

Today's session

1. Introduction & Scope
2. Opportunity
3. Strategy
4. Action
5. Questions and answers

1 Introduction

2m

36 cm

Land Acknowledgment

We acknowledge the diverse Indigenous Peoples, whose ancestors' footsteps have marked this territory for centuries; from First Nations, Métis, Inuit, and now settlers from around the world.

We do this to create awareness that we are all treaty members, and to show recognition and respect for Indigenous Peoples and the traditional territories on which we live and work.



About me



About me



Today's presentation

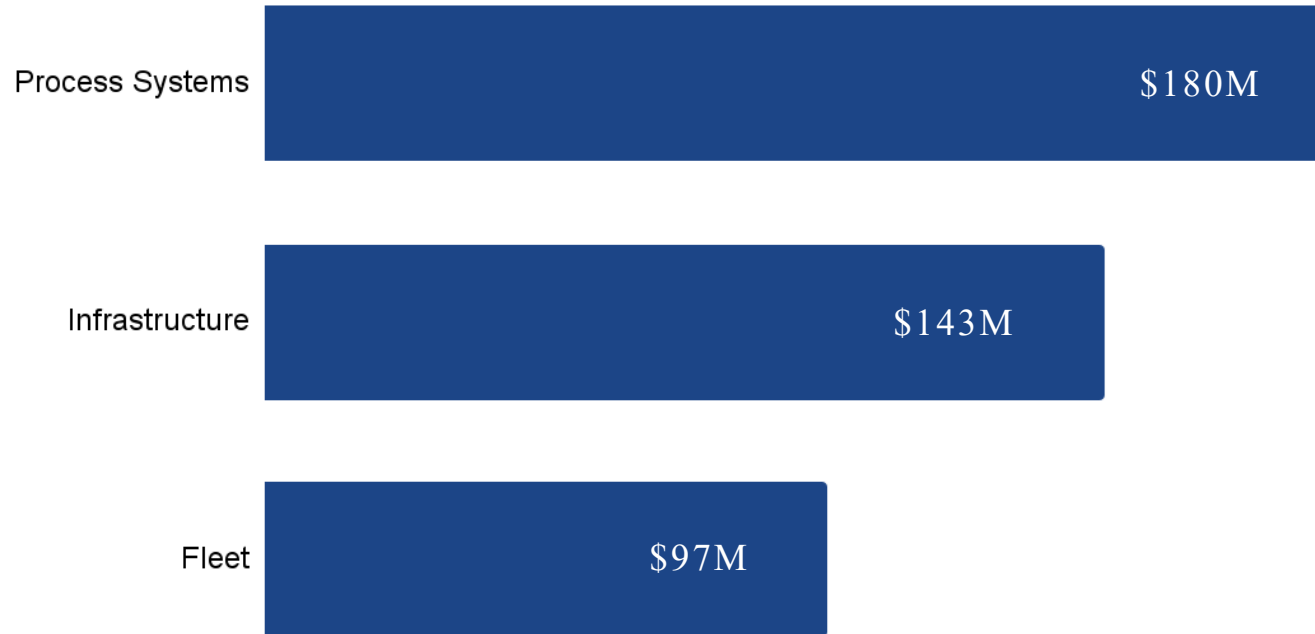


Organizational Context

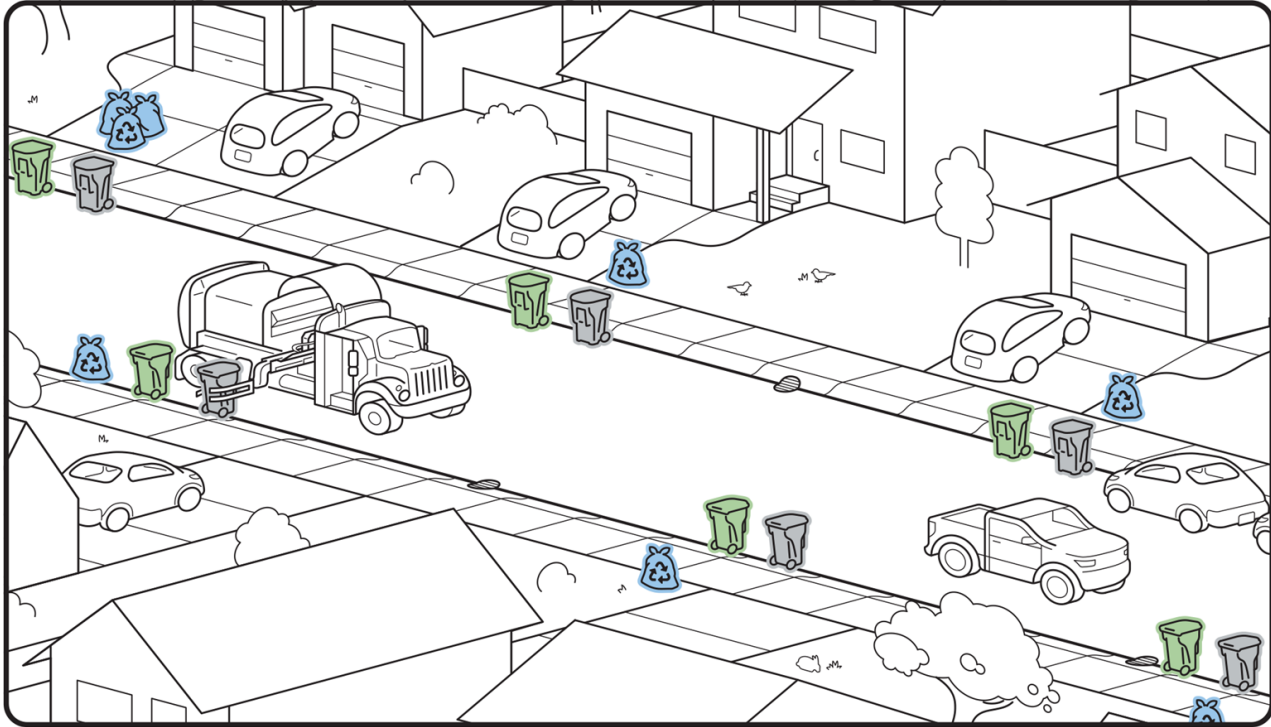
- 1.3M Metropolitan Citizens
- 12,000 Employees
- 400,000 Households
- 90% Waste Diversion goal
- Worlds greatest hockey team
(back in the 80's)



CoE Waste Asset Portfolio



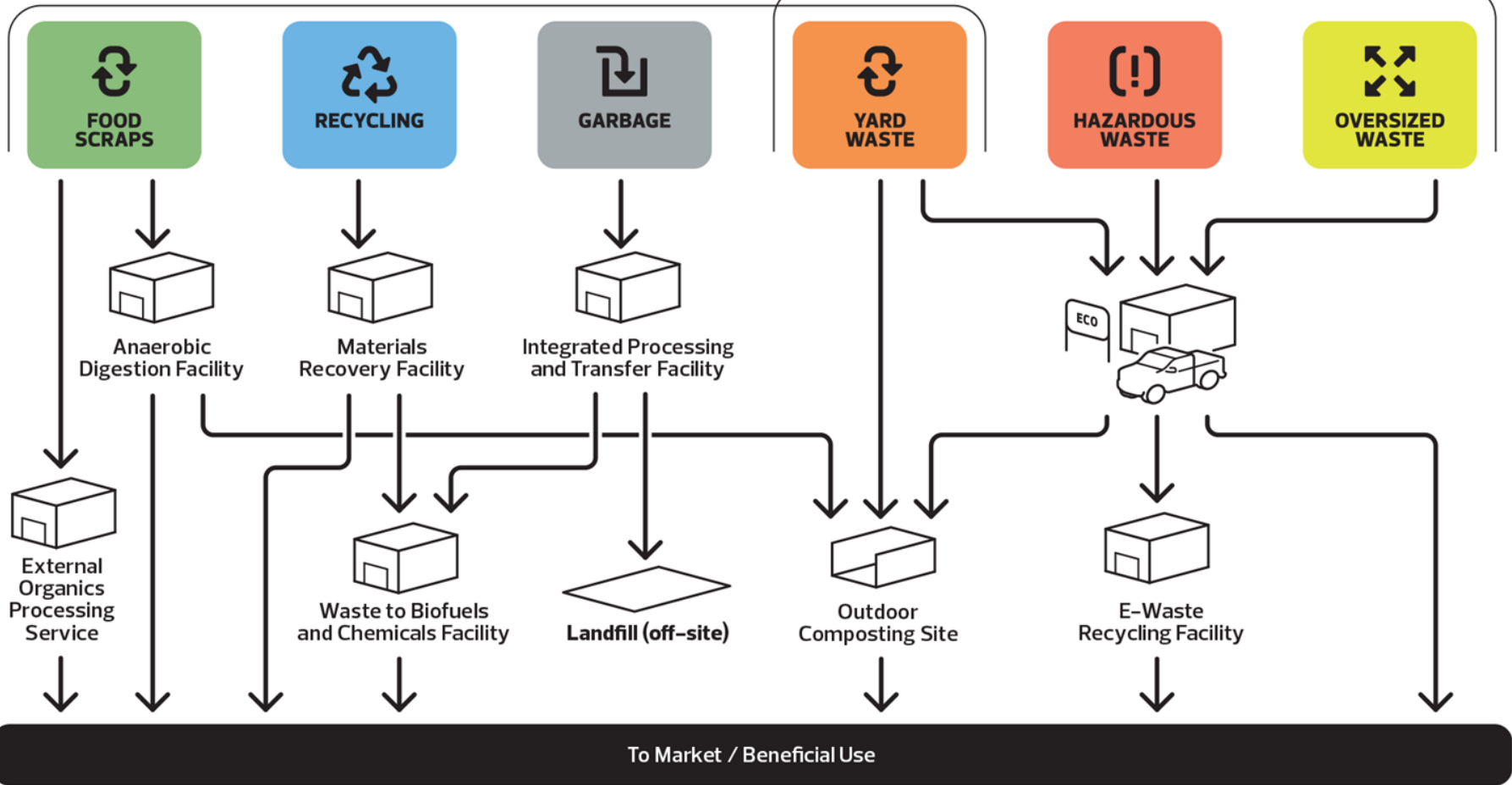
Value of global waste management market



\$1,300 Billion

Set out for collection

Drop off at the Eco Station



2 Opportunity

2m

36cm

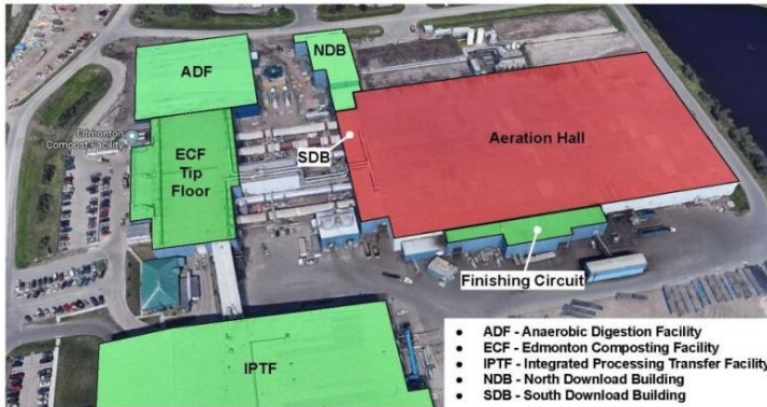
Garbage audit shows Edmonton falls short of standards

Audit finds not as much waste being diverted from the landfill

Demolition of Edmonton's compost facility to cost \$12M, city says

Administration recommending to proceed 'as quickly as possible', report says

CBC News - Posted: Sep 27, 2019 4:30 PM MDT | Last Updated: September 27, 2019



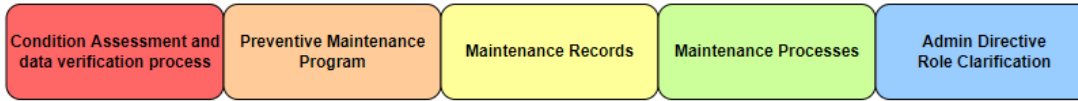
Buildings in red, part of the compost facility, are slated to be demolished. (City of Edmonton)

Local News

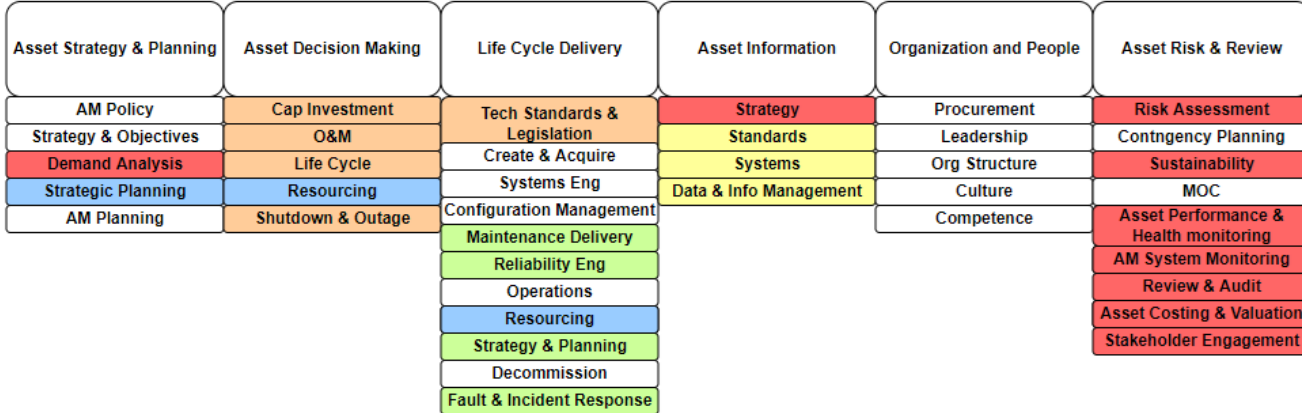
Freedom of information request shows flawed repairs, design issues behind failing compost facility

Opportunity

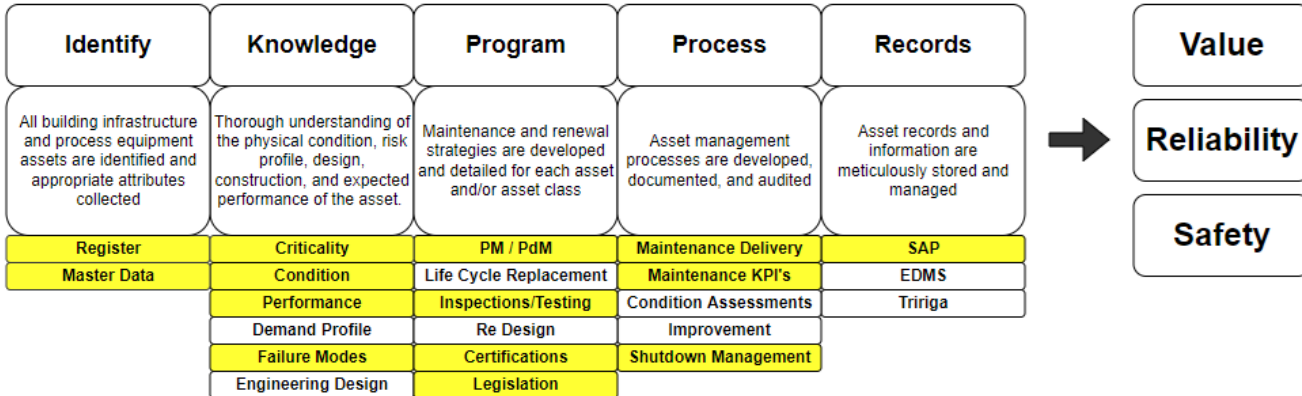
Auditor



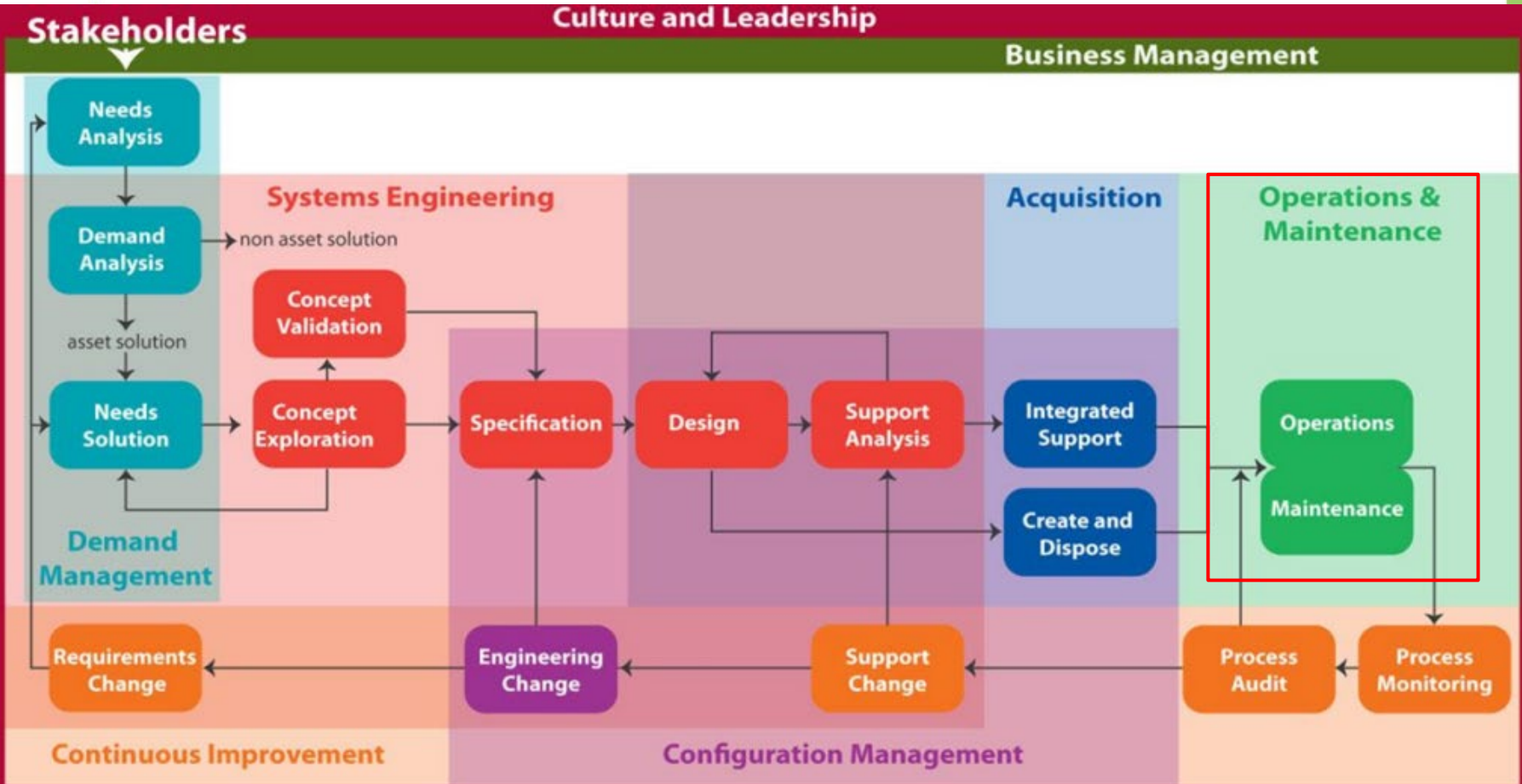
ISO 55000



Pillars



Capability Delivery Model (AM Council)











Opportunity

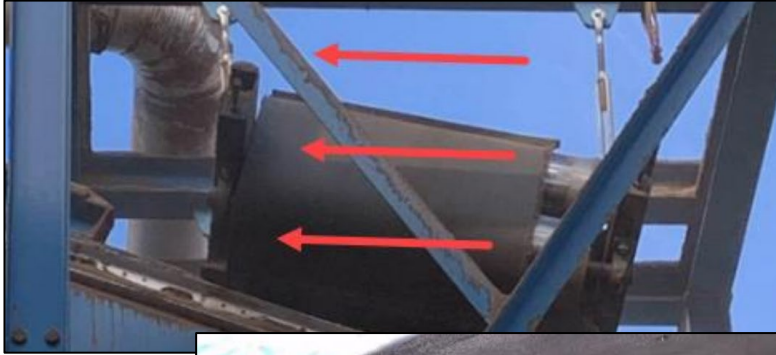
Implement a maintenance program on \$180M of Processing Assets
&
author a 10-year, \$150M Maintenance Service Agreement



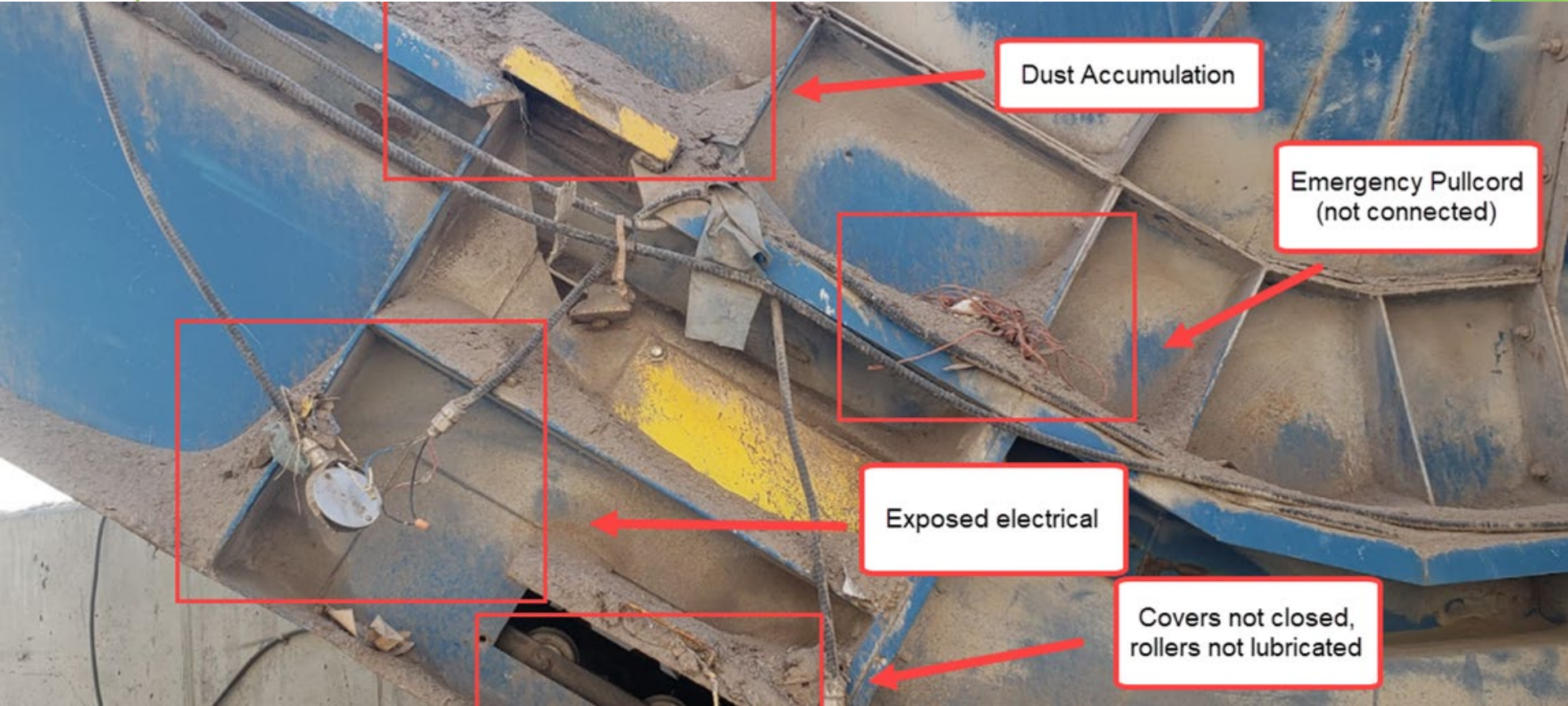
Opportunity

- × No continuous improvement programs 
- × No inventory or quality management systems 
- × Limitations on liability 
- × Substantial maintenance cost 
- × No documented maintenance program or planning 
- × No Maintenance work management system 
- × CoE not the custodian of its own maintenance information 
- × Lack of meaningful performance reporting or management 

Opportunity



Opportunity



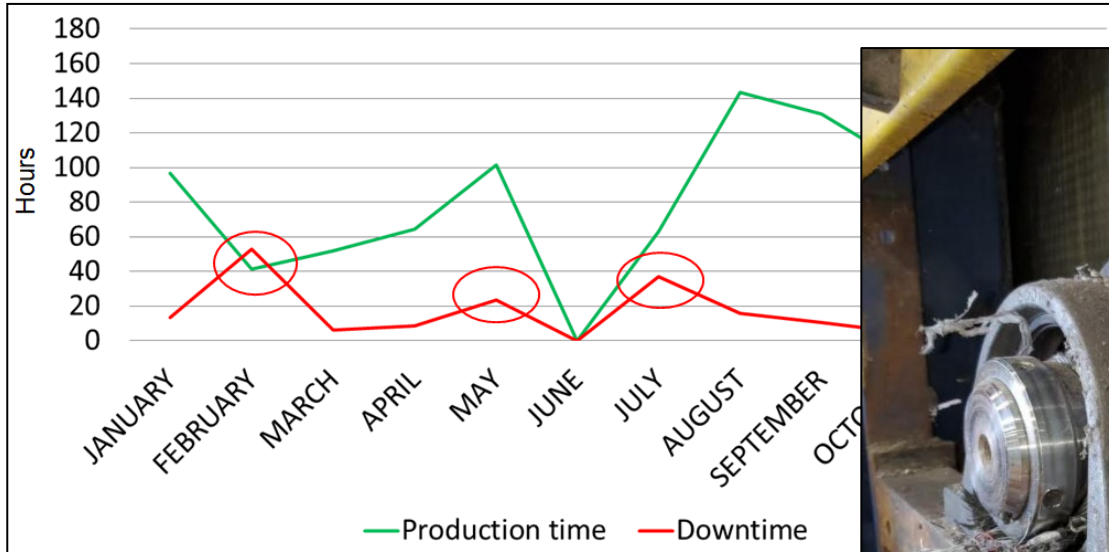
Dust Accumulation

Emergency Pullcord
(not connected)

Exposed electrical

Covers not closed,
rollers not lubricated

Opportunity



Opportunity



3 Strategy

2m

36cm

Strategy

“If you can't describe what you are doing as a process, you don't know what you're doing.”

W. Edwards Deming



Strategy

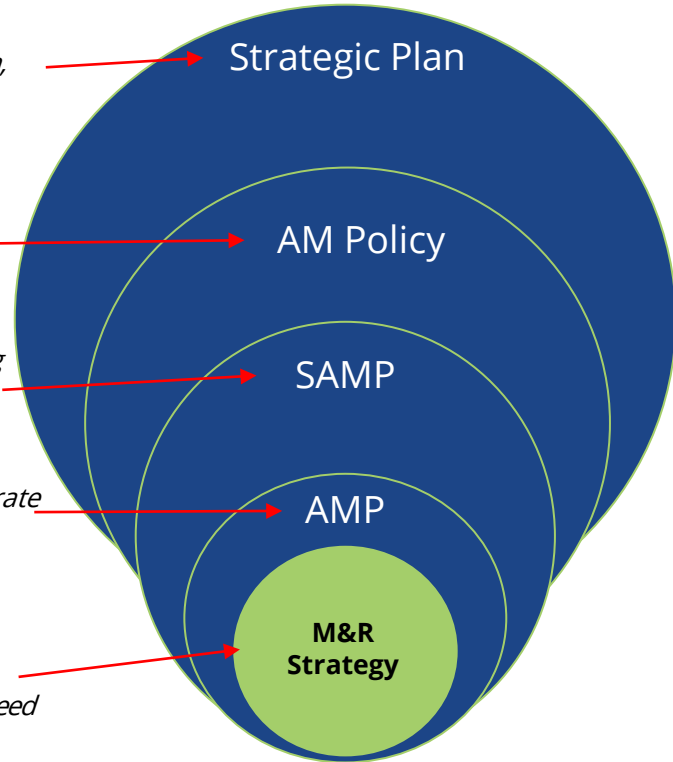
"By making transformational impacts and managing the corporation, Waste Services will implement a zero waste framework committed to diverting 90% of single-unit residential waste from landfills."

"To maximize benefits, The City of Edmonton will manage risk and provide satisfactory levels of service in a sustainable manner."

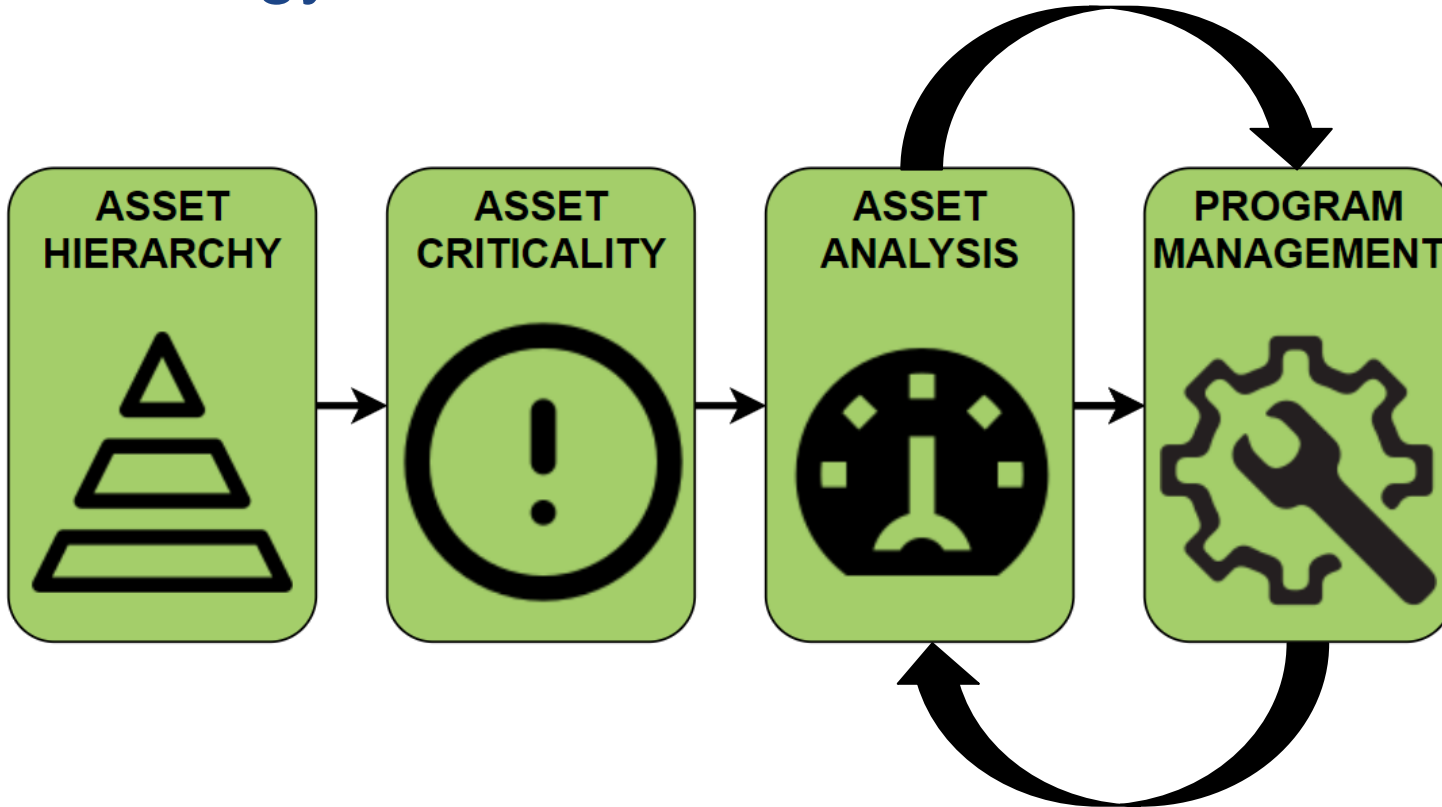
"The Vecobelt will offer value by operating safely and reliably, meeting required service level requirements in a sustainable manner, through asset management planning."

"The Vecobelt needs to operate safely and reliably with an availability rate of 80% at a cost of under \$240K."

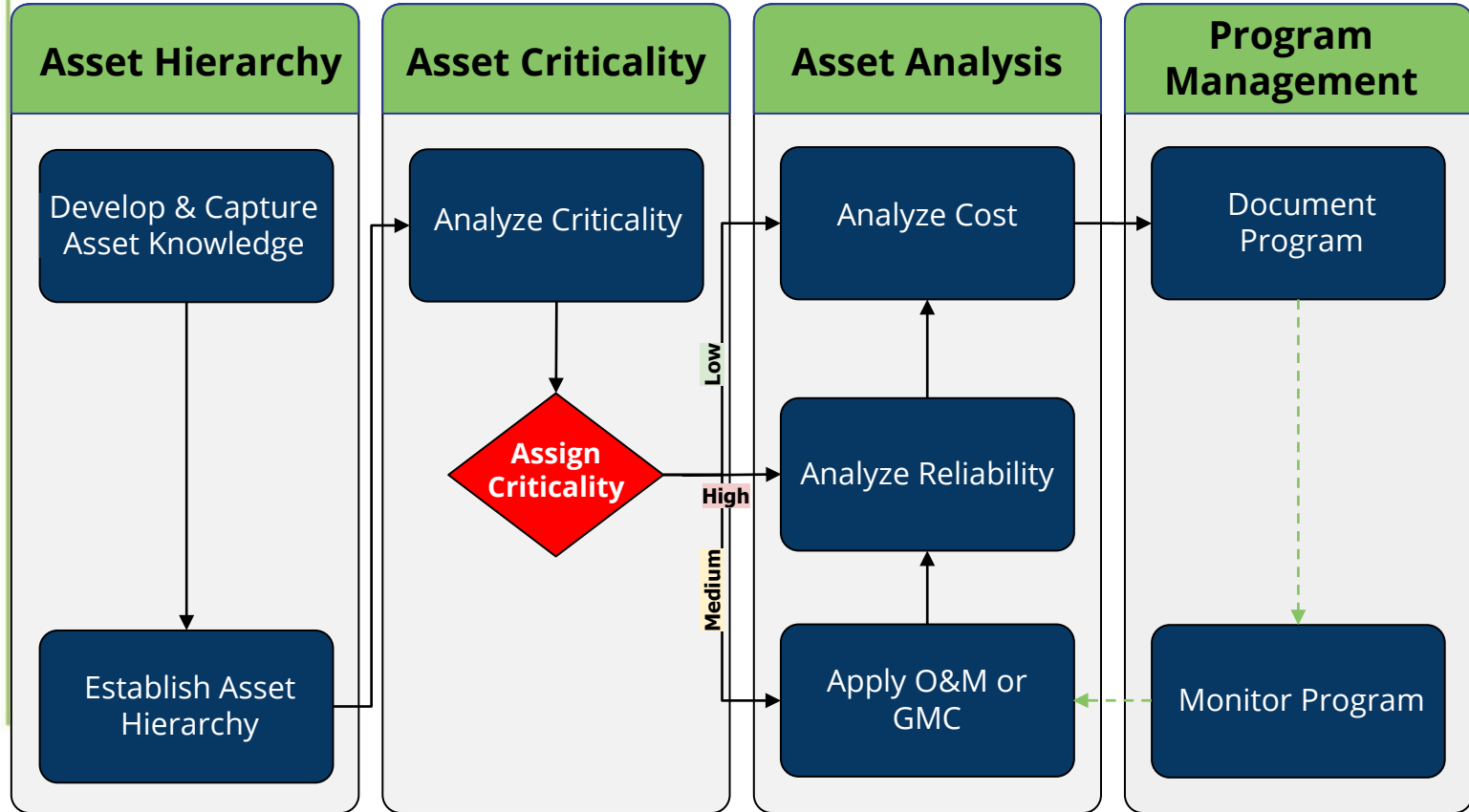
"The Vecobelt will support the City to divert 100,000 tons of waste a year, if it can safely and reliably operate at 30 tons per hour for 3400 hours out of 4368 planned hours. Maintenance charges must not exceed \$140K"



Strategy framework



Strategy process



Asset Knowledge

Technical asset information must include, but is not limited to;

- *Engineered Drawings*
- *P&IDs*
- *Electrical Single Lines*
- *Spec & Data Sheets*
- *PHA's*
- *O&M manuals*
- *Process Information*
- *Control Narrative & Logic*

Asset Knowledge

Vecobelt Conveying System

Asset ID: CO-2501

Plant: RDF

Location: SW Plant

Main Function(s): CONVEYING

Sub-function(s): PROCESS & EMERGENCY SHUTDOWN, CONTROLLING, MONITORING

Functional Statement:

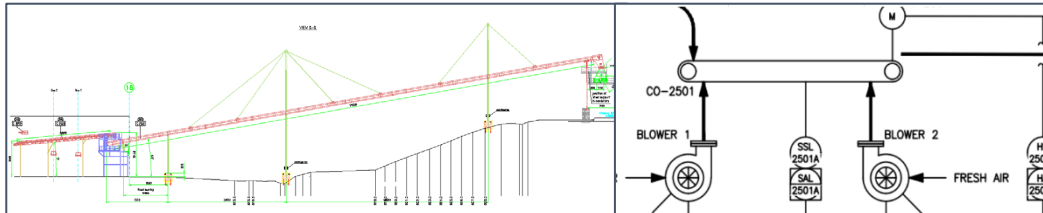
The Vecobelt conveying system must deliver 30 tons of feedstock per hour without any disruption and must be able to stop immediately in the event of an emergency.

Operating Context:

Major temperature swings, long operating hours, wood chips, msw, mixed residual waste, \$1500 per hour of downtime

Redundancy Feature(s):

No redundancy in the system



- System Description
- Asset ID
- Geographical info
- Main Function
- Sub-function
- Function statement
- Operating context
- Redundancy Features

Asset Knowledge

Swing

Asset ID: SWG190

Zone/Park: Rundle

Location: 2909 113 Ave NW

Main Function(s): SWINGING

Sub-function(s): PHYSICAL ACTIVITY

Functional Statement:

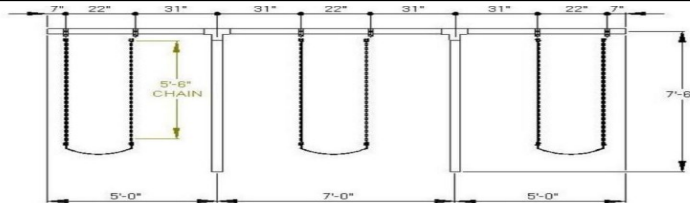
The swing must support and safely transport a seated user of up to 350lbs in a pendulum motion, powered primarily by the user's legs and gravity.

Operating Context:

The swing operates outdoors, exposed to various weather conditions like rain, sun, and snow. It is frequently used by children aged 3-12 years but can accommodate teenagers and adults as well.

Redundancy Feature(s):

Dual chains on either side of the swing seat to distribute weight and reduce the risk of breakage. (3 swings in system)

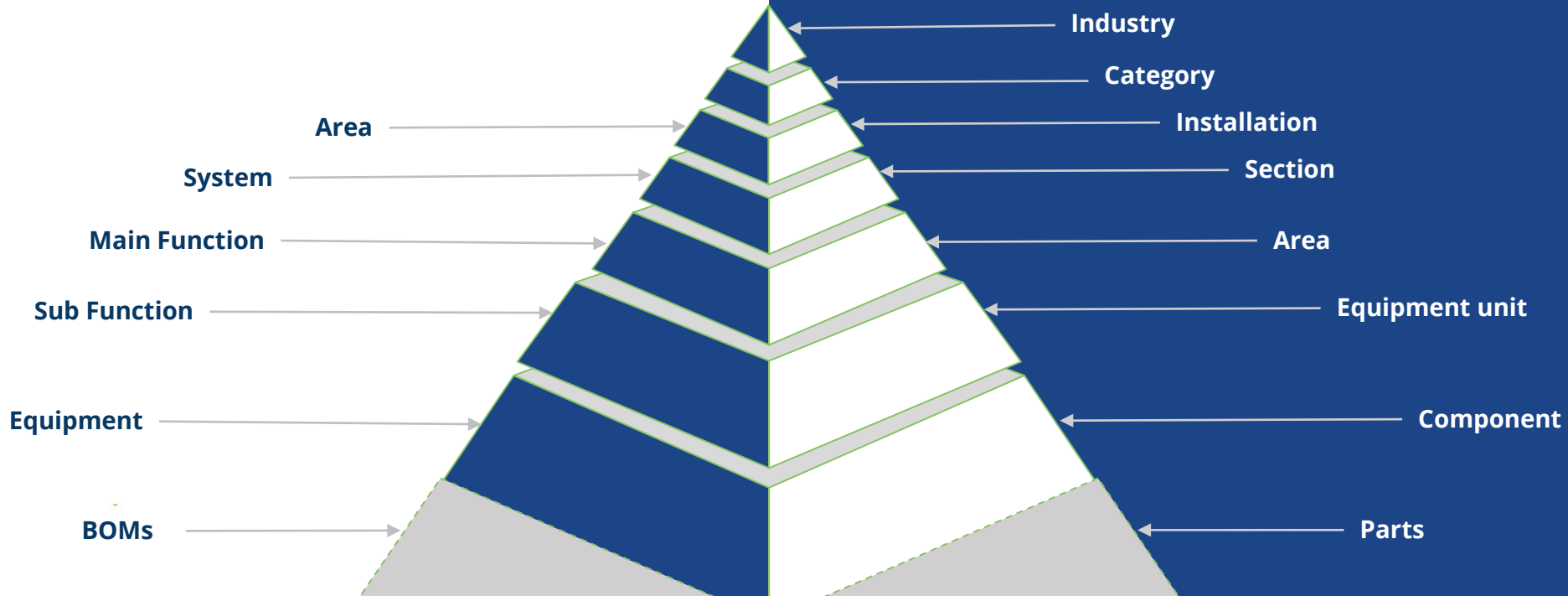


- System Description
- Asset ID
- Geographical info
- Main Function
- Sub-function
- Function statement
- Operating context
- Redundancy Features

Hierarchy Establishment

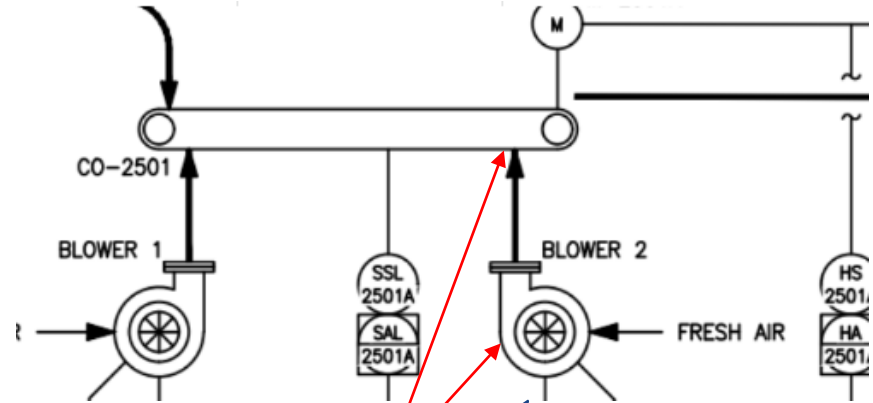
NORSOK Z-008

ISO 14224



Hierarchy Establishment

- Enhanced Work Management efficiency
- Easier Asset Identification
- Asset Information Optimization



Schedule maintenance on the blower system while the conveyor is down for planned maintenance.

Analyze criticality

						Consequence				
						Safety	Environment	Public Relations	Production	Cost
C4 = Severe						Fatality, serious injury, LTA Render Safety Critical Systems inoperable Fire/explosion potential Direct Impact to Emergency Response Systems	Release with major adverse environmental effect Non-recoverable damage to environment External emergency response or external resources required Significant regulatory response	National news, provincial and federal attention	Stop in production or significant reduction in output exceeding 12 hours	>\$100,000
C3 = Moderate						Injury requiring medical treatment without LTA	Release with moderate adverse environmental impacts. Impacts reversible. Regulatory limit exceeded. Low to Moderate regulatory response expected Reportable release	Local news and council attention	Brief stoppage in production or reduced rate of production lasting less than 12 hours	>\$10,000 <\$100,000
C2 = Minor						Near miss	Minor release Contained release Non reportable release	Notification to the City	Minor effect on production	<\$10,000
C1 = Insignificant						No safety risk	No environmental risk	No call / report	No impact	No Cost

Analyze criticality

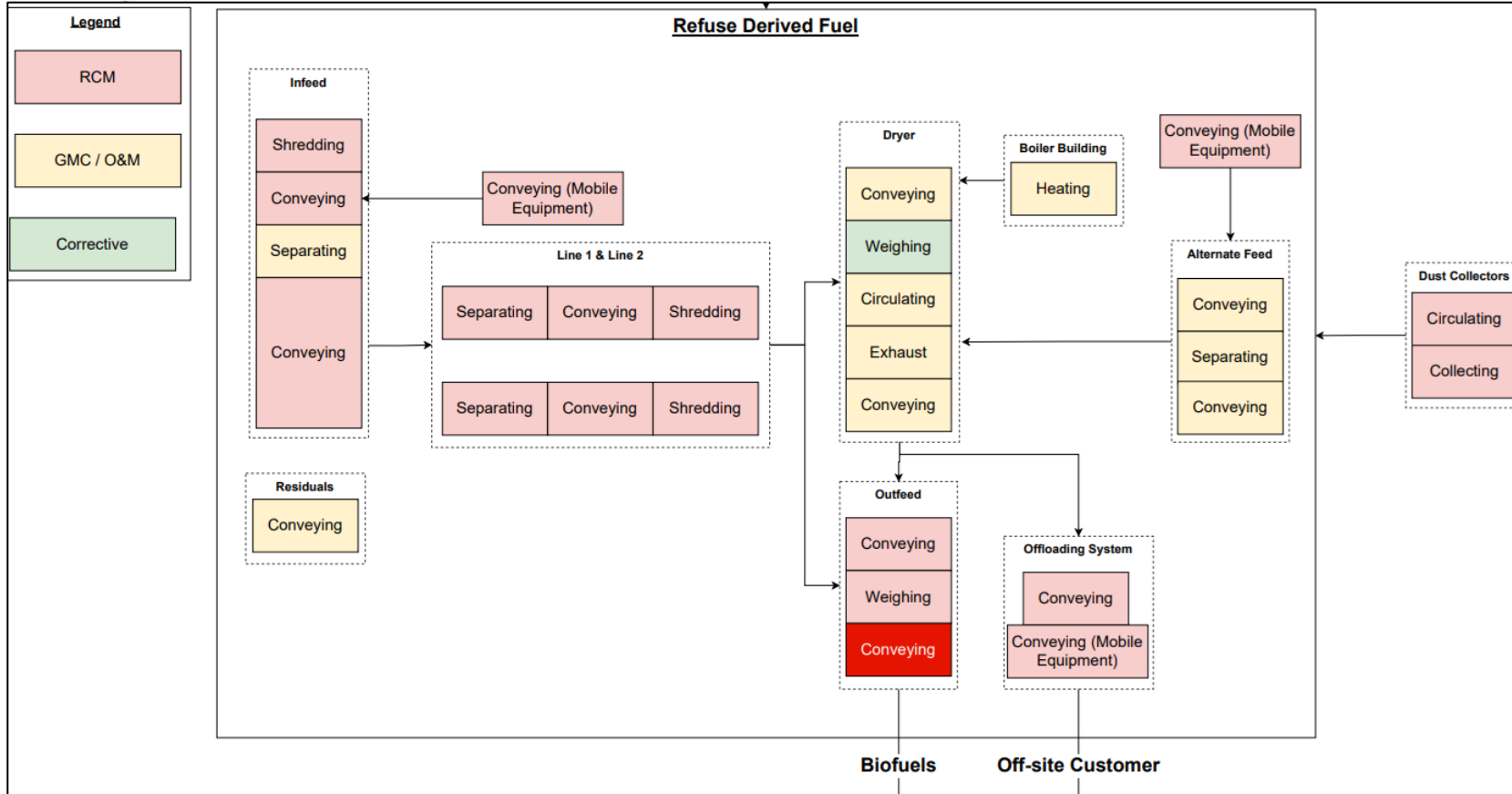
Criticality Score = Likelihood x Consequence x Redundancy (R1=1.20,R2=1.10, R3=1)

		Consequence			
		Insignificant [1]	Minor [2]	Moderate [3]	Severe [4]
Likelihood	Very Likely [5]	5	10	15	20+
	Likely [4]	4	8	12	16
	Possible [3]	3	6	9	12
	Unlikely [2]	2	4	6	8
	Very Unlikely [1]	1	2	3	4

* R



Analyze Criticality



Analyze Reliability

RCM determines what must be done to ensure that the asset continues to do what its users want it to do in its operating context.

1. ARE THE COOLING FINS ON ALL MOTORS CLEAR OF DEBRIS?
ACCEPTABLE _____ CLEANED _____

2. CHECK ALL OF THE BOLTS ON THE MOTOR AND GEARBOXES. ARE ALL OF THE FASTENERS SECURED?
ACCEPTABLE _____ ADJUSTED _____ REPLACEMENT REQUIRED _____

3. DO A COMPLETE RETORQUE ON ALL BOLTED JOINTS. HAS ALL BOLTED JOINTS BEEN RETORQUED?
COMPLETE _____ INCOMPLETE _____

4. GET AN NDT COMPANY TO DO AN INSPECTION ON THE TROMMEL. HAS THIS TROMMEL BEEN INSPECTED?
COMPLETE _____ INCOMPLETE _____

Overheating	▼	Blockage/Plugged	▼	No	▼	Medium	▼	Regular cleaning of motor/ lubrication of rotating machinery
Vibration	▼	Misaligned	▼	No	▼	Low	▼	Inspection, alignment check, fastener tightening
Vibration	▼	Looseness	▼	No	▼	Medium	▼	Inspection and retorque of fasteners
Breakdown (serious damage)	▼	Wear	▼	No	▼	High	▼	Inspections, thickness check in multiple areas

Analyze Reliability

Conveyors													
Component	Failure Type	Failure Description	Failure Mode	Failure Mechanism	Hidden?	H&S	Env	Prod	Cost	Frequency	Risk	Task	Frequency
Belt	Functional Loss	Belt tracks off to the side gets torn apart	Breakdown (serious damage)	Misaligned	No	C	C	A	A	F4	H	1, 2, 3	1W
				Wear	No	C	C	A	A	F4	H	1, 2, 3	1W
		Belt is stretched and tears apart	Breakdown (serious damage)	Fatigue	No	C	C	B	B	F2	M	1, 2, 3	1W
				Looseness	No	C	C	B	B	F2	M	4, 5	1W
				Wear	No	C	C	B	B	F2	M	1, 2, 3	1W
				Breakage	No	C	C	A	A	F4	H		
	Splice fails and belt tears apart	Breakdown (serious damage)	Fatigue	No	C	C	A	A	F4	H			
			Looseness	No	C	C	A	A	F4	H			
	Belt edges wear out	Breakdown (serious damage)	Looseness	B	No	C	C	B	B	F3	M	2	1W
				C	No	C	C	B	B	F3	M	2	1W

#	Maintenance Task(s)	Interval
1	CLEAN OFF ALL EQUIP - IE. MOTOR'S, GEARBOXES, PULLEY'S/SPROCKET'S, ROLLERS, BEARINGS, PANS, SCRAPERS ETC.	1 WEEK
2	INSPECT THE BELT (BOTH SIDES) AND THE CLEATS (WHERE APPLICABLE) FOR DAMAGE, WEAR AND CLEANLINESS.	1 WEEK
3	INSPECT THE BELT FOR TRACKING/ALIGNMENT.	1 WEEK
4	INSPECT THE BELT FOR PROPER TENSION.	1 WEEK
5	INSPECT THE BELT TENSIONERS FOR PROPER FUNCTION.	1 WEEK
6	INSPECT THE SKIRTING FOR DAMAGE AND WEAR.	1 WEEK
7	INSPECT THE CONDITION OF THE GUARDS. ENSURE THEY ARE ALL IN PLACE AND SECURE.	1 WEEK
8	INSPECT THE BEARINGS - NOTE HOT SPOTS AND NOISE. LUBRICATE AS NEEDED - REFER TO THE MANUAL FOR FREQUENCIES AND GREASE TYPES.	1 WEEK
9	INSPECT THE MOTOR(S) FOR DAMAGE, WEAR AND CLEANLINESS. LUBRICATE AS NECESSARY - REFER TO THE MANUAL FOR FREQUENCIES AND GREASE TYPES.	1 WEEK
10	INSPECT THE GEARBOX(S) FOR DAMAGE, WEAR AND LEAKS.	1 WEEK
11	INSPECT THE ROLLERS FOR PROPER FUNCTION AND CLEANLINESS.	1 WEEK
12	INSPECT THE BELT SCRAPER FOR DAMAGE, WEAR AND CLEANLINESS.	1 WEEK
13	INSPECT THE STRUCTURE FOR DAMAGE, WEAR AND LOOSE BOLTS.	1 WEEK
14	INSPECT THE MCC CABINET(S) EXTERIORS FOR CLEANLINESS. VACUUM THE CABINET AND ALL CUBICLE EXTERIORS.	2 WEEKS
15	INSPECT ALL ELECTRICAL COMPONENTS AND CONNECTIONS (INCLUDING VFDS), WITH LOAD ON THEM, USING A THERMAL IMAGING CAMERA. NOTE DEFICIENCIES AND MAKE NOTIFICATIONS WITH CORRECTIVE ITEMS AS NEEDED.	3 MONTHS

C	C	C	C	C	F2	L	2	1W
C	C	A	B	F4	H			
C	C	A	B	F4	H	8	1W	
C	C	A	A			8	1W	
C	C	C	C			8	1W	
C	C	C	C	C	F2	L	8	1W
C	C	A	B	F4	H			
C	C	A	B	F4	H			
C	C	A	B	F4	H			
C	C	B	B	F2	M			
C	C	B	B	F2	M			
C	C	B	B	F2	M			
C	C	B	B	F2	M			

Strategy Gaps



Generic Maintenance Concepts

Benefits:

- Reduce the effort to create maintenance programming
- Uniform and consistent documented maintenance strategies
- Knowledge transfer between plants with similar physical assets and operating contexts
- Accurate asset analysis

Application:

- Similar design / operating contexts (i.e. belt conveyors, compressors, pumps)
- Similar failure modes, mechanisms & frequencies
- Amount of similar assets justifies concept creation

Analyze cost

Cost of Failure / Cost of Maintenance Activity =
PM Cost Benefit Ratio



Criteria	Failure	Maintenance Activity
Frequency	Once a year (Likelihood of failure)	Quarterly (3 months)
Plant downtime	\$54,000 (Unplanned downtime)	\$750 (Planned downtime)
Parts & supplies	\$11,400	\$25
Total (annual)	\$65,400	\$775
PM Cost Benefit Ratio: 88.5 (lubricating this bearing is definitely worth doing)		

Document Program

The following information must be documented in the maintenance program:



- Organizational goals & objectives
- Methodology & strategy
- Performance Measures (Assurance)

Safe, Helpful, Integrated, Accountable, Excellent

Maintenance and Asset Management

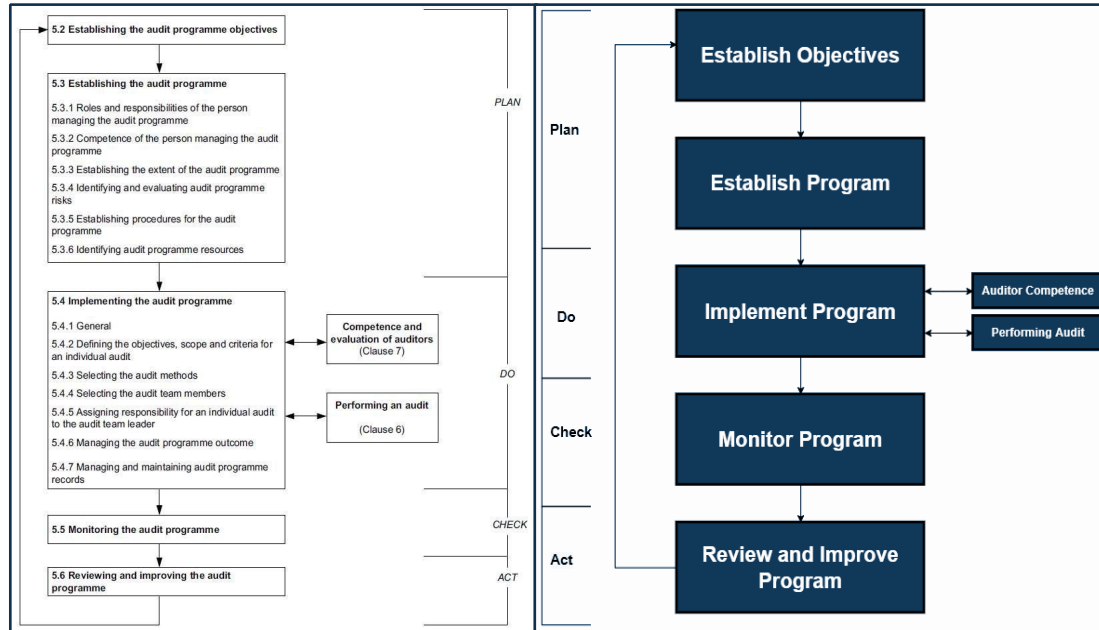
IPTF & Environmental Services
Prescribed Maintenance Program

Waste Services / City of Edmonton



Monitor Program

Asset assurance can be guaranteed by using a maintenance effectiveness audit process aligned with ISO 19011



Monitor Program



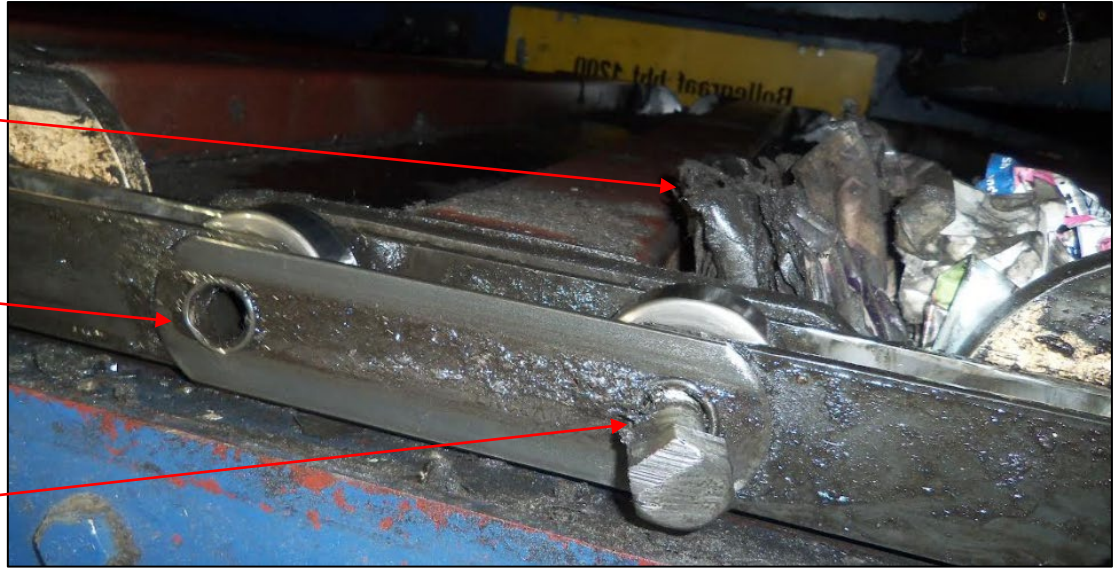
	Strategy	People & Teams
Excellence	Maintenance programs clearly support org strategic goals, well established, documented, & continuously improved.	Fully developed active multiskilling autonomous operator & maintainer teams. Specialist engineering support available.
Competence	Maintenance strategy & plans align with org strategic goals. Improvements in place. Maintenance is under control.	Multiskilling & managed teams of maintainers & operators. Regular use of RCFA & RCM analysis teams.

Monitor Program

Is it clean?

Is it tight?

Is it calibrated?



4 Action

2m

36cm

Edmonton

Action



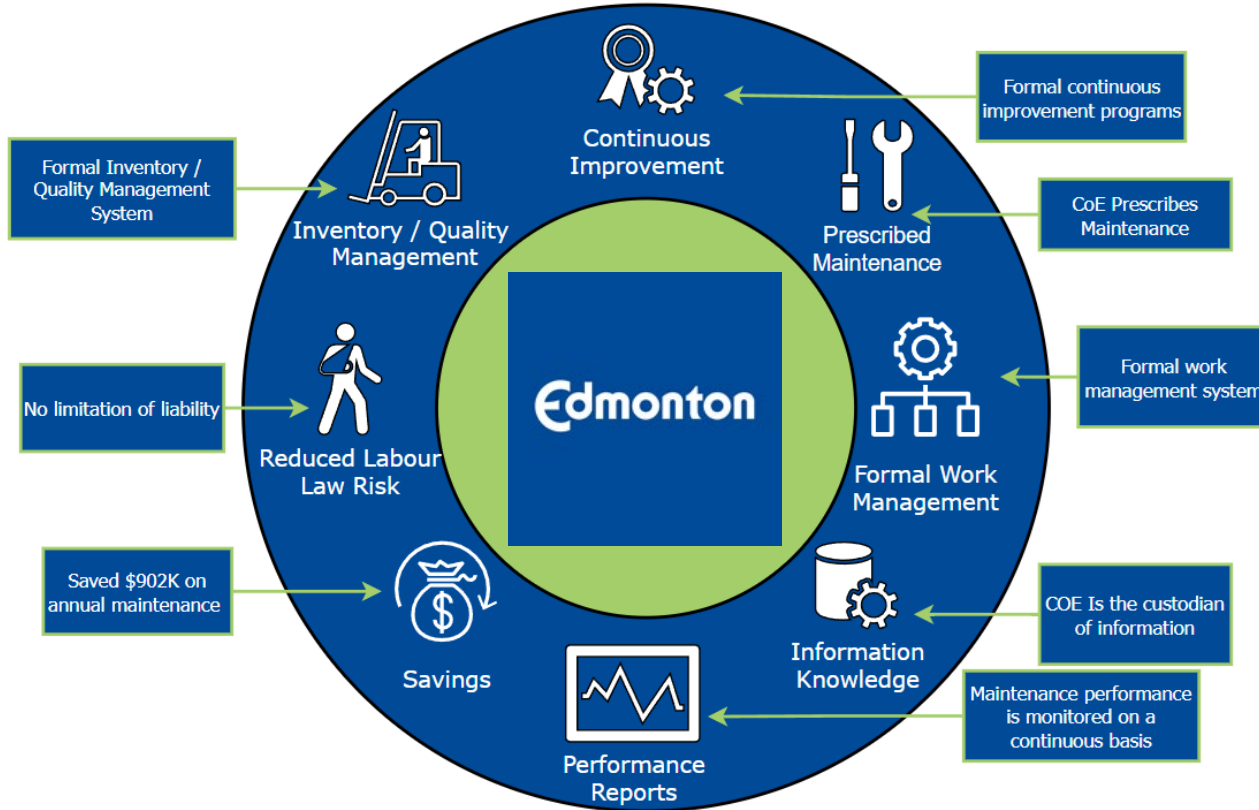
Edmonton

Action

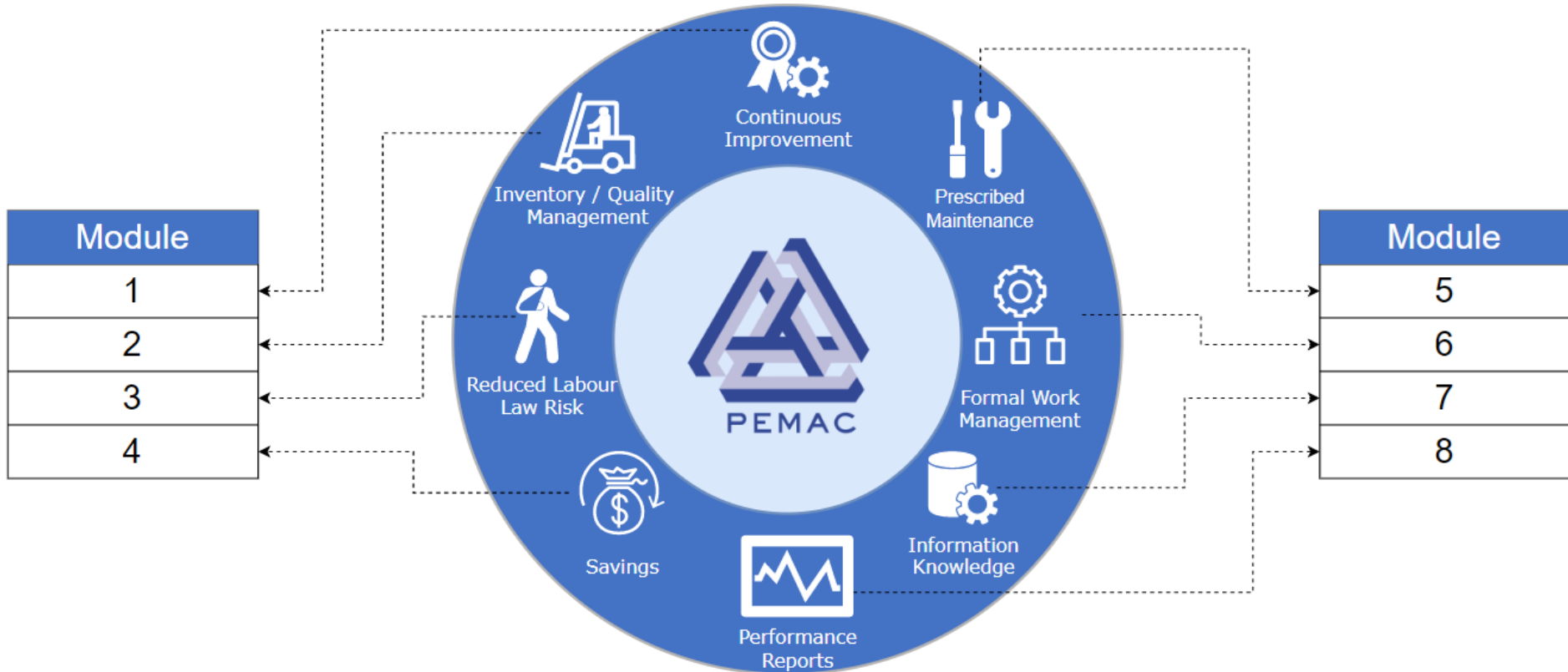
\$902,174

Annual Prescribed Maintenance Savings

Action



Acknowledgement



5 Questions and answers

2m

36cm