City of Key West

Wastewater Asset Management Program Deployment

January 2025

Jacobs Engineering Inc.

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Executive summary

December 18, 2024

Matt Wilman
Utilities Director
City of Key West
1300 White Street
Key West, FL 33040

Subject: Out-of-Scope Proposal for Asset Management Program

Dear Mr. Wilman:

Jacobs would like to propose the following out-of-scope services as further defined below. These services will comply with the requirements of the Operations, Maintenance and Management Agreement between Operations Management International, Inc. and the City of Key West, Florida dated 31 March 2014.

What is being provided: Jacobs will provide the following scope services for development of a site specific Asset Management Program (AMP) that will underpin efforts to enhance asset management and capital project planning across the wastewater collection and treatment system. Details of the approach include six (6) key tasks necessary to enable the development and deployment of the AMP, summarized as below:

- Project Initiation
- CAMRA+ and Initial Assessment
- Risk Profile Development
- Condition Assessment
- Capital Plan Development
- Support Elements

Further detail on the approach and key elements of each task are included in the proposal for your consideration. Jacobs provides best in class expertise in the field of Asset Management and has developed numerous Asset Management Programs for clients across the United States.

When it is being provided: Start date is to be determined pending issuance of an NTP from the City and subject to mutual agreement The project is anticipated to be completed within twelve (12) months of the start date.

Project costs: The lump price of this work is $274,350.08. If during the performance of this scope, Jacobs encounters unforeseen conditions, Jacobs shall retain the right to bill City for any additional labor and/or materials needed to complete the scope as intended.

Payment terms: Payment will be due and payable within thirty (30) days following receipt of Jacobs' invoice.

All other terms and conditions of the Agreement between OMI and the City of Key West remain in full force and effect.

The pricing contained in this letter is valid for thirty (30) days. If these terms are agreeable to you, please sign this letter. A fully executed version of this Agreement will be returned for your files.

Jacobs appreciates the opportunity to provide these additional services to the City of Key West.

Sincerely,

Andy Rouse

Vice President

Jacobs

Both parties indicate their approval of the above described services by their signature below.

Operations Management International, Inc.:	City of Key West, Florida
_____	_____
Name: Andy Rouse	Name: Matt Wilman
Title: Vice President	Title: Utilities Director
Date:	Date:

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1. Project understanding

1.1 Background and Objectives

The City of Key West owns the Richard A. Heyman Environmental Pollution Control Facility, 27 lift stations and approximately 75 miles of collection system piping (main line and lateral collection). The City has made significant investments into these wastewater facilities over the last 20+ years.

More recently, investments include capital improvements to rebuild the collection system, upgrades to an Advanced Wastewater Treatment facility and deep injection wells for plant effluent to decommission the ocean outfall. These needed improvements have benefited the community and the surrounding environment. To protect this investment and to maintain the integrity of the collection system, treatment facilities as well as proactively plan for future improvements the need for a formal asset management program was identified.

Jacobs is proposing the development and integration of an Asset Management program for the Key West Wastewater facilities intended to support the needs of aging infrastructure by developing and integrating industry best practice asset management strategies that are right sized for Key West. The Asset Manager position who will lead this program is to be supported by the deployment of a robust asset management program. This proposal is for deployment of the Asset Management Program.

The Asset Management Program and guiding principles are rooted in recommendations from recognized industry agencies including the Environmental Protection Agency, Institute of Asset Management, International Infrastructure Management Manual. The approach of the programs initiates the methods and practices for becoming an ISO55000 recognized utility and lays out a repeatable and defensible program for managing assets and capital improvement decision making.

2. Solution/Methodology

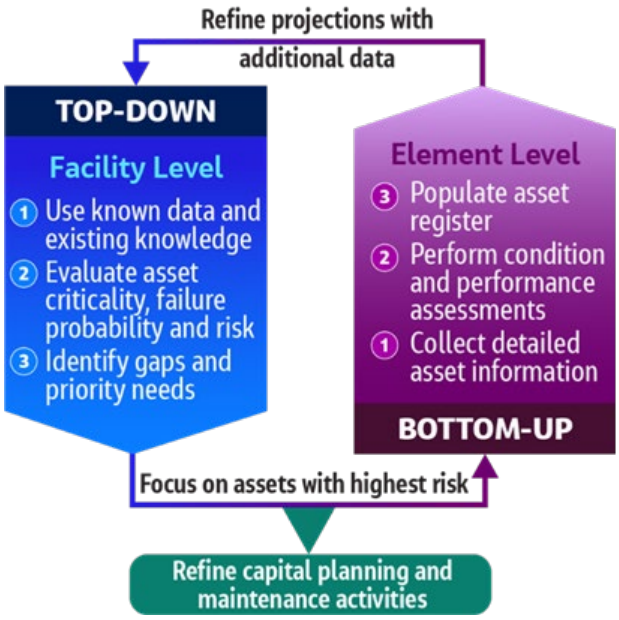
2.1 Scope

With this program, Jacobs intends to implement Asset Management best practices to ultimately support the Asset Manager with the develop of a Risk based, forward-thinking asset management program that addresses risk reduction through proactive capital investment planning. This effort will be coordinated with several integrated tasks that collectively deliver the program for the City. These tasks, detailed further in the following sections, include:

- Baseline Assessment of Asset Management Maturity, Maintenance and Reliability Gap Analysis
- Asset Registry Validation
- Consequence and Likelihood of Failure Risk Profile of the Wastewater Treatment Plant and Lift Stations
- Condition Assessment to determine current conditions and equipment Remaining Useful Life
- Capital investment planning and scheduling
- Asset Replacement Modeling
- Continued asset management program support elements for continuous improvement

Because of Jacobs contracting history with the City we will use a "Top-Down, Bottom-Up" approach to develop the Asset Management program as shown in Figure 1. This allows Jacobs to leverage and refine existing information and quickly move the program to focusing on the highest risk assets.

Figure 1: Top Down Bottom Up Methodology



2.2 Task Descriptions

2.2.1 Task 1 Project Kickoff and Management

The project kick off will be held as one collaborative workshop. This workshop will include:

- Introduction to all key Jacobs project staff
- Review and discussion of scope, schedule, and budget
- Project deliverables, overview of the critical success factors and milestones
- Project documentation, data and information sharing
- Communication and coordination protocols
- Billing and invoicing requirements

2.2.1.1 Deliverables

Deliverable for Task 1 will include:

- Meeting agenda and minutes
- Project schedule and execution plan

2.2.2 Task 2 CAMRA+ and Asset Validation

The Comprehensive Asset Management Review & Assessment+ (CAMRA+) is an assessment tool designed by Jacobs in conjunction with Institute of Asset Management's (IAM) best practices. The objective is to measure an organizations mature level as it relates to asset management.

2.2.2.1 CAMRA+

The CAMRA+ tool allows for two types of maturity assessments: Asset Management at the leadership level and Maintenance & Reliability at the front-line O&M level.

The Asset Management assessment allows the organization to assess its current Asset Management capabilities against key aspects of recognized good practice as defined in the Institute of Asset Management's (IAM) 39 Subjects and ISO 55000. The assessment covers 40 questions and is designed to be completed in a half-day workshop plus follow-up interviews and document review for business unit. The assessment is based on a pre-defined maturity scale which aligns with ISO 55000.

The Maintenance and Reliability Assessment allows for a deep-dive into the vital areas of Maintenance & Reliability and assess current capabilities against the full range of good practice requirements based on guiding resources such as Uptime Elements. The assessment covers 113 questions and is designed to be a thorough assessment conducted through interviews, data analysis, and document reviews focused at the facility.

The CAMRA+ assessment will give a baseline of current capabilities in Asset Management and Maintenance & Reliability. Based on these findings the assessors will define a set of realistic and achievable short-, medium-, and long-term goals for advancing maturity in relevant areas. After agreeing upon the realistic goals and priorities for improvement, the next step is to construct the improvement. Roadmap. This sets out the initiatives and actions required to improve maturity in each priority area. Quick wins and longer-term change initiatives are programmed taking into account the organization's ongoing workload and resources so that the organization has a realistic and achievable path towards achieving good practice, or even going beyond that if there is a desire and clear business benefit in doing so..

2.2.2.2 WWWTP and Lift Station Asset Validation

An essential component of an asset management program is an accurate asset registry. Currently assets are managed in the Maintenance Connection (MC) maintenance management software. The asset registry in MC is considered to be accurate however an audit for new assets, removed and decommissioned assets is required to support an up to date asset registry for the condition assessment in Task 3.

2.2.2.3 Deliverables

- Workshop and Minutes
- Summary document and Road Map of Asset Management assessment
- Summary document and Road Map of Maintenance and Reliability assessment
- Validated asset registry uploaded to Maintenance Connection CMMS

2.2.3 Task 3 Risk Profile Development

Risk identification is a fundamental element of the Asset Management program. By quantifying the Consequence of an asset or a process failing, and the Likelihood of its failure a repeatable and defensible framework for decision making can be made regarding an asset's future.

This task includes using a standard approach to customize a risk matrix to score the risk profile for the Key West WWTP and pump stations. The risk profile scoring will be applied at the Wastewater Treatment Plant process and sub-process area levels. Determination of the correct hierarchical level at which to score Risk will be determined in collaboration with The City with decision input from Jacobs. Risk profiling for pump stations will occur at the station or location level.

Jacobs is aligned with the International Infrastructure Management Manual (2016) standard approach for Risk scoring but will configure the WWTF and lift station risk matrix Levels of Service criteria for the City so they are relative to actual operations and business drivers. Risk is calculated by the following equation:

$$\underline{Risk = Consequence\ of\ Failure \times Likelihood\ of\ Failure}$$

2.2.3.1 Consequence of Failure (CoF)

Jacobs will facilitate a 2-hour Risk review workshop to discuss and score the CoF component of risk for the WWTP and lift stations. CoF scoring is applied at the main process area or subprocess area level of the plant and at the location level for lift stations. Jacobs will work with the City to confirm the areas of the plant to be included in the risk profile assessment.

Using a top-down approach, Jacobs will populate the CoF scoring matrix using existing knowledge of the Key West WWTP and lift station facilities to identify levels of service required by the City. The criteria included in the CoF matrix includes identifying levels of service, weighting factors and scoring criteria. Each service level category has a range of consequences that are scored on a 1 (negligible) to 10 (severe) scale. The service level categories will be weighted by percentage, based on their relevance to the City (based on discussions with City staff), out of a possible 100.

IIMM industry standard levels of service categories that will be adapted for this assessment are:

- Health and Safety of Public and City Staff
- Regulatory/Environmental Compliance
- Service Delivery

- Financial Impact
- Public Confidence

An example Consequence of Failure matrix is shown in Figure 1: Consequence of Failure. Level of Service details for each of the CoF categories will be developed as part of the Risk workshop.

Figure 2: Consequence of Failure

Consequence by Level of Service						
LOS Category	**Description**	**Wt.**	**Negligible = 1**	**Low = 4**	**Moderate = 7**	**Severe = 10**
Safety of site employees	Potential to cause harm	30%	No injuries or adverse health effects	No lost-time injuries. Recordable incident Medical attention required	Lost-time injury or medical attention required	Permenant injury, widespread outbreak of illness, Potential loss of life
Financial impact	Typical cost of materials and labor to complete repair and impact from procurement processes; or impact to cost of operations such as biosolids disposal	20%	Can be repaired within project budget (<$25,000) to to cost of operations	Between $25,000 to $125,000 for repair or cost of operations	Between $125,000 to $250,000 for repair or cost of operations. Implement BCE analysis	Greater than $250,000.
Service Delivery	Impact on contract terms and compliance; operations	15%	No impact	Minor impact to process if out of service > 24 hours.	Major impact to process if out of service >12 hours, Minor impact to contract KPIs	Major impact to process if out of service >2 hours, Major impact to contract KPIs.
Customer confidence	Potential for negative press, reputation damage	10%	No social or economic impact to customers. No reactive media coverage. Any media coverage is a result of proactive announcements by Utility. No complaints.	Minor disruption (e.g., traffic, dust, noise). No adverse media coverage. Some complaints.	Substantial but short-term disruption. Adverse media coverage due to customer impact. Localized media coverage.	Long-term impact. Area-wide disruption. Regional media coverage.
Regulatory/Environmental compliance	Outage impact to permits and compliance resultign in fines and penalties	25%	No State or local permit violations	Requires regulatory reporting and notification.	Probable enforcement action, but fines unlikely. Audit by regulator.	Enforcement action with fines; Consent decree.

2.2.3.2 Likelihood of Failure (LoF)

Jacobs will facilitate a 2-hour workshop to discuss and score the LoF component of risk. LoF is the second component of risk and is the most common factor in changing the total risk an asset poses. While changing the *CoF* usually requires a process or regulatory change, LoF is dynamic and will change more frequently based on operation and maintenance of the asset. Similar to CoF, service levels criteria will be defined for the WWTP and pump stations with input from the City staff. Typical service levels categories for LoF include:

- Physical condition – for example, what is the physical condition of the components of the facility
- Operations & Maintenance (O&M) protocols – for example, is there is a O&M plan in place and if the documentation for the O&M plan is readily available
- Performance – for example, does lift station meet capacity needs and Ten State Standards

Each LoF service level will have criteria details developed for the workshop that are relative to the City , which will be scored on scale of 1 (negligible) to 10 (severe). An example is shown in Figure 2: Likelihood of Failure. Each service level will be weighted out a possible 100 percentage points based on input from The City. The LoF for each lift station will be assessed preliminarily as part of this Task (top-down approach based on assumptions), and completed in more detail through the field assessments in Task 3.

Figure 3: Likelihood of Failure

Likelihood by Category							
Likelihood Category		**Wt**	**Negligible = 1**	**Unlikely = 3**	**Possible = 5**	**Likely = 7**	**Very Likely = 10**
Physical Condition	Assessed condition, operating as intended	60%	Grade 1. Very good. New or nearly new. Only normal maintenance required. (95% life remaining)	Grade 2. Good. Minor wear. (75% life remaining)	Grade 3. Fair. Major wear impacting level of service. (50% life remaining)	Grade 4. Poor. Unable to meet level of service life. Failure imminent. (25% life remaining)	Grade 5. Very poor. Requires complete rehabilitation or replacement. Failed. (0% life remaining)
O&M Protocols	Maintenance program in place, SOPs in place. Reduces useful life and increases Mean Time To Repair	30%	Complete, up-to-date, written, easily accessible and is being used.	Complete, written, up-to-date, being used but not easily accessible.	Partially documented; used periodically.	Written, but out-dated and not used.	No written protocols.
Performance	Is it asset under or over utilized impacting typical useful life and Mean Time Between Failure	10%	Sufficient capacity to meet average and peak flow requirements. Appropriate utilization and function.	Able to meet current average capacity demand, but not peak demands.	Sufficient capacity, but does not meet functional requirements, or over-utilized.	Under-utilized or oversized, causing O&M issues.	Unable to meet current average capacity needs.

2.2.3.3 Risk Profile

Jacobs will prepare a draft and final top-down Risk Assessment technical memorandum (TM) to summarize the development of the risk matrix categories, level of service criteria and the top-down assessment of the lift station rankings based on the risk criteria. The TM will document how the risk profile was developed and why Process areas and pump stations scored as they did. Available data will include CoF and LoF scores and Total Risk rankings for each process area and pump station.

2.2.3.4 Deliverables

- Consequence of Failure workshop meeting minutes
- Likelihood of Failure workshop meeting minutes
- Memo summarizing risk scoring and resulting risk profiles for the Wastewater Treatment Plant and Pump Stations.
- Integration of Risk scores with Maintenance Connection (CMMS) at the asset level to support prioritization and decision making

2.2.4 Task 4 Condition Assessment

2.2.4.1 Assessment Criteria

Using the asset registry developed in Task 2, assets will be organized by WWTF Process or Sub-Process Areas and Location or Sub-Locations as defined in Task 3. Assets will be organized into specific asset types to which assessment criteria is assigned. For each asset type to be assessed Jacobs will assign specific assessment criteria. Assessment criteria for specified asset types and question weighting is pre-existing in the Jacobs Asset Condition Evaluation System (ACES) and will be edited to correctly match the priorities for this specific assessment.

Assessment criteria will be reviewed in a workshop between The City and Jacobs and agreed upon before field work begins. Jacobs will populate the Asset Condition Evaluation System (ACES) database tool with the asset registry and assessment criteria information. ACES is a mobile application that also integrates with Maintenance Connection. Assessment data is entered into ACES in the field via mobile devices and can be managed/edited through a desktop computer.

2.2.4.2 Field Condition Assessment

Using the assessment criteria and scoring developed in this task, Jacobs will begin site visits for assessments to assess the condition of assets. The assessments are expected to be performed over a 2-4 week period depending on number of teams in the field (one team of two for four weeks, two teams of two for two weeks).

Condition Assessments are tiered into three categories:

- Tier 1 - Visual Inspection
    - Qualitative inspection, visual assessment criteria, historical information
- Tier 2 - Detailed Inspection
    - Quantitative and Qualitative inspection of assets including predictive testing and visual assessment

Jacobs intends to assess assets at the Tier 1 and Tier 2 levels. Jacobs will complete condition assessment forms electronically in ACES for each asset documenting deficiencies and recommended improvements. Condition rating will be assigned to each asset based on the guidelines of International Infrastructure Management Manual (IIMM, 2016) as shown in the following table. Condition assessment will focus on non-destructive testing and visual observation.

Figure 4: Condition Category Description

Condition Score	Description	Remaining Useful Life
1	Indicates the asset is new or in like new condition. Continuation of current maintenance practices and operating procedures is recommended	>90%
2	Indicates the asset is in good condition. Some minor additional maintenance may be required, continue the current maintenance and operating procedures	75%
3	Indicates the asset is in fair condition. Asset has one or more deficiencies requiring immediate attention. The current maintenance and operating procedures or intervals may need to be modified or adjusted to avoid recurrence of identified deficiencies	50%
4	Indicates the asset is in poor condition. Planning for rehabilitation or replacement should begin. Review of current maintenance practices and procedures is recommended. If this is a critical asset a predictive maintenance program should be evaluated to prevent reaching this condition in the future.	25%
5	Indicates the asset is in very poor condition. Failure of the asset is imminent or has already occurred. Greater than 50% of the asset requires replacement. If this is a critical asset a predictive maintenance program should be evaluated to prevent reaching this condition in the future.	5% or less

2.2.4.3 Deliverables

Jacobs will provide a draft Condition Assessment Summary report electronically summarizing the results of the assessment by Process Area, Risk Score and Condition Score. Assessment summary results will also include:

- Individual assessment forms completed for each asset assessed with complete assessment scoring and asset photographs in pdf form
- Deficiencies report for corrective maintenance activities
- Asset typical design life and remaining useful life of the asset
- Estimated replacement purchase cost
- General comment and recommendations from the assessment team

2.2.5 Task 5 Capital Plan Development – Asset Replacement Modeling

While asset condition and Risk is a primary driver in capital decisions other factors such as annualized cost to maintain, design life (obsolescence), master planning processes and return on investment are also considered. Jacobs uses its Asset Replacement Modeling (ARM) to rank and score these inputs to identify appropriate timing for asset rehabilitation and replacement.

Condition assessment results are organized by Risk and by condition. Assets that score condition of 4 and 5 are immediately placed into near term rehabilitation or replacement categories. These deficient assets may be addressed as individual replacements or grouped into projects and recommended for capital replacement. By using the ARM near term (5 year) and medium term (6 -10 year) asset rehabilitation and replacement may be forecasted and planned. Long term, 11-20 forecasts, are also generated for planning purposes.

2.2.5.1 Deliverables

- Asset rehabilitation and replacement forecast broke out into short, near term and long term planning forecasts
- Class 4 estimates for budgetary planning

2.2.6 Task 6 (Optional) Linear Asset Management Review and Demo

Jacobs, as an optional task, would like to include a business process assessment related to the City's Collection system CCTV scheduling, inspection and cleaning practices. As part of this assessment Jacobs would evaluate current inventory status, use of GIS and assessment practices. Jacobs has developed state-of-the-art, EPA highlighted linear asset management tools to enhance the condition assessment, prioritization and cost estimation of collection system assets. It is challenging to manage field data, prioritize asset conditions, and developing rehabilitation, maintenance and reinspection plans for wastewater and stormwater assets. The effort is complicated by various inspection techniques, software platforms, and inventories. Jacobs helps numerous utilities around the country overcome these challenges through the use of intelligent modeling and through the use of artificial intelligence (AI).

Jacobs Argon, see **Appendix D** for full details, has been used for over a decade on almost 100 projects and has been installed on utilities' networks around the country. Over the years, Argon has been refined with engineering logic and AI and has been ground-truthed to provide accurate condition and risk scores for pipe prioritization. Argon can be customized for each utility to create tailored recommendations. Argon's AI analysis targets defect combinations with a higher likelihood of failure enabling utilities to implement proactive intervention strategies

Jacobs' Dragonfly technology, **see Appendix E** for full details, allows for the review of inspection video while it analyzes and provides prescriptive guidance on how best to maintain your buried assets. Dragonfly enables the user to address issues before they become problems, and provides integrated asset management support, generating optimized re-inspection and maintenance schedules as well as prioritized rehabilitation lists. Dragonfly is vendor-neutral and compliments your existing CCTV management tools and investments.

Deliverable

- Workshop meeting minute summaries
- Technical Memo for Business Process review regarding GIS inventory, CCTV inspection and cleaning scheduling, defect review process, rehabilitation and replacement estimating and scheduling.
- Estimate for pilot programs for Argon and Dragon Fly

2.3 Schedule/Program

Jacobs will perform the scope of work outlined in this proposal per the below schedule.

Figure 5 – Schedule

Task Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Kickoff												
Baseline CAMRA+ Assessment Asset Validation												
Risk Profile												
Condition Assessmetn field work												
CA Review and initial CIP development												
Asset Replacement Modeling												

3. Commercial offer

The lump price of this work is $274,350.08. If during the performance of this scope, Jacobs encounters unforeseen conditions, Jacobs shall retain the right to bill City for any additional labor and/or materials needed to complete the scope as intended. The lump sum price is broken down by task as below:

#	TASK	TOTAL PRICE
1	Kick off Baseline Gap Analysis and Asset Validation	$78,212.78
2	Risk Profile Plant and Stations	$18,722.03
3	Condition Assessment database and Field Work	$87,062.84
4	CA Review and CIP initial development	$29,450.40
5	Asset Replacement Modeling	$31,802.40
6	Linear Asset AM evaluation - Optional	$29,099.63
	Total	**$274,350.08**

If during the performance of this scope, Jacobs encounters unforeseen conditions, Jacobs shall retain the right to bill City for any additional labor and/or materials needed to complete the scope as intended.

Payment terms: Payment will be due and payable within thirty (30) days following receipt of Jacobs' invoice.

All other terms and conditions of the Agreement between OMI and the City of Key West remain in full force and effect.

4. Appendices

Refer to supplemental information supporting this proposal in the following appendices.

Appendix A. CAMRA+

Jacobs

Challenging today.
Reinventing tomorrow.

CAMRA+ Asset Management Assessment Tool

Helping your organization advance its asset management capabilities

CAMRA+ Capabilities

- Assess maturity of current Asset Management and/or Maintenance & Reliability practices
- Establish clear improvement plans
- Track progress

Key Outcomes

- Deliver sustainable levels of service effectively and efficiently
- Demonstrate optimal management of assets to customers, regulators, and stakeholders

Comprehensive Assessment Methodology

The Comprehensive Asset Management Review & Assessment+ (CAMRA+) tool enables your organization to conduct two types of maturity assessments: **Asset Management** and **Maintenance & Reliability**.

Asset Management

Firstly, it allows the organization to assess its current Asset Management capabilities against key aspects of recognized good practice as defined in the IAM's 39 Subjects and ISO 55000. The assessment covers 40 questions and is designed to be completed in a half-day workshop plus follow-up interviews and document review for a service area or business unit. The assessment is based on a pre-defined maturity scale which aligns with ISO 55000.

Maintenance & Reliability

The tool also allows the organization to perform a deep-dive into the vital area of Maintenance & Reliability and assess its current capabilities against the full range of good practice requirements based on resources such as Uptime Elements. The assessment covers 113 questions and is designed to be a deep-dive assessment conducted through interviews, data analysis, and document reviews at facility or area level across a number of facilities/areas.

Objective Maturity Benchmarking

CAMRA+ is objective and allows organizations to see where they fall in terms of maturity level, as shown in the chart below. From there, Jacobs is skilled at partnering with organizations to develop customized improvement plans to meet organizational needs and objectives.

Innocent	Aware	Developing	Competent	Optimizing	Excellent
Level 1	Level 2	Level 3	Level 4	Level 5	
The organization has not recognized the need for this requirement and/or there is no evidence of commitment to put it in place	The organization has identified the need for this requirement, and there is evidence of intent to progress it	The organization has identified the means of systematically and consistently achieving the requirements, and can demonstrate that these are being progressed with credible and resourced plans in place	The organization can demonstrate that it systematically and consistently achieves relevant good practice requirements	The organization can demonstrate that it is systematically and consistently optimizing its asset management practice, in line with organization's objectives and operating context	The organization can demonstrate that it employs leading practices, and achieves maximum value from the management of its assets, in line with the organization's objectives and operating context

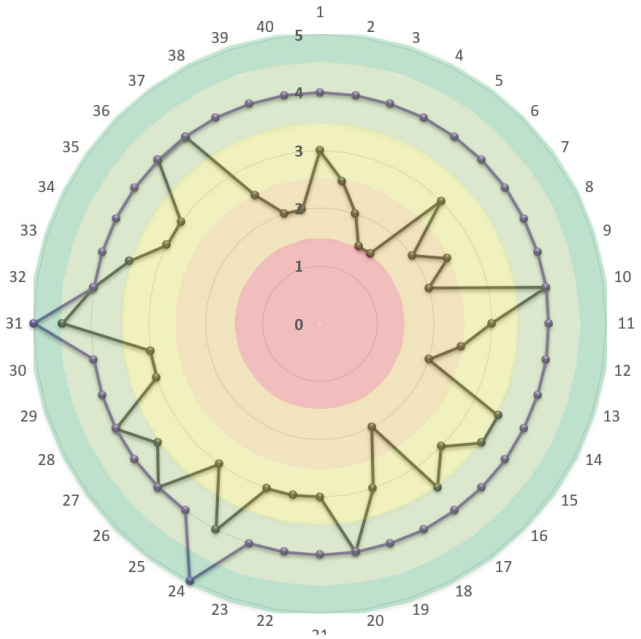
Jacobs *CAMRA+ Asset Management Assessment Tool, cont.*

Future Goals, Implementation Roadmaps & AM Program Design

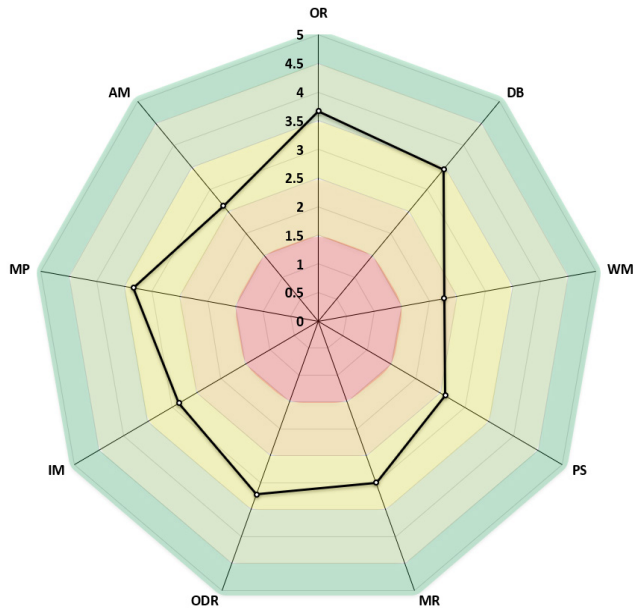
The CAMRA+ assessment will give you a baseline of your current capabilities in Asset Management or Maintenance & Reliability. Based on these findings the assessors will work with your organization to define a set of realistic and achievable short-, medium-, and long-term goals for advancing maturity in relevant areas.

After agreeing upon the realistic goals and priorities for improvement, the next step is to construct the Improvement Roadmap. This sets out the initiatives and actions required to improve maturity in each priority area. Quick wins and longer-term change initiatives are programmed taking into account the organization's ongoing workload and resources so that the organization has a realistic and achievable path towards achieving good practice, or even going beyond that if there is a desire and clear business benefit in doing so.

Asset Management Maturity Assessment



Maintenance & Reliability Maturity Assessment



How Jacobs Can Help

Jacobs is your trusted partner throughout the asset management journey. We are equipped to help you with everything from communications and training to assessment workshops and implementation roadmaps.

Communications
We can help you develop the messaging and material you need to get your stakeholders involved in the process.

Basic Training
To make sure people in the Assessment Workshop are aware of the breadth of the subject, we provide high-level overview training. This typically takes one half-day session per group.

Assessment Workshop
We facilitate a group workshop with a cross section of staff from your organization to go through the questions in Jacobs' proprietary CAMRA+ tool.

Results Review
After the workshop, we combine the results and share our draft findings with you as a validation step.

Implementation Roadmap
We will develop a 3–5-year Implementation Roadmap to help get you where you want to go as an organization.

Final Report
We will combine findings from the assessment and the developed roadmap into a Final Report that will serve as the complete deliverable of the CAMRA+ assessment.

Contact us!

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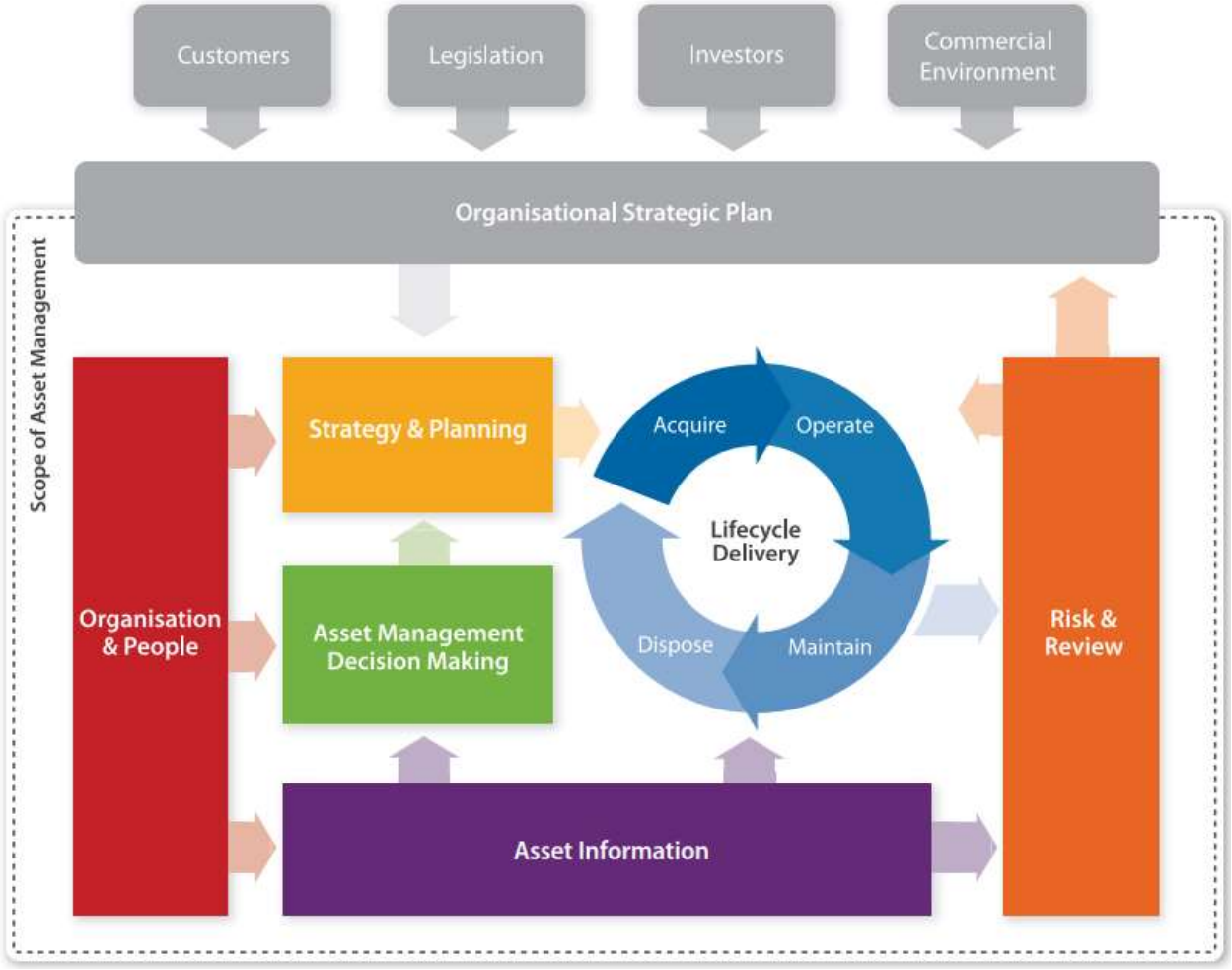
The Institute of Asset Management IAM PATRON
IAM endorsed ASSESSOR
IAM endorsed TRAINER

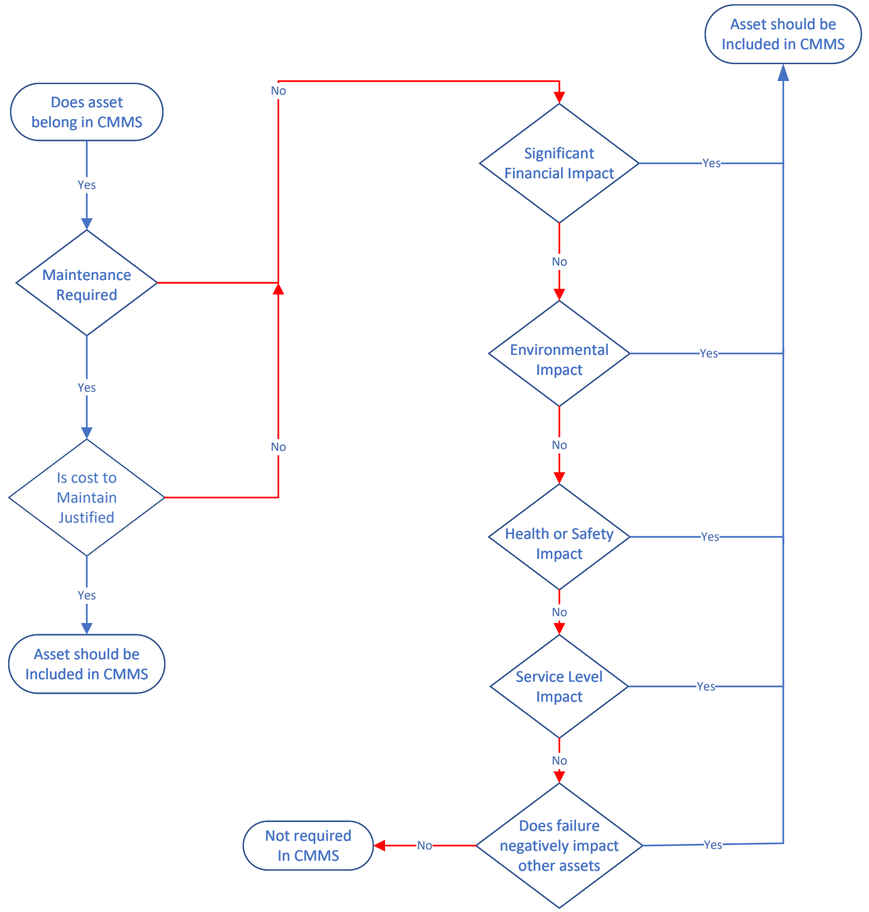
Appendix B. IAM

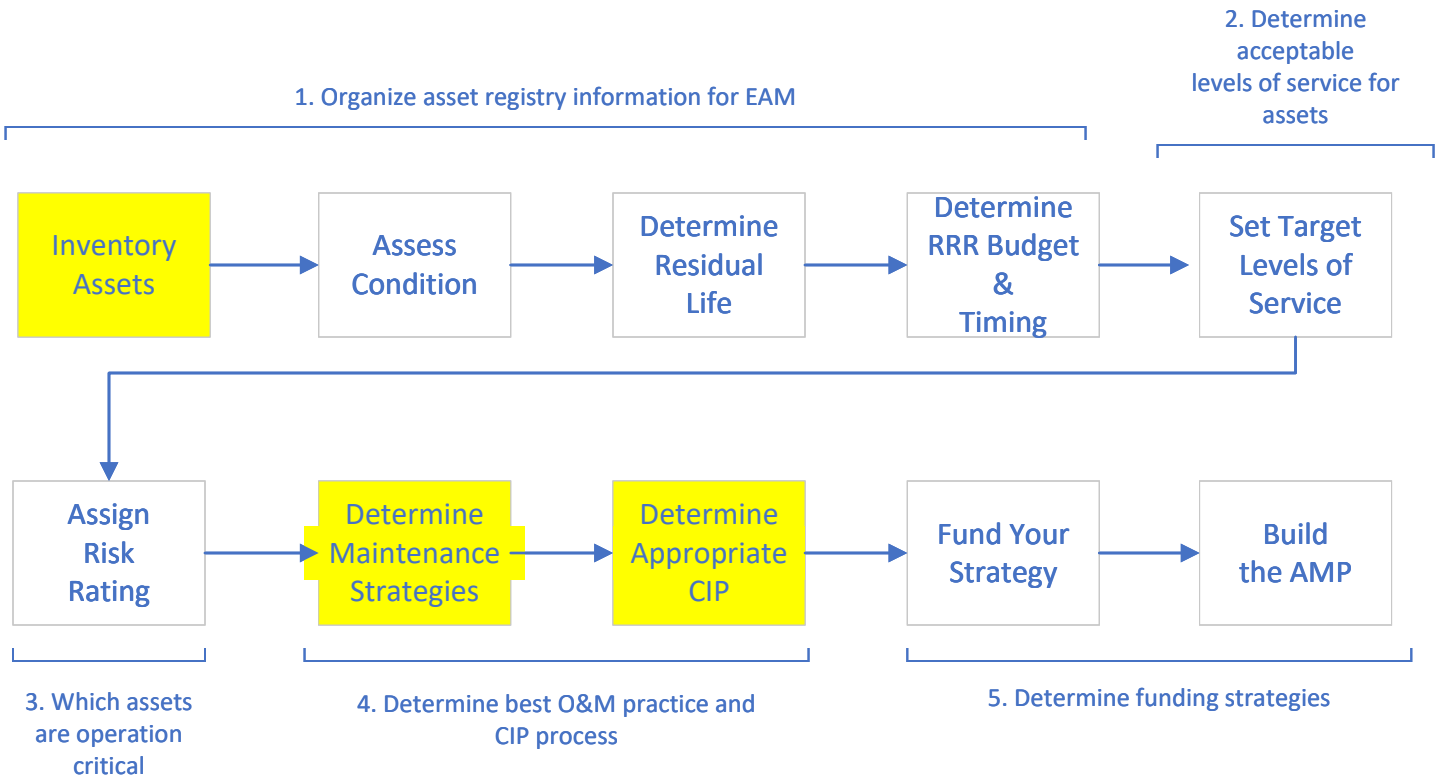
Institute of Asset Management's Conceptual Asset Management Model

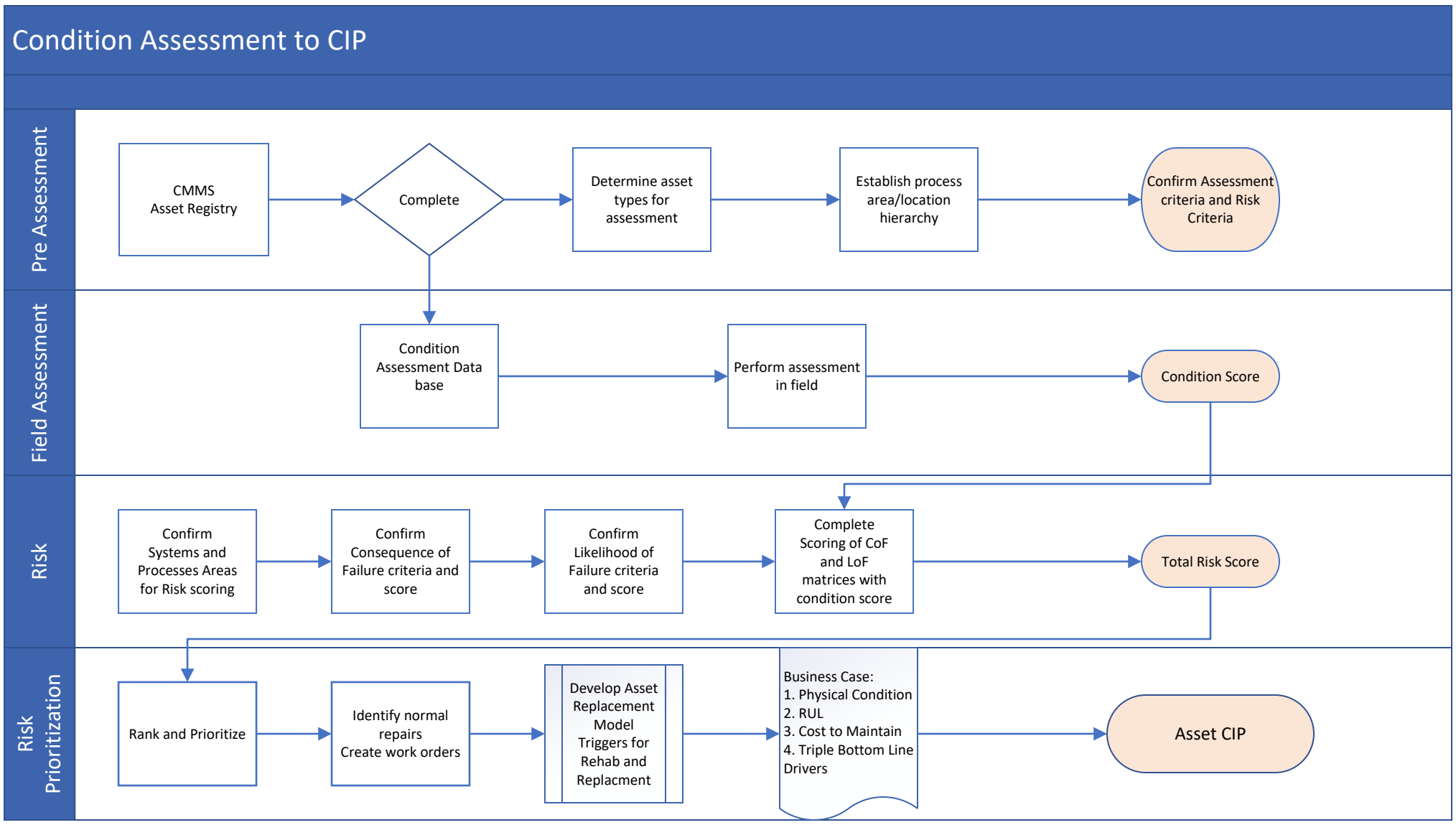


Appendix C. Condition Assessment to Capital Improvement Plan

Yes


Asset should be Included in CMMS
Does asset belong in CMMS
No
Yes
Significant Financial Impact
Yes
Maintenance Required
No
Yes
Environmental Impact
Yes
No
Is cost to Maintain Justified
No
Health or Safety Impact
Yes
Yes
No
Asset should be Included in CMMS
Service Level Impact
Yes
No
Not required In CMMS
No
Does failure negatively impact other assets
Yes


1. Organize asset registry information for EAM
2. Determine acceptable levels of service for assets
Inventory Assets
Assess Condition
Determine Residual Life
Determine RRR Budget & Timing
Set Target Levels of Service
Assign Risk Rating
Determine Maintenance Strategies
Determine Appropriate CIP
Fund Your Strategy
Build the AMP
3. Which assets are operation critical
4. Determine best O&M practice and CIP process
5. Determine funding strategies


Condition Assessment to CIP
Pre Assessment
CMMS
Asset Registry
Complete
Determine asset types for assessment
Establish process area/location hierarchy
Confirm Assessment criteria and Risk Criteria
Field Assessment
Condition Assessment Data base
Perform assessment in field
Condition Score
Risk
Confirm Systems and Processes Areas for Risk scoring
Confirm Consequence of Failure criteria and score
Confirm Likelihood of Failure criteria and score
Complete Scoring of CoF and LoF matrices with condition score
Total Risk Score
Risk Prioritization
Rank and Prioritize
Identify normal repairs
Create work orders
Develop Asset Replacement Model
Triggers for Rehab and Replacment
Business Case:
1. Physical Condition
2. RUL
3. Cost to Maintain
4. Triple Bottom Line Drivers
Asset CIP

Appendix D. Argon

Argon
by Jacobs

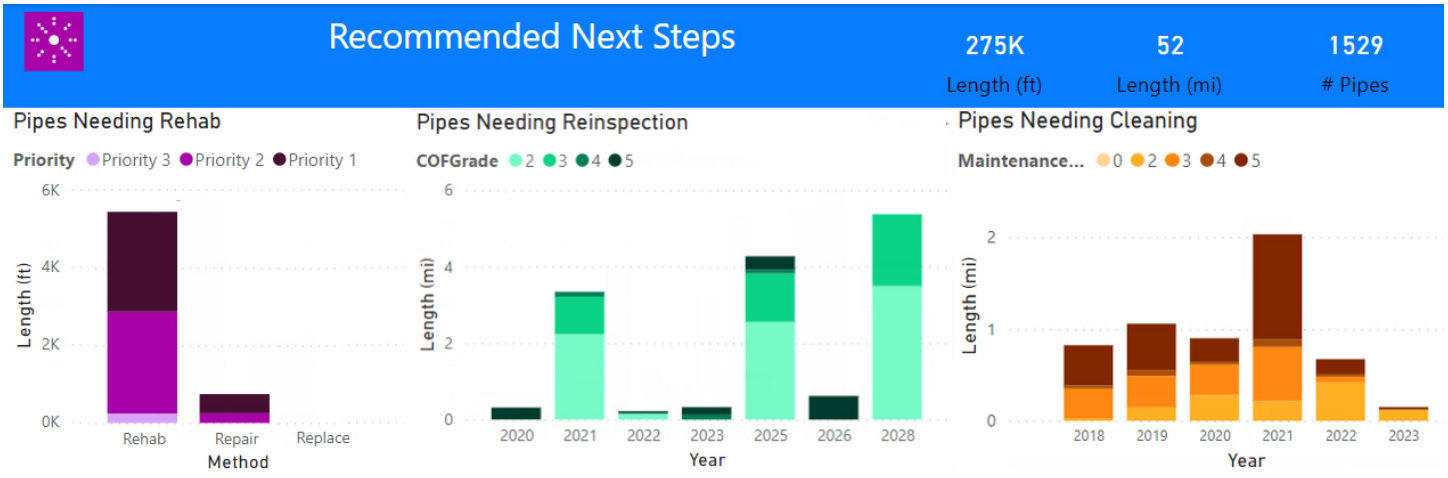
From Field Data to Solutions

Utilities face daunting challenges when managing field data, prioritizing asset, and developing plans and schedules for their wastewater and stormwater assets. Argon (formerly SCREAM) was created to help utilities overcome these challenges by enhancing their ability to process and prioritize vast collections of condition data.

Argon has been used for over a decade on almost 100 projects and has been installed on utilities' networks around the country. Over the years, Argon has been refined with engineering logic and AI and has been ground-truthed to provide accurate condition and risk scores for pipe prioritization. Argon can be customized for each utility to create tailored recommendations. Argon's AI analysis targets defect combinations with a higher likelihood of failure enabling utilities to implement proactive intervention strategies. Argon is a state-of-the-art, EPA-highlighted sewer and storm management system to help you stay on top of your assets.

- **Argon** calculates robust condition scores, designed for prioritization.
- **Argon** estimates assets' remaining useful life and calculates risk scores based on detailed asset data and GIS
- **Argon** incorporates work order history then recommends and schedules future work orders for both maintenance and structural purposes.
- Finally, **Argon** estimates immediate and life-cycle costs of repair, replacement and rehabilitation and chooses the optimal methodology for corrective action.

> Armed with insights from Argon, utilities can create informed, data-driven re-inspection, maintenance, and rehabilitation plans. Utilities can use Argon for a snapshot of their system or can install Argon to generate weekly work assignments and work orders.



The Argon Steps

The Argon process has five distinct steps to help utilities manage data and prioritize assets. Utilities may use some or all the steps.

Score **Calculate condition scores**

Argon's condition scores provide accurate asset prioritization. Argon assigns defect scores based on defect code, defect extent, pipe material and aggregates scores by defect families (like cracks, roots, or corrosion) which have distinct pipe failure mechanisms.

AI Trigger **Target defect combinations using AI**

Argon's artificial intelligence (AI) model analyzes defects, pipe attributes and pipe location, targeting the pipes with combinations of defects and attributes that are more likely to fail.

Risk **Calculate risk scores (bottom up) using AI**

Argon uses a risk-based, information driven, bottom-up approach to identify the Consequence of Failure (Cof) and Likelihood of Failure (LoF) risk matrices on an asset-by-asset basis. Utilities can use their own risk scoring process in place of Argon Risk. Argon Risk can also be used on its own without the other Argon steps.

Next Step **Create Plans and Schedules**

Condition scores, risk scores, and work order history are input into Argon's logic matrices to recommend next steps for each pipe (e.g., should it be rehabilitated or monitored). Each pipe is given both structural and maintenance next steps which are then scheduled to create lists of recommend work orders.

- Re-inspection plans and schedules
- Maintenance plans and schedules
- Rehab plans (for CIP)

Costing **Rehab and Maintenance Costs**

Calculate remaining useful life (RUL), immediate and life-cycle costs.
Argon Costing calculates the cost of repairs, replacement, rehab and continued maintenance over time. Argon estimates short-term and life-cycle costs for each methodology and chooses the optimal methodology for addressing the utilities' priority assets. Cost estimates are ideal for budgeting purposes.

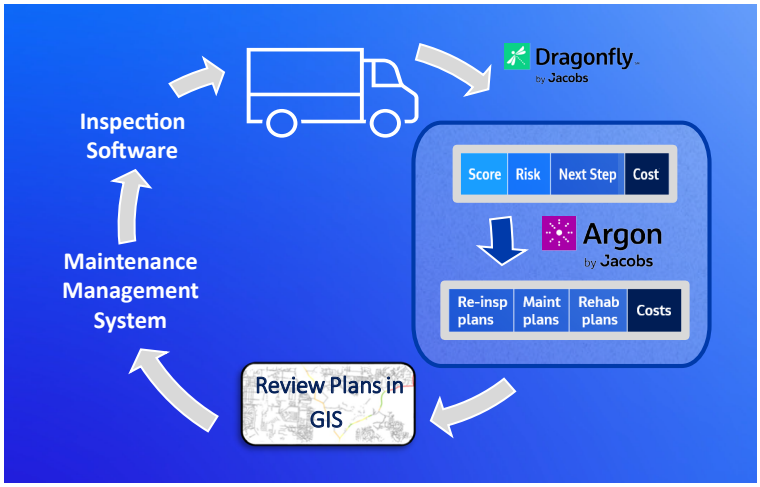
Argon is used three different ways:

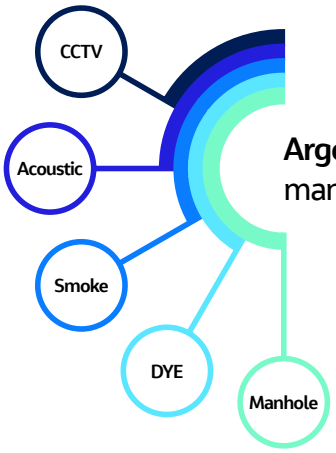
- As a short-term solution to perform analyses for Jacob's projects
- As part of Jacob's web-based Dragonfly software, analyzing the PACP results
- As a continuous management system, installed on a utilities' network

When Argon is installed on site, it is integrated with the utilities' maintenance management system, inspection software and GIS. Argon is then scheduled to run (typically nightly) so results are up to date and assets are managed seamlessly.

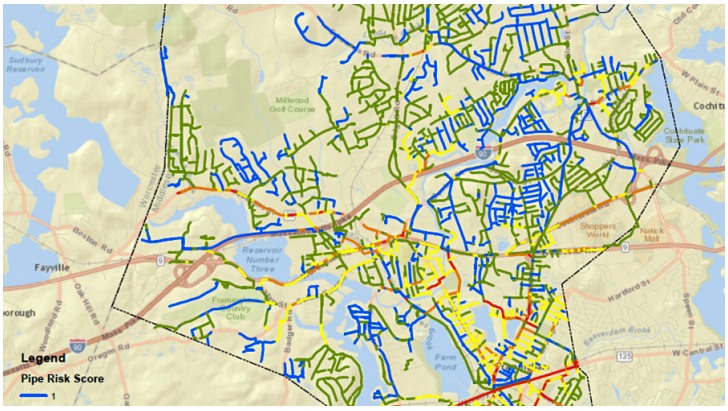
Argon's goal is to complete the inspection to work order cycle, integrating with your existing software systems

Argon integrates with and complements your existing CMMS and Inspection software





Argon incorporates many inspection types



Example Argon Grades displayed in GIS

Diameter Large/ Small	Latest Inspection Type	High Defect Acceleration	Risk COF Grade	Structural Grade					
				0	1	2	3	4	5
Small	CCTV	No	1-2						
			3-4						
			5-6						
			7-8					CCTV 18 months	
			9-10						
			Unknown						

Example Portion of Argon Next Step Structural Logic

Replace Immediate Costs		
	Option 1	Option 2
	Trench	Tunnel
Costing Factor	1.25	1.00
Num laterals total	7	7
Lateral reinstate unit cost ($ per lat)	1,355	1,355
Replace unit cost ($/ft)	415	2,124
Total cost	$151,351	$589,550
Selected Option	Trench	
Selected Option Cost	$151,351	

Repair Immediate Costs		
	Option 1	Option 2
	Trench	Internal Spot Repair
Costing Factor	1.25	1.00
Num laterals in trenches	2	2
Lateral reinstate unit cost ($ per lat)	1,355	1,355
Replace unit cost ($/ft)	816	220
Feet of trench costed as point	10	10
Num trenches	2	2
Total cost	$21,233	$6,705
Selected Option	Internal Spot Repair	
Selected Option Cost	$6,705	

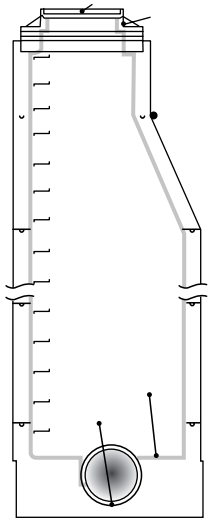
Rehab Immediate Costs			
	Option 1	Option 2	Option 3
	CIPP	Slipline	Shotcrete
Costing Factor	1.00	1.00	1.00
Num laterals in trenches	1	1	1
Lateral reinstate unit cost ($ per lat)	200	200	200
Replace unit cost ($/ft)	127	253	10,000
Feet of trench costed as point	10	10	10
Num trenches	1	1	1
Total cost	$41,662	$76,007	$2,737,859
Selected Option	CIPP		
Selected Option Cost	$41,662		

Argon Costing for an Example Pipe includes estimates for rehab, repair and replacement. life-cycle costing is also available for four different options

Other Argon Capabilities

Manholes And Special Structures:

The **Argon** steps are available for manholes and other special structures. **Argon** Scoring, Next Step and Costing gives utilites the ability to better prioritize and pinpoint assets needing reinspection, cleaning rehab or repair. **Argon** incorporates MACP inspections and can be configured for other inspection types.

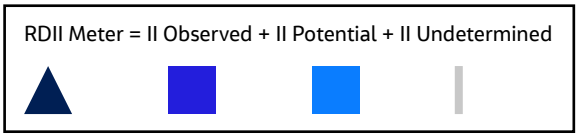


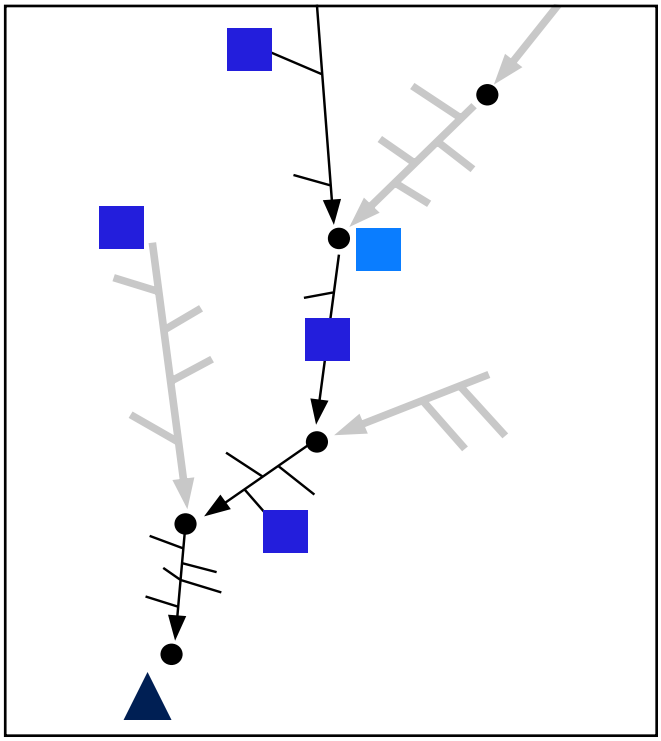
Argon Macp Inspections

Component	Struct Grade	StructII Grade	Corrsn Grade	Quick Fix Needed
Cover and Frame	3	3	0	Yes
Seal	0	0	0	No
Chimney	1	2	1	No
Cone	0	1	0	No
Wall	0	1	0	No
Bench	0	0	0	No
Steps	0	0	0	No
Channel	0	0	0	No
Drop	0	0	0	No

Infiltration And Inflow:

Argon's infiltration/inflow (II) balancing module compiles both observed and potential sources of II from multiple inspection types then allows users to balance the flow using metering data.





Argon's Infiltration/Inflow (II) Balancing Module

Appendix E. Dragon Fly

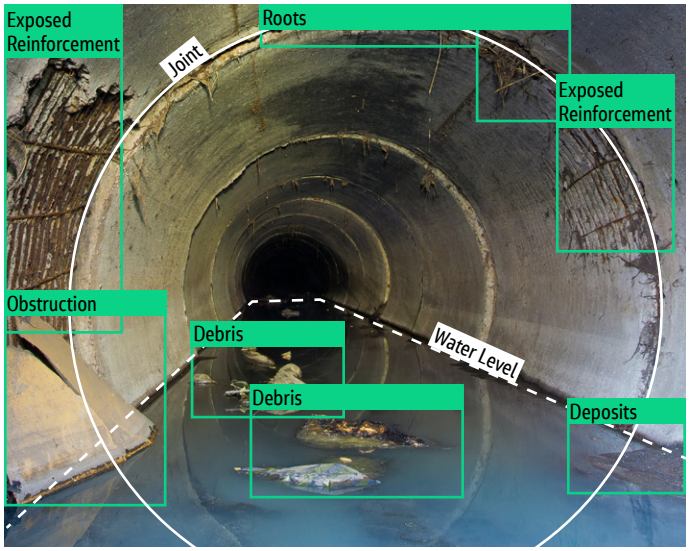
Dragonfly℠
by Jacobs

Dragonfly for Sewers

AI-powered condition assessment and guidance to cost-effectively manage collection system infrastructure.

Managing aging infrastructure requires ever-increasing time and financial resources to stay ahead of failures. While today's processes are well established, they tend to be reactive, manually intensive, and prone to errors, which results in inconsistent data. It is no wonder utilities rank data quality as one of their top challenges in analyzing how, when, and where to invest their improvement dollars.

Jacobs' Dragonfly technology allows you to review your inspection video while it analyzes and provides prescriptive guidance on how best to maintain your buried assets. Dragonfly enables you to address issues before they become problems, and provides integrated asset management support, generating optimized re-inspection and maintenance schedules as well as prioritized rehabilitation lists. Dragonfly is vendor-neutral and compliments your existing CCTV management tools and investments.



Dragonfly efficiently provides the accurate data and AI-driven recommendations your team needs to optimize decision-making and refine your system management and intervention strategies.

✓ Accurate

- Consistent and objective data
- AI reduces the variability of manual detection
- Rigorous, human-augmented QA/QC procedures
- Trained on over 10 million feet of sewer video footage
- Validated by Jacobs sewer inspection experts

✓ Recommendations Powered by Argon

- Support proactive intervention
- Forecast remaining useful life with AI
- Create maintenance plans and schedules
- Create rehabilitation plans
- Develop cost estimates for high-level budgeting

✓ Efficient

- Automatically identify standard sewer defect codes
- Track and analyze defect locations and severity
- Detect faster than the human eye
- Process more backlog CCTV footage
- Rapidly identify issues

✓ Trusted, Comprehensive Support

- Jacobs provides a complete range of professional services to help our clients build thriving cities, create resilient environments, and realize operational advancements.
- Dragonfly is an integrated offering built on the foundation of Jacobs' global water and digital expertise.

Upload

- Sewer Video
- Pipe Inventory

Analyze

- Detect Defects
- Score Assets

Guide

- Analytical Insights
- Recommendations

Upload

Dragonfly is a 100% web-based application. Users access the solution from a browser to view the dashboard and upload/download files through a secure transfer interface.

Analyze

Once uploaded, Dragonfly's AI "eye" automatically identifies sewer pipeline defects, their locations, and severity. The results then undergo a thorough quality assurance protocol where they are reviewed by NASSCO PACP-certified technicians for accuracy and completeness.

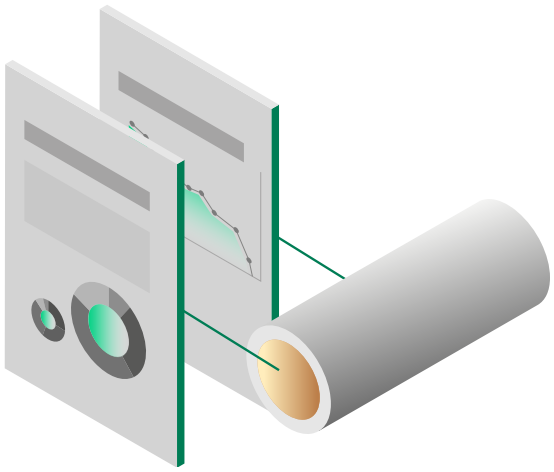
Data can be exported from the web interface and the final NASSCO Standard Exchange PACP Database imported into client GIS, CMMS, or CCTV data organization tools.

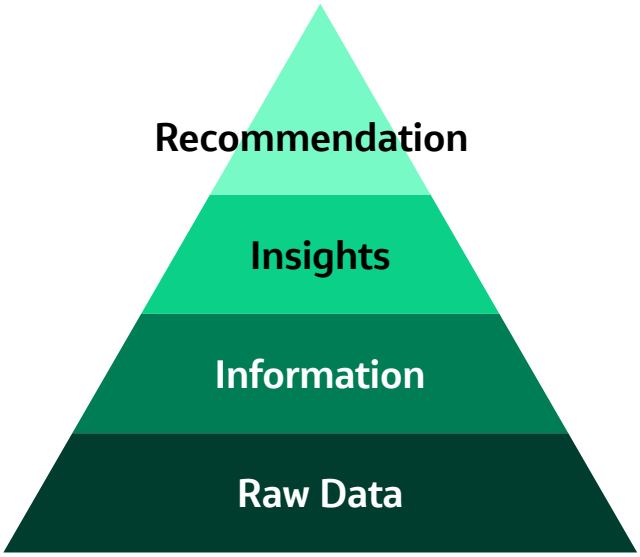
Guide

Dragonfly turns data into recommendations using the advanced analytics and powerful AI-driven forecasts in Jacobs' asset management model Argon (formerly SCREAM).

Argon forecasts how frequently different types, quantities, and combinations of defects lead to failure and suggests cost-effective remedial solutions.

The robust asset management engine can identify priority pipes, schedule re-inspection, identify needed maintenance and offer estimates for rehabilitation, repair, and replacement.





Email: dragonfly-info@jacobs.com

Jacobs