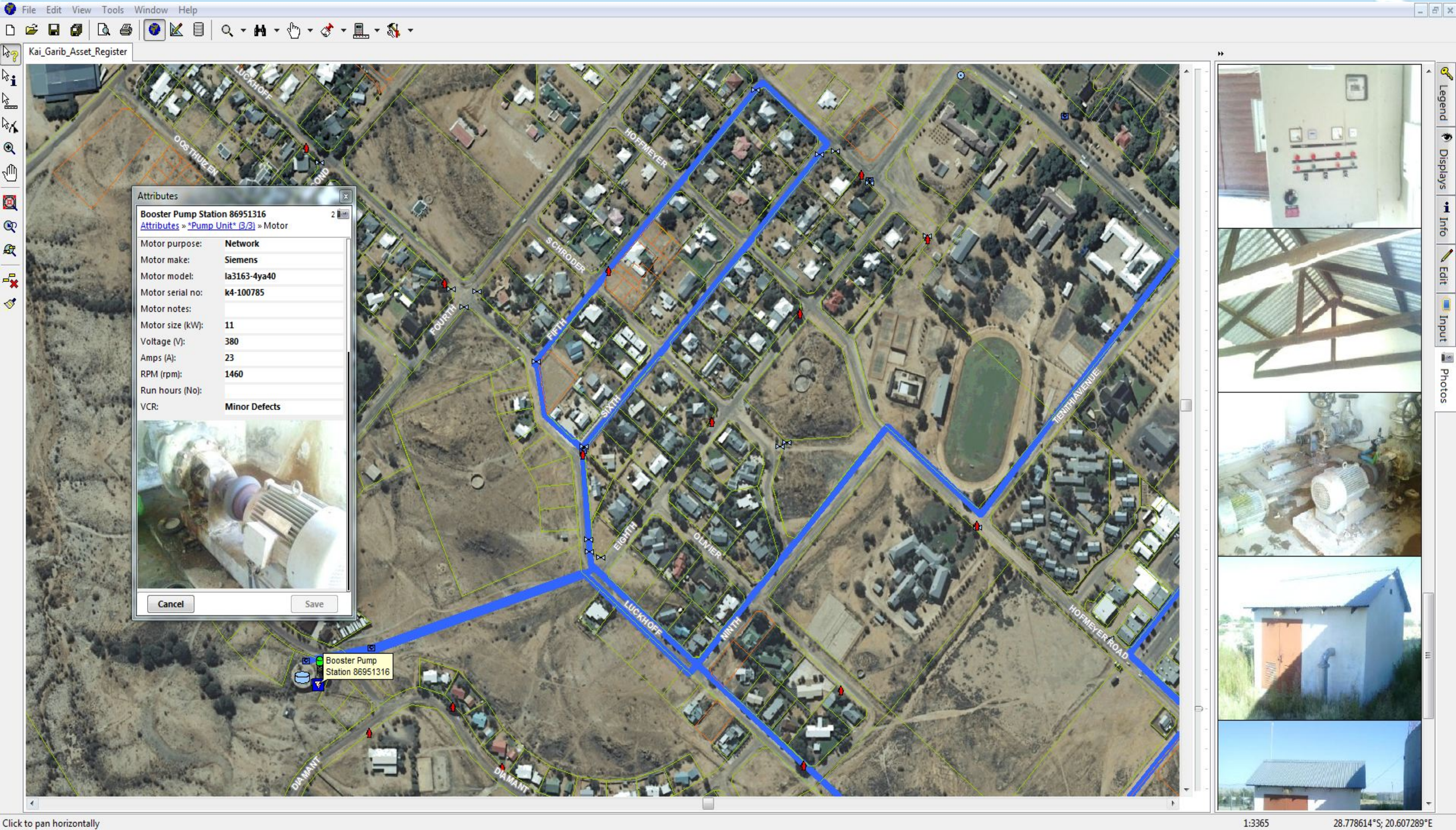

360° Panoramic Image
IPS2
Data Capture
TOPCON
3D Mobile Mapping
TGIS
Road Inspection
Point Cloud Top View
Point Cloud 3D View


Attributes
Command Reservoir 55040314
Attributes » *Reservoir* » Tank (1/1)
---< COMPONENT DETAIL >---
Component accessible: Yes
Component status: Normal Use
Professional input required: No
Component owner: Municipality
Mun no:
Comments:
Data acquisition: Observed
Reservoir type: Ground
Tank material: Concrete
Tank circumference (m): 68
Tank length diameter (m): 21
Tank width (m):
Tank height (m): 6
Tank capacity (m³):
VCR: Minor Defects
[Add] [Delete] [Previous] [Next]
Cancel
Save
Attributes
LV Pole 55429316
Attributes » Pole (LV)
---< COMPONENT DETAIL >---
Component accessible: Yes
Component status: Normal Use
Professional input required: No
Component owner: Municipality
Mun no:
Comments:
Data acquisition: Observed
Pole material: Wood
Pole height (m): 7
No of poles (No): 1
No of connections (No): 1
Connection type: Airdack
Light count (No):
Pole support: Yes
No of lateral cable stays (No):
No of slanted cable stays (No): 1
No of vertical pole stays (No):
No of slanted pole stays (No):
VCR: Minor Defects
Cancel
Save

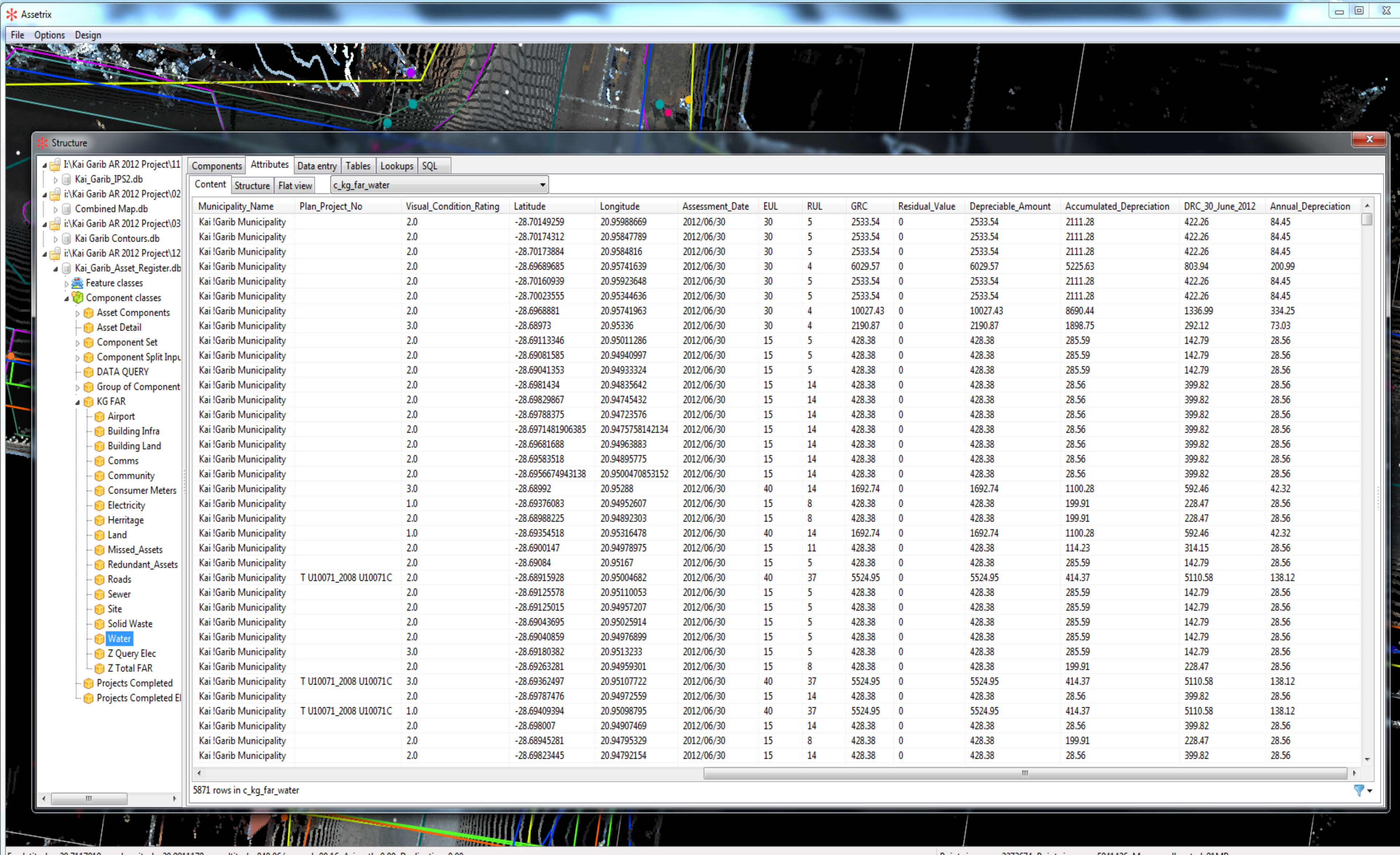


Complete component information with a data logger

Overlaying assets in GIS captured with hand-held data logger



Asset Register Values of Components



Municipality_Name	Plan_Project_No	Visual_Condition_Rating	Latitude	Longitude	Assessment_Date	EUL	RUL	GRC	Residual_Value	Depreciable_Amount	Accumulated_Depreciation	DRC_30_June_2012	Annual_Depreciation
Kai !Garib Municipality		2.0	-28.70149259	20.95988669	2012/06/30	30	5	2533.54	0	2533.54	2111.28	422.26	84.45
Kai !Garib Municipality		2.0	-28.70174312	20.95847789	2012/06/30	30	5	2533.54	0	2533.54	2111.28	422.26	84.45
Kai !Garib Municipality		2.0	-28.70173884	20.9584816	2012/06/30	30	5	2533.54	0	2533.54	2111.28	422.26	84.45
Kai !Garib Municipality		2.0	-28.69689685	20.95741639	2012/06/30	30	4	6029.57	0	6029.57	5225.63	803.94	200.99
Kai !Garib Municipality		2.0	-28.70160939	20.95923648	2012/06/30	30	5	2533.54	0	2533.54	2111.28	422.26	84.45
Kai !Garib Municipality		2.0	-28.70023555	20.95344636	2012/06/30	30	5	2533.54	0	2533.54	2111.28	422.26	84.45
Kai !Garib Municipality		2.0	-28.6968881	20.95741963	2012/06/30	30	4	10027.43	0	10027.43	8690.44	1336.99	334.25
Kai !Garib Municipality		3.0	-28.68973	20.95336	2012/06/30	30	4	2190.87	0	2190.87	1898.75	292.12	73.03
Kai !Garib Municipality		2.0	-28.69113346	20.95011286	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		2.0	-28.69081585	20.94940997	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		2.0	-28.69041353	20.94933324	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		2.0	-28.6981434	20.94835642	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		2.0	-28.69829867	20.94745432	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		2.0	-28.69788375	20.94723576	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		2.0	-28.6971481906385	20.9475758142134	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		2.0	-28.69681688	20.94963883	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		2.0	-28.69583518	20.94895775	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		2.0	-28.6956674943138	20.9500470853152	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		3.0	-28.68992	20.95288	2012/06/30	40	14	1692.74	0	1692.74	1100.28	592.46	42.32
Kai !Garib Municipality		1.0	-28.69376083	20.94952607	2012/06/30	15	8	428.38	0	428.38	199.91	228.47	28.56
Kai !Garib Municipality		2.0	-28.68988225	20.94892303	2012/06/30	15	8	428.38	0	428.38	199.91	228.47	28.56
Kai !Garib Municipality		1.0	-28.69354518	20.95316478	2012/06/30	40	14	1692.74	0	1692.74	1100.28	592.46	42.32
Kai !Garib Municipality		2.0	-28.6900147	20.94978975	2012/06/30	15	11	428.38	0	428.38	114.23	314.15	28.56
Kai !Garib Municipality		2.0	-28.69084	20.95167	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality	T U10071_2008 U10071C	2.0	-28.68915928	20.95004682	2012/06/30	40	37	5524.95	0	5524.95	414.37	5110.58	138.12
Kai !Garib Municipality		2.0	-28.69125578	20.95110053	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		2.0	-28.69125015	20.94957207	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		2.0	-28.69043695	20.95025914	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		2.0	-28.69040859	20.94976899	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		3.0	-28.69180382	20.9513233	2012/06/30	15	5	428.38	0	428.38	285.59	142.79	28.56
Kai !Garib Municipality		2.0	-28.69263281	20.94959301	2012/06/30	15	8	428.38	0	428.38	199.91	228.47	28.56
Kai !Garib Municipality	T U10071_2008 U10071C	3.0	-28.69362497	20.95107722	2012/06/30	40	37	5524.95	0	5524.95	414.37	5110.58	138.12
Kai !Garib Municipality		2.0	-28.69787476	20.94972559	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality	T U10071_2008 U10071C	1.0	-28.69409394	20.95098795	2012/06/30	40	37	5524.95	0	5524.95	414.37	5110.58	138.12
Kai !Garib Municipality		2.0	-28.698007	20.94907469	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56
Kai !Garib Municipality		2.0	-28.68945281	20.94795329	2012/06/30	15	8	428.38	0	428.38	199.91	228.47	28.56
Kai !Garib Municipality		2.0	-28.69823445	20.94792154	2012/06/30	15	14	428.38	0	428.38	28.56	399.82	28.56

5871 rows in c_kg_far_water

Example

Discussion

Valuation of Assets

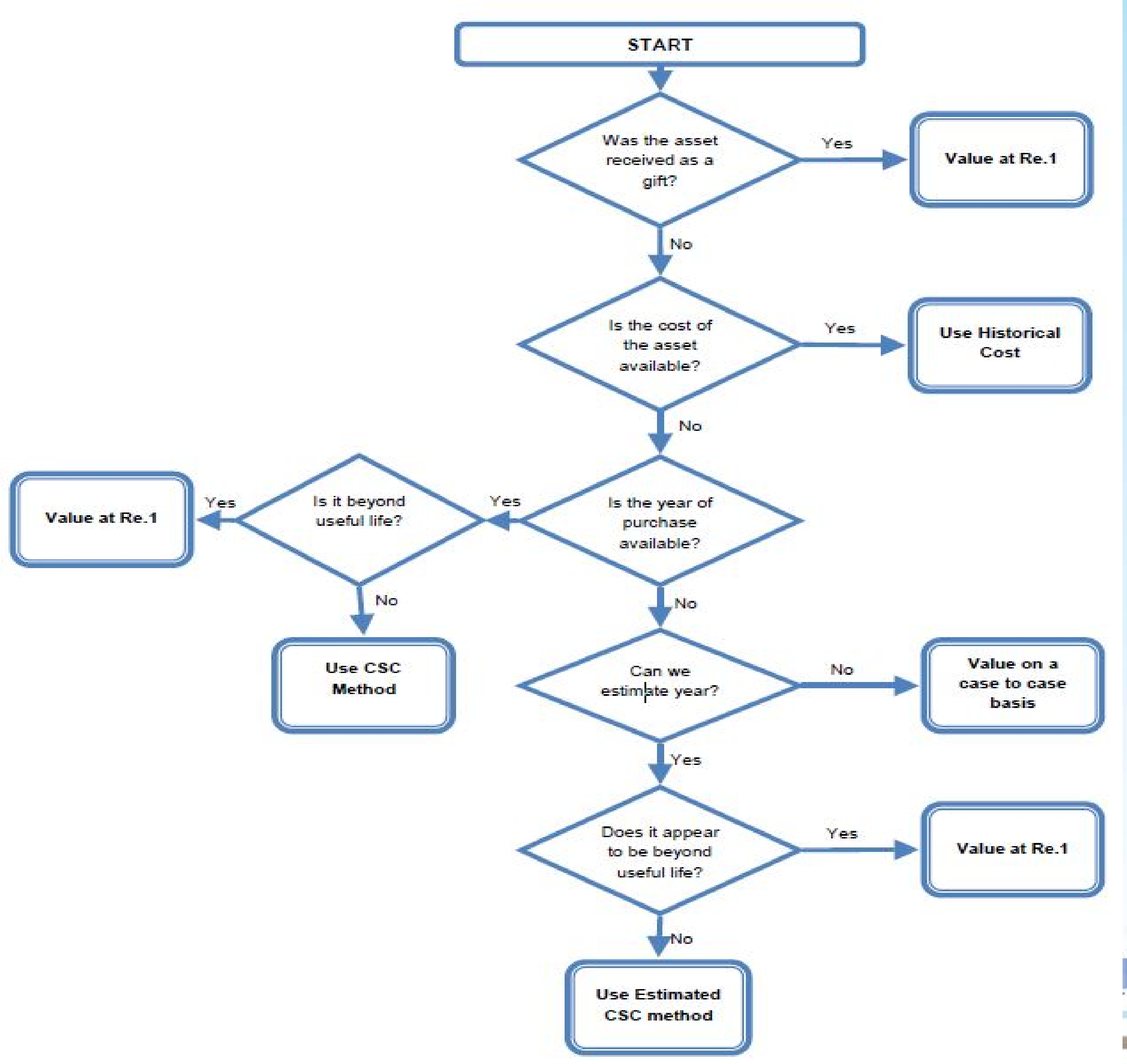
Valuation Principles

- Basis for valuation
  - All new assets are measured initially at their cost of acquisition.
  - Where an asset is acquired at no cost, the cost of acquisition is deemed to be the asset's fair value
- Important to understand
  - What constitutes cost of an asset

Cost components of an Asset

- Cost of an asset includes:
  - **purchase price**
  - **import duties** and non-refundable purchase taxes
  - **LESS:** trade discounts and rebates.
  - any **costs directly attributable** to bringing the asset to the **location and condition** necessary for it to be capable of operating in the manner **intended** by management.
  - The initial estimate of the costs of **dismantling and removing the item and restoring** the site on which it is located.

Flow chart for asset valuation of FA



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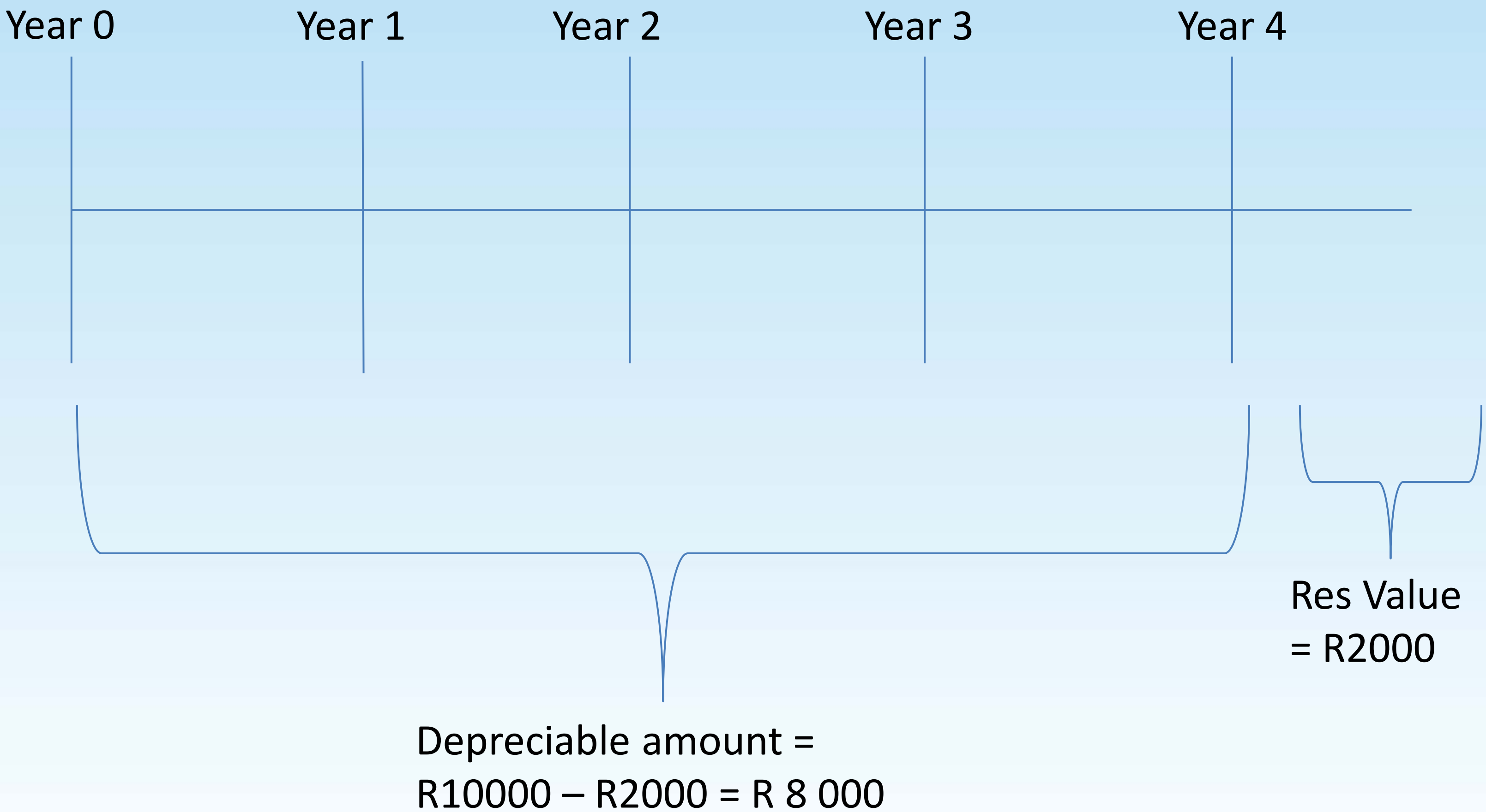
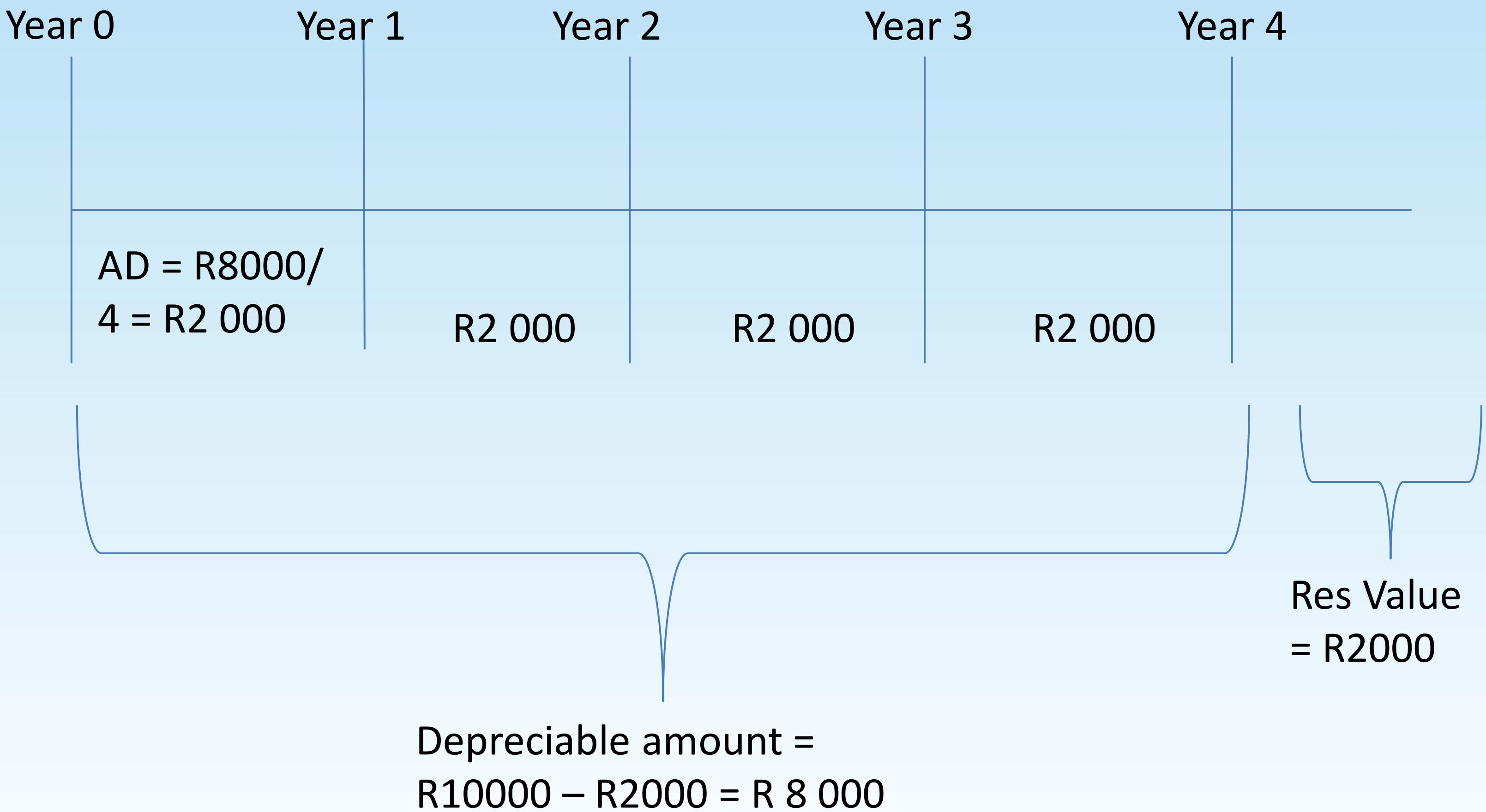
Valuation Method(s)

- Cost model:
  - Cost less accumulated depreciation and impairment
- Revaluation model: Fair value less accumulated depreciation and impairment
- Apply policy to all assets within same class
- **Time to think…**
  - An entity purchases an asset for R10,000 - Historical costs
  - It estimates that the asset will last for 4 years &
  - A residual at the end of the 4 years of R2,000.
  - How do we account for it?

Accounting of the asset



Accounting of the asset



Cost Model

- Data to determine the gross replacement cost will be obtained from a range of sources. These may include:
  - recent actual construction contracts and prices;
  - similar or reference projects in other locations;
  - industry construction guides; and
  - theoretical first principals designs
- The calculation of the GRC will differ depending upon:
  - the nature of the asset;
  - components;
  - construction techniques;
  - whether you would reproduce the asset or replace it with a modern equivalent;
  - whether there are any sunk costs that need to be taken into consideration; and
  - allowance for any decommissioning or reinstatement cost

Cost Model - Valuation

- The bulk of assets controlled by public sector entities would typically be valued using the cost approach.
  - This approach is commonly referred to as the depreciated current replacement cost (DCRC) basis
- Critical part of GRC calculation
  - Based on unit rate for different asset components
  - Combination of various costs
  - Apportionment across various asset components
- Determination of GRC will require extensive professional judgement & may include
  - engagement of an external expert (such as a valuer).
  - It is important that sufficient and appropriate audit evidence to support the gross current replacement cost is properly documented
- Once the GRC determined
  - Need to determine useful life of an asset
  - Need to depreciate the asset based on its pattern of consumption

Assessing Asset Age

- Based on records of asset installation & commissioning
- Where records on asset installation not available
  - Estimate based on staff knowledge – consistent with development history of the area
  - Condition based assessment
- UL defined
  - The period over which an asset is expected to be available for use by an entity
- Factors in determining the UL of an asset
  - Expected usage of the asset
  - Expected physical wear & tear – operational factors
  - Technical & commercial obsolescence
  - Legal aspects

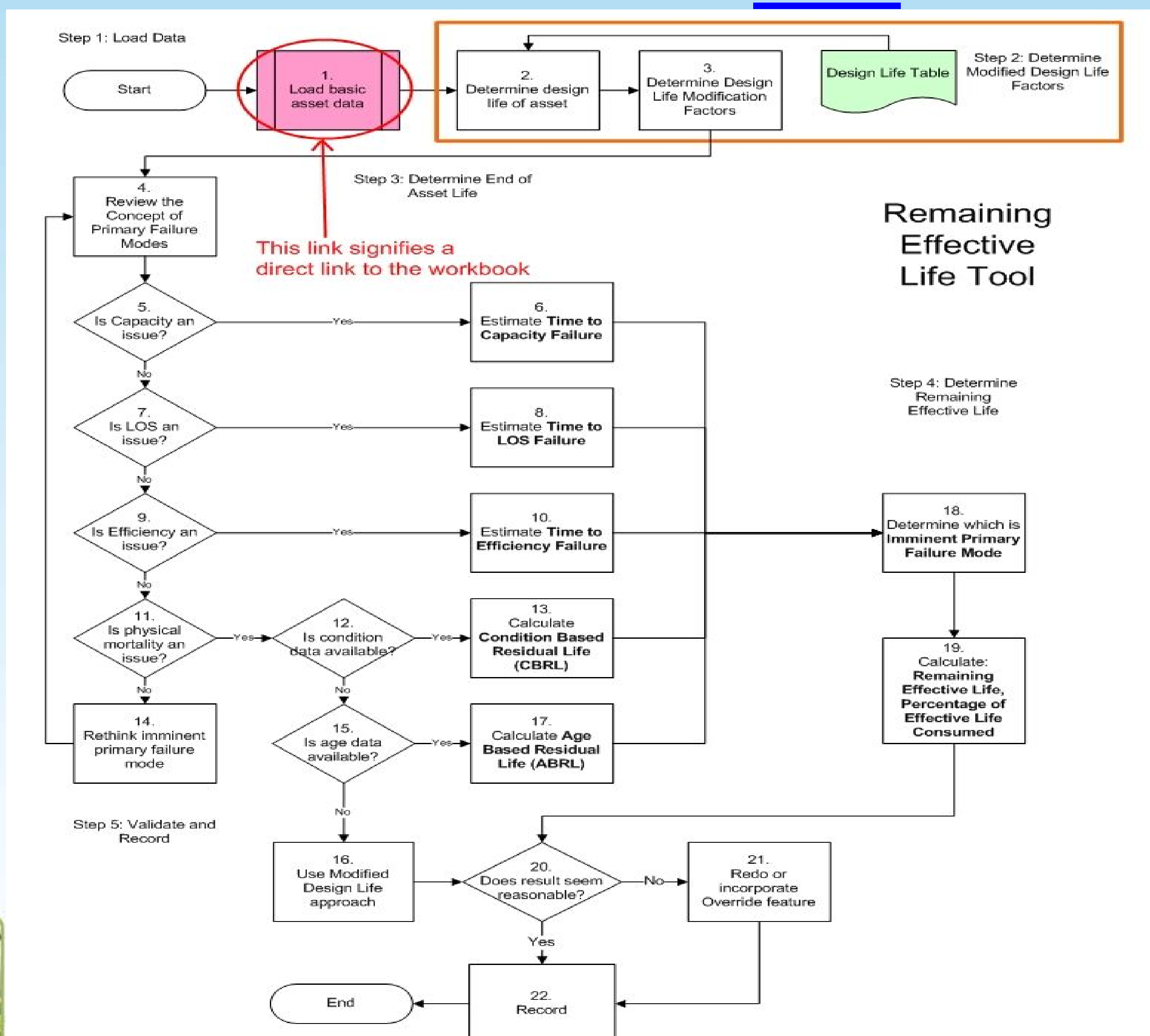





Determination of the Useful Life

- Following parameters are required to determine the DRC
  - Useful Life (UL)
  - Asset Age
  - Remaining Useful Life (RUL)
- UL defined
  - The period over which an asset is expected to be available for use by an entity
- Factors in determining the UL of an asset
  - Expected usage of the asset
  - Expected physical wear & tear – operational factors
  - Technical & commercial obsolescence
  - Legal aspects or similar limits

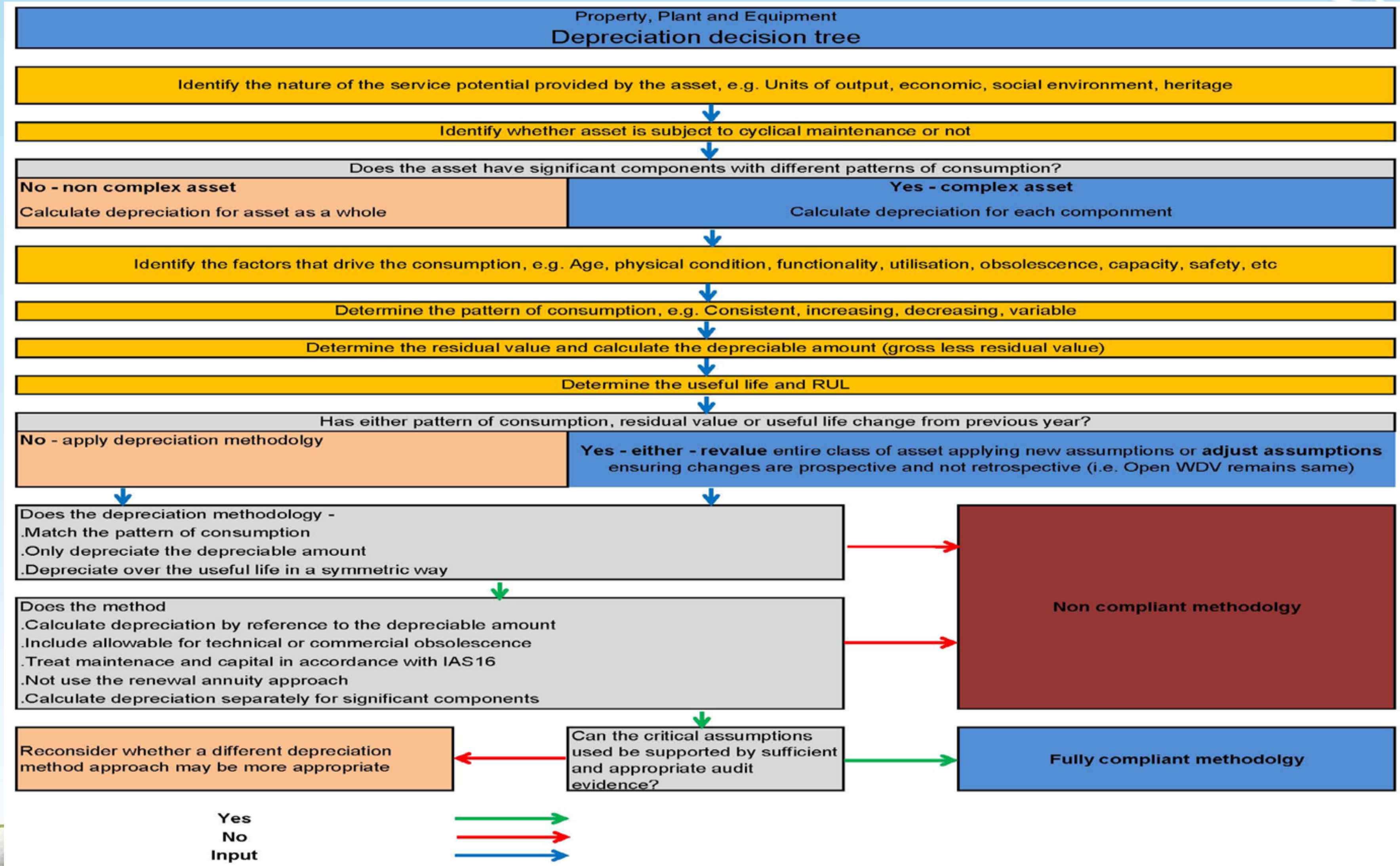
Determine RUL



Depreciation of assets

- Allowable methods must comply with the following
  - Method must “match pattern of consumption”
  - Where the asset has a number of different components with varying patterns of consumption, each component is to be depreciated separately
  - Depreciation is to be calculated on a systematic basis over its useful life
  - A “Residual Value” needs to be determined and must not be depreciated
  - As a minimum, the pattern of consumption, Useful Life and Residual Value need to be reassessed at year end and the depreciation method adjusted if there are any significant changes

Flow chart for depreciation decision



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Common depreciation methods

Straight-Line	Condition Based Depreciation	Consumption Based Depreciation
Factors Used: Age only Typically uses Actual Age plus RUL to calculate a Total Useful Life. WDV is then determined by RUL/Total Life – Residual. If applied correctly this method is good for assets with a short and predictable Useful Life. However, in practice it is often incorrectly applied resulting in material misstatement (**see example**). Care needs to be taken to ensure the critical assumptions reflect the asset lifecycle.	Factors Used: Physical Condition Typically a degradation profile is created based on a model that correlates the physical condition to an estimated total life cycle. Most commonly used with road pavements.	Factors Used: Holistic and Component Specific Factors Considers factors such as functionality, capacity, utilization, obsolescence, etc. at the whole of asset level. Then takes into account the physical condition and repair and maintenance history of the asset to determine the level of remaining service potential. A Matrix is created to link the level of service to the valuation and depreciation.

Selecting the best depreciation method

- When selecting the best method to adopt, consideration should be given to –
  - The nature and size of the portfolio
  - The risk of material misstatement
  - Whether the asset tends to be renewed through cyclical maintenance
  - How often the asset is replaced
  - How the asset's service potential is consumed
  - Whether the information is reliable and relevant enabling it to be used to assist in other decisions across the local government
- Determining depreciated current replacement cost depends on
  - whether replacement with a modern equivalent asset or
  - reproduction is the more likely way of replacing the asset's service potential – intrinsic value in the asset - heritage value

Summary of Asset Register Values in MS Excel

	Asset_Category	Asset_Class	Asset_Group	Asset	Component_Group	Component	sum(crc)	sum(drc_30_June_2012)
204	Infrastructure	Water	Purification Works	Clarifier Tanks	Civil Works	Tank	R 3 637 831.90	R 726 803.60
205						Walkway	R 140 790.41	R 36 325.68
206					Pipe Works	Piping	R 247 955.86	R 147 768.88
207						Valve	R 65 682.96	R 34 723.51
208				Clear Water Pump Station	Civil Works	Dry Well	R 33 225.54	R 12 625.71
209						Overhead Beam	R 56 914.09	R 39 839.86
210						Walkway	R 24 778.35	R 15 120.05
211					Electrical Works	Motor	R 736 145.25	R 449 239.29
212						Switch Gear	R 1 304 602.86	R 793 061.22
213					Mechanical Works	Airblower	R 154 433.79	R 61 773.52
214						Pump	R 1 361 790.76	R 816 586.65
215					Pipe Works	Meter	R 149 313.53	R 29 862.72
216						Piping	R 156 515.56	R 130 634.49
217						Valve	R 304 171.02	R 138 531.22
218				Clear Water Storage	Civil Works	Tank	R 1 871 641.91	R 951 140.73
219						Tank Column	R 187 036.79	R 144 953.51
220					Pipe Works	Meter	R 4 466.37	R 446.64
221						Piping	R 28 907.85	R 24 543.66
222						Valve	R 7 600.62	R 5 320.44
223				Desludge Dam	Civil Works	Tank	R 974 855.47	R 935 861.25
224					Pipe Works	Piping	R 2 346.82	R 2 268.59
225						Valve	R 8 344.02	R 7 787.76
226				Filtration	Civil Works	Filter Unit	R 831 314.53	R 352 149.55
227						Filter Media	R 118 425.58	R 54 210.02
228					Electrical Works	Motor	R 20 414.55	R 17 692.61
229						Switch Gear	R 137 326.62	R 34 331.66
230					Mechanical Works	Airblower	R 43 873.24	R 39 485.92
231					Pipe Works	Meter	R 38 715.66	R 3 871.56
232						Piping	R 185 785.50	R 93 241.86
233						Valve	R 366 077.09	R 139 472.97
234				Floculation	Civil Works	Baffle Block	R 179 708.13	R 22 463.52
235						Foundation	R 1 901.23	R 304.20
236						Sluice Gate	R 380 784.94	R 60 925.59
237						Tank	R 52 030.05	R 10 234.30
238						Tank Column	R 26 671.48	R 3 333.94
239						Tank Platform	R 13 696.20	R 1 712.03
240					Electrical Works	Motor	R 107 725.82	R 21 545.16
241					Mechanical Works	Stirrer	R 13 651.20	R 5 187.45
242					Pipe Works	Piping	R 1 190.42	R 190.47
243						Valve	R 4 003.49	R 667.26

Expenditure subsequent to recognition

Type	Operational	Maintenance	Renewal	Upgrade	Disposal
Notes	Day-to-day running costs.	May extend life of asset but by definition must either extend life by less than 12 months or be immaterial	May include part- disposal as part of the renewal	Improvement on original design	Total end of life disposal
Treatment	Expense	Expense	Capitalise	Capitalise	Expense or Reduce Existing Liability
Budget Type	Recurrent	Recurrent	Capital	Capital	Capital
Funding	Non-discretionary	Non-discretionary	Non-discretionary	Discretionary	Discretionary (except if linked to renewal)
Examples	Salaries & wages Supplies Electricity Grass mowing Street cleaning Chemicals Water testing	Miscellaneous repairs Window replacement Patch leaking roof Grind footpath trip hazard Unblock pipes Replace broken sections of pipes Chemical treatment of pipes for tree root intrusion	New fit-out and painting of building Reseal road surface Gravel re-sheet Pump replacement Reline pipes Refurbishment Replace old with new Replacement of part of segment of road, footpath, kerb, etc	Road widening Change road alignment Upgrade footpath from gravel to concrete Replace pumps with greater capacity Replace timber bridge with concrete bridge Extension to building	Demolition Costs Removal of Debris Repatriation of site

Example

- This example demonstrates the care that needs to be taken when applying the formulas. The assumptions are –
  - Asset originally commissioned 40 years ago.
  - Based on current condition the RUL is assessed as another 40 years.
  - The Gross Cost of the asset is R50,000
  - Every 15 years the asset is renewed at a cost of R15,000 which restores the asset back to "as new" with a Design Life of 50 years.
- Determine the DRC using all three methods
- Which method is suitable for the asset

Determining the depreciation method

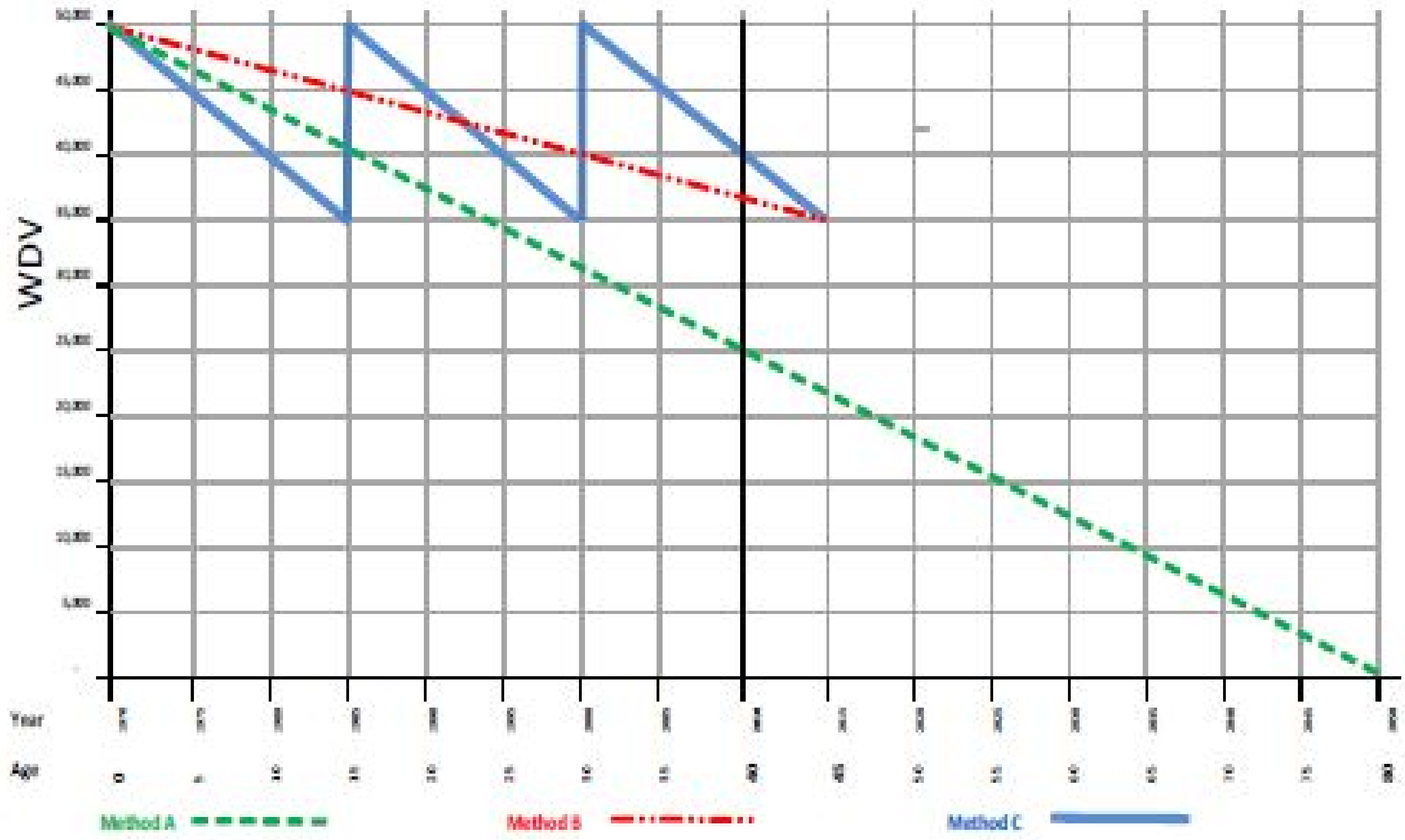
- Methods A and B assume the “Age” is 40 years
  - the asset was originally commissioned 40 years ago.
- Method C recognises that the asset was “renewed” back to “as new” 10 years ago and
  - therefore its real age is only 10 years.
- Methods B & C recognise that based on the typically asset management practices
  - the asset will be renewed “back to as new” in 5 years’ time & therefore the RUL is 5 years.
- Method A assumes a RUL of 40 years being the estimate of time to total “end of life”
- Methods B & C have assessed the Residual Value as R35,000 being the estimated value of the asset at the time of next renewal whereas Method A has assumed a Nil Residual Value at “end of life

Impact on the WDV

	Method A (Straight Line)	Method B (condition based)	Method C (Consumption based)
Gross	R50,000	R50,000	R50,000
Age	40 years (since date of commissioning)	40 years ((since date of commissioning)	10 years (date since last renewal)
RUL	40 years based on current condition	5 years Based on estimated RUL till next renewal	5 years Based on estimated RUL till next renewal
Useful Life (Age + RUL = UL)	80 years	45 years	15 years
Residual Value	Nil Assets like these never sold	R35,000 Gross less renewal to bring back to "as new"	R35,000 Gross less renewal to bring back to "as new"
Depreciation (Gross – RV) / UL	R625 (R50k - R0) / 80	R333 (R50k - R35k) / 45	R1,000 (R50k - R35k) / 5

	Method A	Method B	Method C
WDV	R25,000	36,667	40,000
%Error	(37.5%)	(8.3%)	-
Depreciation	R625	R333	R1,000
%Error	(37.5%)	(66.7%)	-

Depreciation impact



Discussion

WHAT ARE THE CONDITION & PERFORMANCE OF THE ASSETS

Why Condition Assessment

"Free State municipality
fails to provide clean water"
Infrastructure News, 7 August 2012
"A Free State municipality's inability to provide clean running water to residents had been found to be a **human rights violation**"

"6 months to repair
Pretoria sinkhole"
News24, 12 July 2012
A leak in a water pipe crossing the N14 Ben Schoeman freeway, in Centurion, caused a sinkhole between the north and south-bound carriageways

"NMB Water Crisis: DA requests emergency meeting in Bhisho to discuss 'crumbling infrastructure' " Metro News, 4&6 August 2012 "…the water crisis would have a knock-on effect on continued economic development in Nelson Mandela Bay, **seriously affecting growth and job creation due to a lack of confidence in the city's infrastructure**"

"The burst Churchill water pipeline, which provides the city with a third of its water and which burst on Thursday, causing widespread water shortages across the municipality, **was preceded by a massive leak**…"

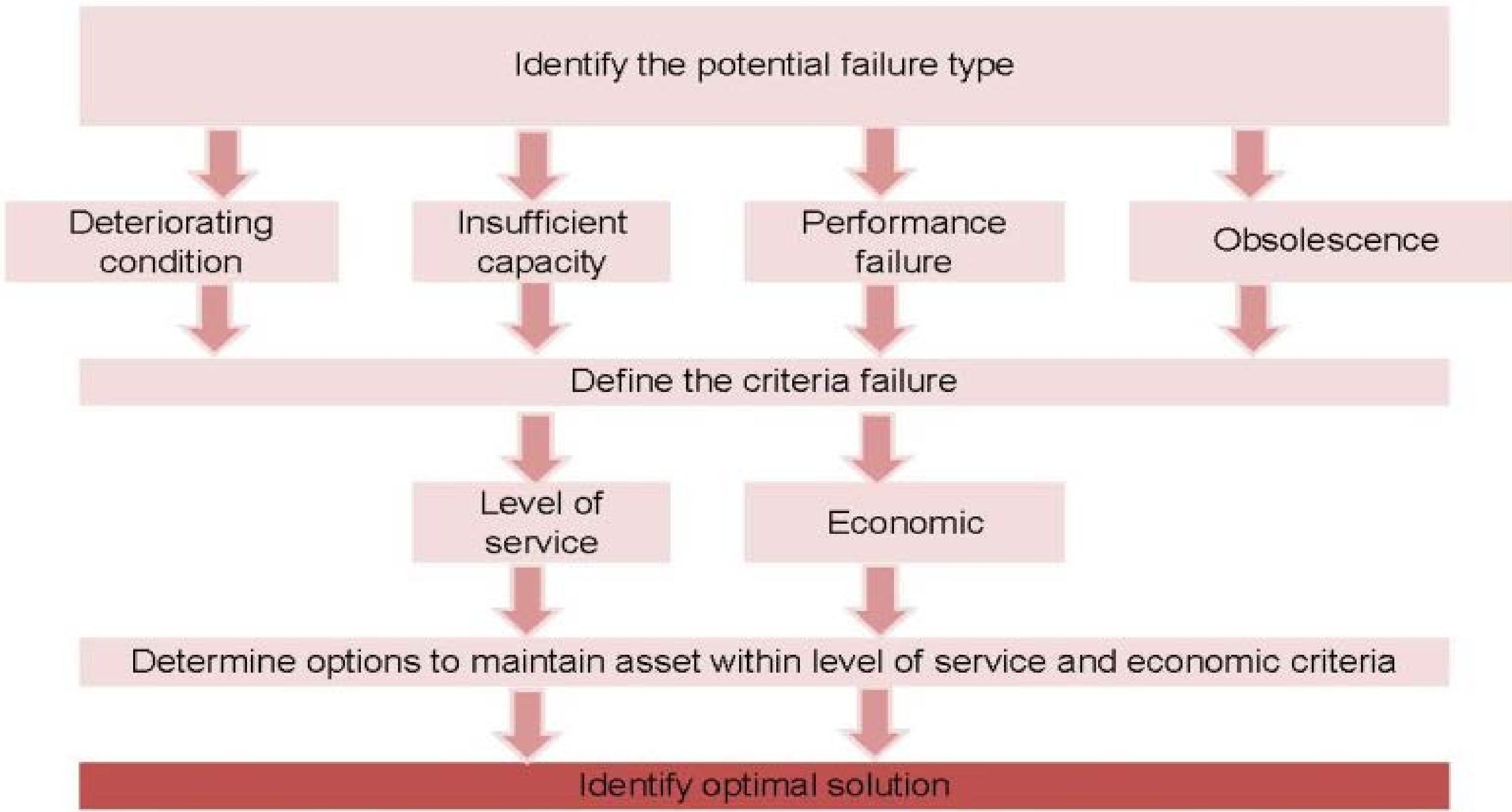
Why condition assessment

- Key business driver for water authorities
  - the need to provide sustained service delivery at an acceptable cost, and
  - in accordance with regulatory requirements.
- Service delivery provided
  - through a combination of the utility's business and asset capabilities
- A key business capability of a utility is its ability to effectively manage and maintain its asset stock
- Asset management philosophies have developed over time. The more advanced approaches focus on risk and service, rather than condition and performance.
  - Condition assessment, however, remains a key component of risk-based asset management
  - The condition and performance of an asset are simply factors in the assessment of risk

Condition Assessment & Failure Modes

- Overall Objective of condition assessment
  - Trigger asset maintenance (condition-based or predictive maintenance);
  - Identify assets such as pipelines or treatment works requiring rehabilitation and replacement in the short and medium term; and,
  - Provide raw data for developing and/or calibrating asset deterioration/failure models for input into the maintenance plan
- Purpose of Condition Assessment & Performance
  - establish the current condition of assets as a means of prioritizing and forecasting maintenance and rehabilitation efforts.
  - to understand the level of asset deterioration and the impact it has on the probability of asset failure, one part of risk

Framework for Condition Assessment



Condition Assessment & Failure Modes

- Condition & performance assessments provide information on issues such as:
  - The value of existing assets.
  - Asset remaining life.
  - The reasons for shortfalls in service provision.
  - The potential for future problems; that is, the risk of failure (probability versus consequence) associated with different assets
- Before condition assessment –
  - Important to determine the critical assets – prioritise assessment

Criticality assessment

- Critical assets are defined as those which have a high consequence of failure (not necessarily a high probability of failure).
- In determining critical assets – need to determine the level of risk of the different assets
- The overall risk depends on both the probability and consequence of the event.
- To estimate the level of risk, organisations should determine:
  - the consequences of failure for events
  - the probability of failure of the asset, and
  - the probability of the event occurring

Probability of asset failure

- Contributing factors to likelihood of failure
  - Asset Age – over time asset deteriorates, from use or from physical conditions
  - Asset condition – critical to determine a reasonable condition of the assets – condition rating
  - Failure history – important to monitor when assets fail & record types of failure (rapture, mechanical, leak,)
- Provide rating of the likelihood of failure

Criteria for consequences of failure

- Economic Impact
  - extent of cost of repairs
  - Loss of income
  - Damage to property
  - Third party losses
- Social factors
  - Loss of service
  - Loss of life or injury
  - Health impacts

Criteria for consequences of failure

- Environmental Factors –
  - Environmental damage
  - Failure to meet statutory requirements
- Rating system is developed for the identified criteria
  - Provide weighting of the different criteria in order to weight the criteria which have significant impact on the failure of the asset

Rating system for critical asset

	Importance criteria	Severity	Score (S) 1 to10	Weighting (W) 1 to 5	Score (S x W)
1a	Number of customers serviced by pipeline	<10	2		
		>10 <50	5		
		>50 <200	8		
		>200	10		
1b	Type of customers serviced by pipeline	Mainly industrial area	3		
		Mainly residential area	5		
		Mainly commercial area	8		
		High safety risk, e.g. hospitals	10		
2	Public health and safety	No effect	0		
		Minor - single illness or injury	4		
		Major - multiple illnesses or injury	10		
3	Environmental impact	No effect (flows contained)	0		
		Minor impact	4		
		Major impact	10		
4	Cost of repair	<R100 000	2		
		>R100 000 <R200 000	4		
		>R200 000 <R350 000	6		
		>R350 000<R500 000	8		
		>R500 000	10		
5	Time to repair	<1 day	2		
		1-3 days	4		
		>3 days	10		
6	Disruption to traffic	No access or road disruption	0		
		Minor access disruption	2		
		Important access disruption	4		
		Minor road disruption	5		
		Major road disruption	10		
TOTAL					

Example of criticality

- The following scenario provides an example of how to use the asset ranking table below:
  - Asset: 250 mm diameter Cast Iron pipe (constructed in 1950), is 64 years old
  - Service History: Numerous breaks in the past 5 years
  - Service Area: Only residential customers (serves 3 major subdivisions), but there are loop lines available
- Likelihood of failure: 4
  - pipe has broken many times, but when repaired it was still in reasonable condition
- Consequence of failure: 2
  - There are loop lines so not all customers will be out of water simultaneously. Repair costs are moderate. Line is not in a critical roadway so repair is relatively easy.

Example of criticality analysis

Multiplier		Consequence (Cost) of Failure				
		1	**2**	**3**	**4**	**5**
Probability of Failure	**1**	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Example of criticality analysis

Multiplier		Consequence (Cost) of Failure				
		1	**2**	**3**	**4**	**5**
Probability of Failure	**1**	1	2	3	4	5
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	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

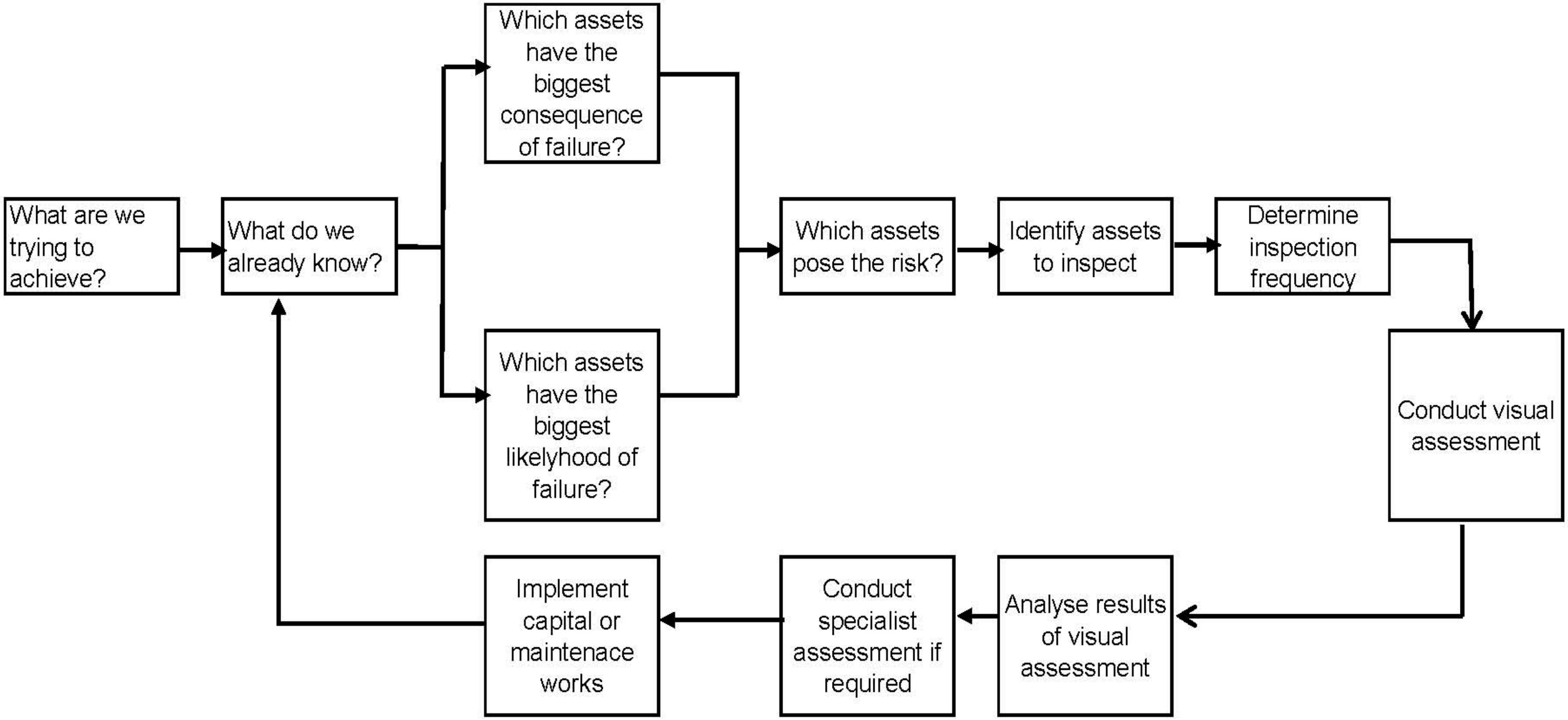
Example of criticality analysis

Multiplier		Consequence (Cost) of Failure				
		1	**2**	**3**	**4**	**5**
Probability of Failure	**1**	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Methods for evaluating condition & performance

Asset	Typical asset condition/performance evaluation method
Dam	Visual inspection Instrumentation monitoring
Weir	Visual inspection
Structures/buildings	Visual inspection Non-destructive testing
Pumps/meters	Number of breakdowns Condition monitoring (e.g. vibration analysis) Efficiency (e.g. kW.h/ML, amperage)
Electrical switchgear/control panels	Number of breakdowns Visual inspection Condition monitoring (e.g. thermography) Proving operation
Water mains	Number of breakdowns Opportunistic inspection (in-ground) Visual inspection (above-ground) and internally for larger diameter mains Efficiency friction factor 'C' value or kW.h/ML Leakage level Intelligent pigging Water quality complaints Flow/pressure complaints
Services	Number of service breaks
Meters	Calibration Number of breakdowns Number of consumer billing complaints
Irrigation channels	Visual inspection
Sewer mains	Number of structural failures Number of blockages Number of overflows Number of odour complaints Visual inspection (CCTV) Void detection (wave impedance)
Manholes	Visual inspections Vacuum testing

Visual Inspection process



Fundamental Principle of Condition Assessment

- Condition assessment is important only to the extent it provides insight into…
  - *Nature* of possible failure
    - Root cause
    - Pattern (shape of the deterioration curve)
  - *Timing* of possible failure
    - residual functional life

Condition Assessment

Pipe sediment build-up progressively constricts flow and reduces service

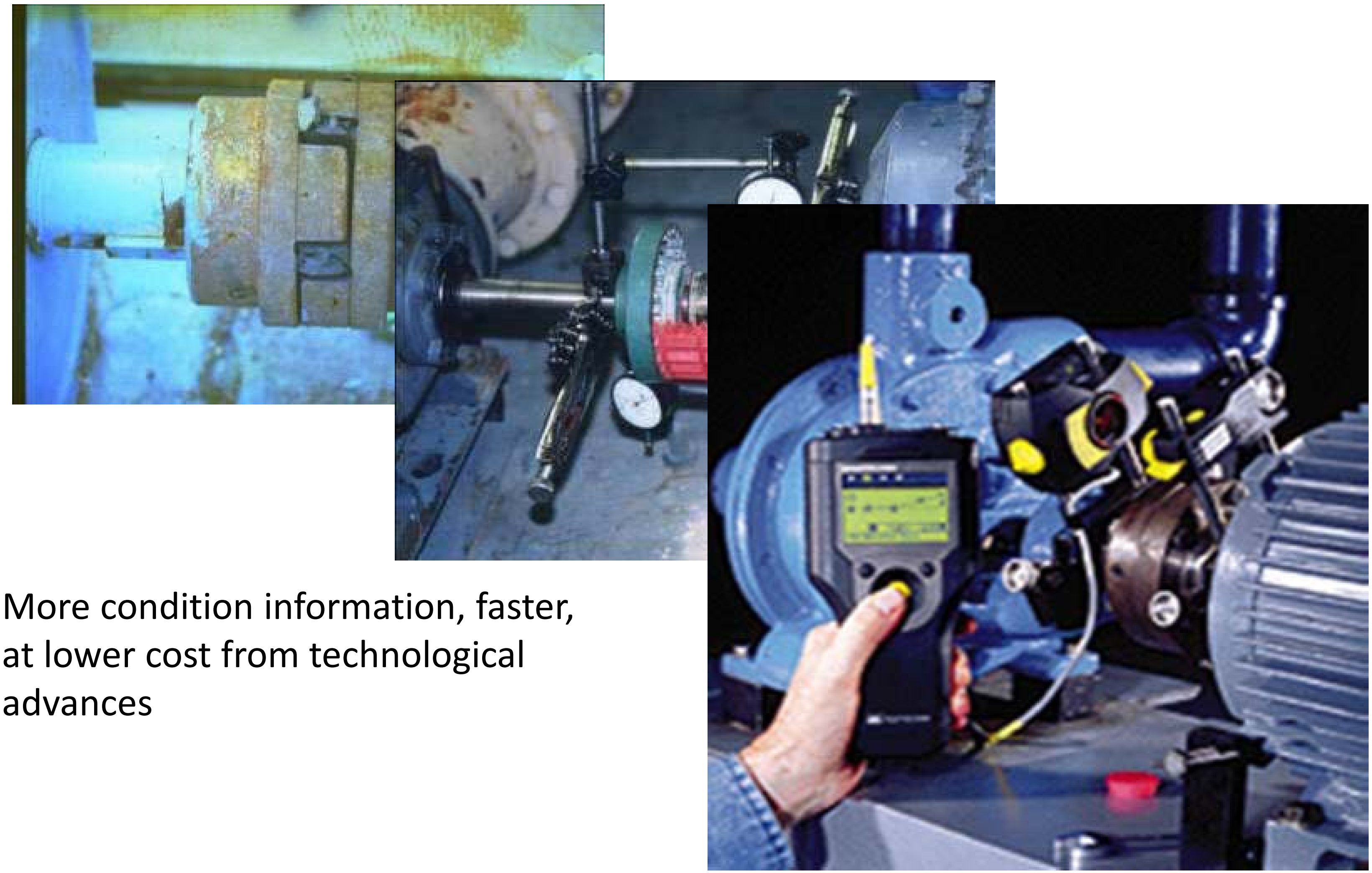
Cleaning and relining restores service and extends useful life, perhaps 50 years

Condition guides timing of *maintenance and renewal investment*

Condition Rating

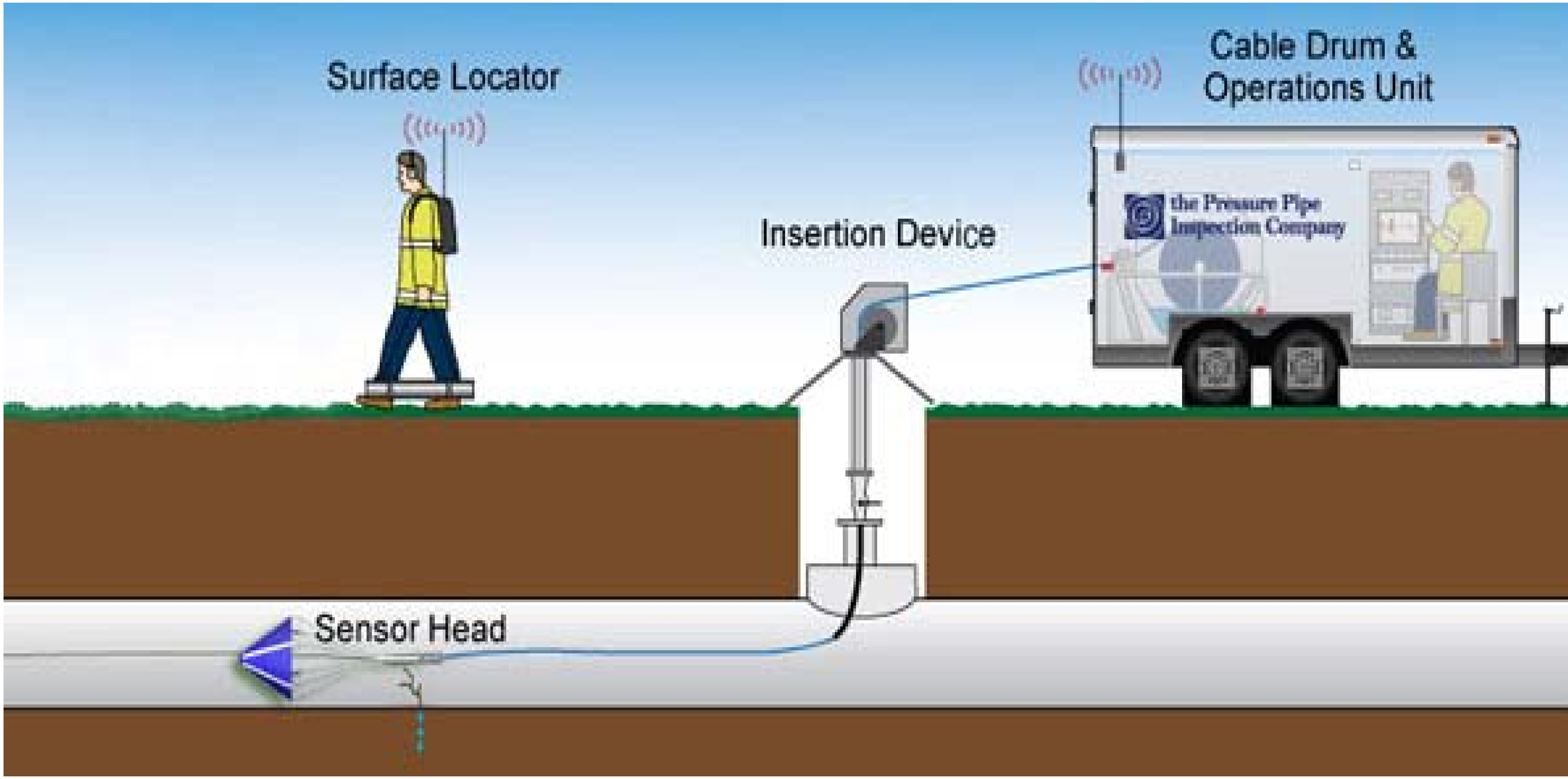
Condition rating	Asset condition	Description	Alternative description (e.g. for a pipeline)
1	Perfect/excellent	Only normal maintenance required.	Expected residual life >50 years
2	Minor defects only	Minor maintenance required (5%)	Expected residual life 20–-50 years
3	Backlog maintenance required	Significant maintenance required.	Expected residual life 6– -20 years
4	Requires major renewal	Significant renewal/ upgrade required.	Expected residual life 2– -5 years
5	Imminent failure /Asset Failed	Over 50% of the asset requires replacement/ Total replacement	Expected residual life <1 year

Improvements in technology



More condition information, faster, at lower cost from technological advances

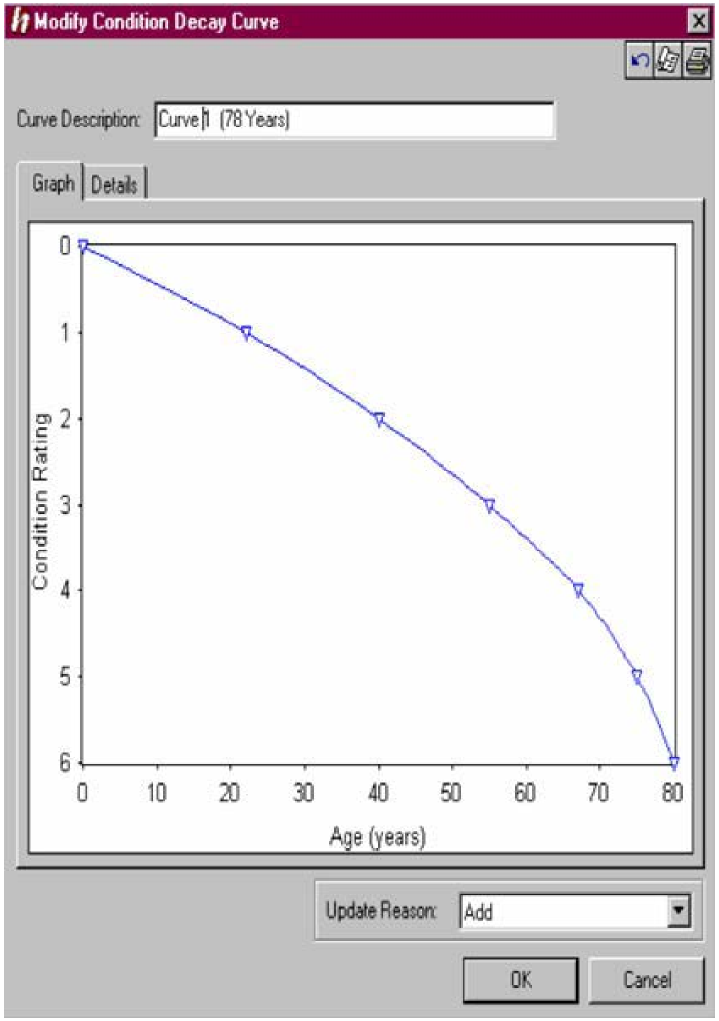
Leak detection system



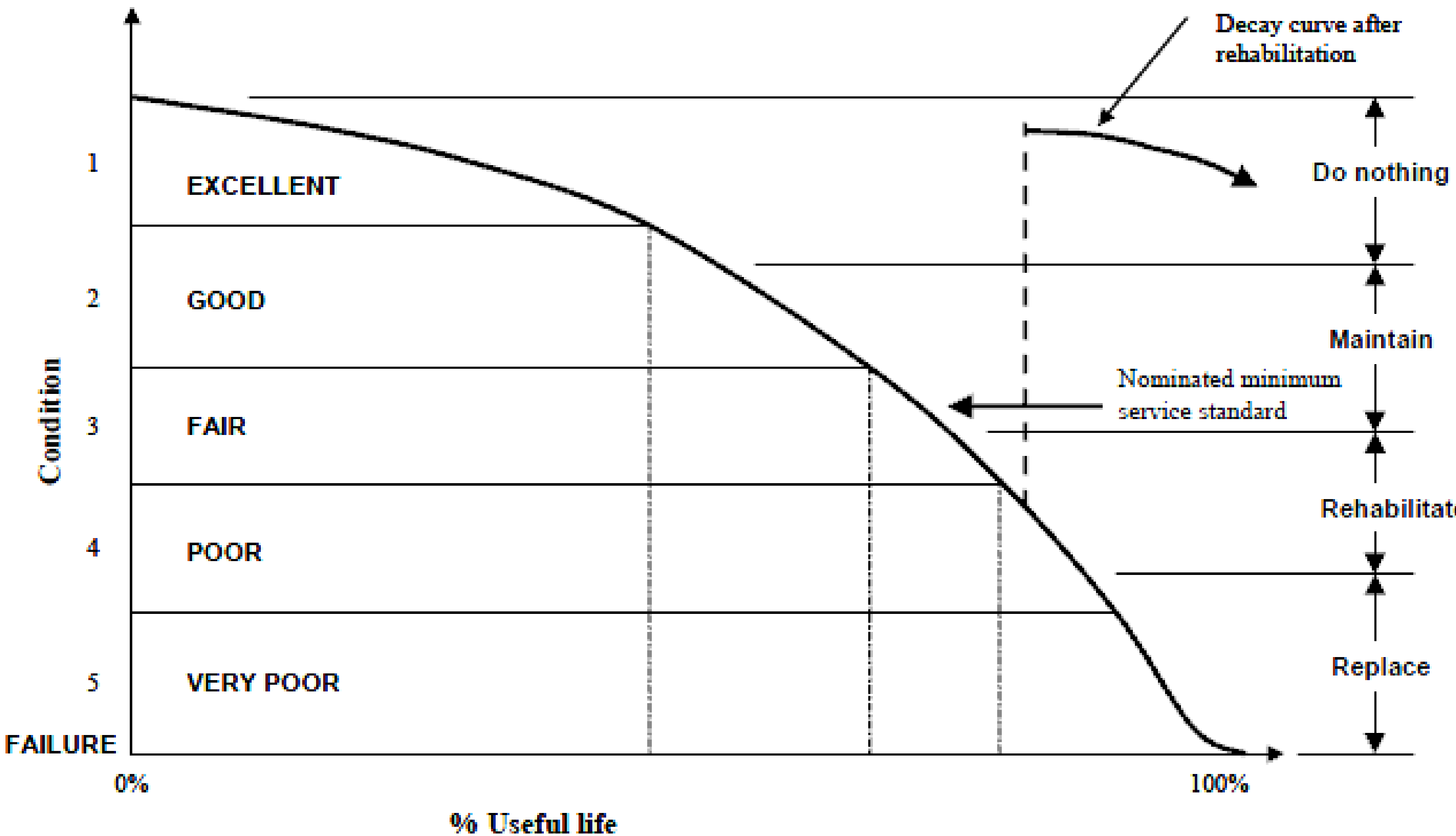
Condition Assessment & Decay Curve

Condition assessment assists in recognizing…

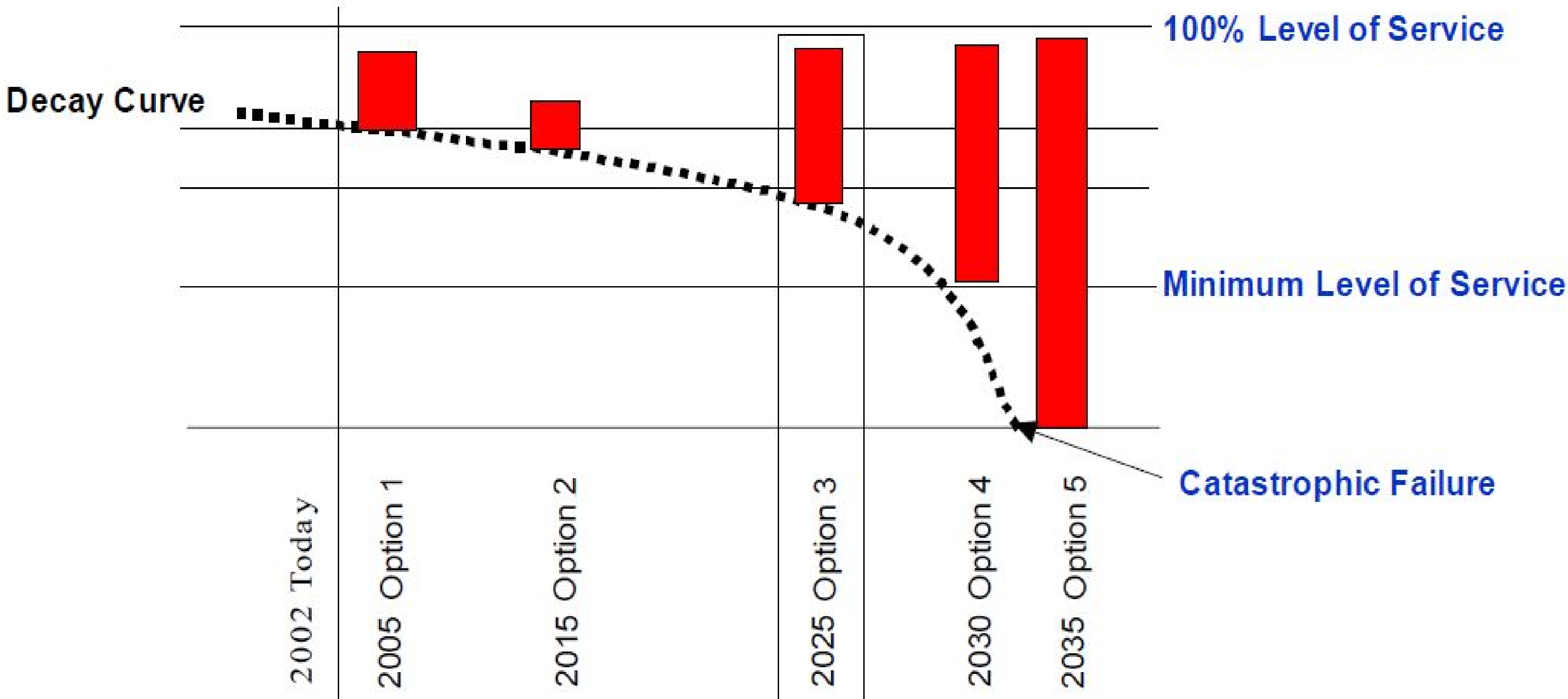
- Nature and shape of the failure or decay (or deterioration) curve
- Whereon the curve is asset's current condition
- Asset's remaining useful life, an estimate



Condition & Asset Management Plan



Best Investment Level



Treatment options	M	M	RH	RP	RP
Direct Cost	270	72	360	610	630
Indirect Cost	0	10	20	40	130
Benefit	200	75	480	780	320
Benefit/Cost Ratio	0.7	0.9	1.3	1.2	0.42
Option Ranking	4	3	1	2	5

Asset Management Plan

- Repair-refurbish-replace decision
  - 1.Fix when broken (run to failure)
  - 2.End of prescriptive life
    - 12 years old replace
    - 3,000 run-time hours
  - 3.Rule of thumb
    - 3 breaks per km or in 24 hours
    - Poor condition (and worst first)
    - FCI > 6% (Facility condition index—O&M as a percentage of replacement cost)
  - 4.Optimized renewal decision making (ORDM)

Optimised decision making

- Systematic search for lowest-cost renewal investment
- Based on interaction of
  - Cost trends (direct O&M, indirect)
  - Condition trends (decay/survivor curve)
  - Risk-consequence trends
- Three major approaches
  - Valued expert judgment
  - Lowest projected average life-cycle cost per year of residual life;
    - Operational costs
    - Risk-weighted, full economic costs
  - Intervention factors; condition, performance, reliability, Business Risk Exposure, etc.

Long term Funding Strategy

- Minimum life cycle cost strategies
- Fundamental asset management options available to the management team are
  - Do nothing (zero-based strategy)
  - Status quo
  - Operate differently
  - Maintain differently—
    - run to failure,
    - preventive-based,
    - predictive-based (condition, usage)
  - Repair
  - Refurbish/rehabilitate
  - Replace
  - Decommission
  - Non asset-based

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It's all investment

Long term Funding Strategy

- Which strategy for each asset?
- Combinations over life cycle of the assets

Asset Management

Application of AM on CRSAT

- Nongoma Water Reconciliation Strategy
  - Existing bulk infrastructure
- Proposed
  - Decommission the Vuna/Vokwana storage & Nongoma WTW
  - Develop new infrastructure from Black Mfolozi River
    - Cost of OCS – nearly R1 billion
- Is it the most optimal approach to water management for Nongoma

Discussion