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Volume 2, Chapter 2

Asset Management Software

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1.0 PURPOSE

The purpose of this document is to provide the Entity with sufficient guidance, such that Asset Management (AM) personnel that are employed by the Entity, can manage the deployment of Asset Management Software (AMS), within the Entity.

AMS is a dedicated application used to record and track each asset, throughout its lifecycle. Implementing AMS contributes to the acceleration of organizational maturity, by enabling:

- Successful deployment of an Asset Management System (as defined within Section 3 of this document), such that the Entity can make better-informed, evidence-based decisions about its assets.
- Optimal management of the asset portfolio, by balancing costs, risks, and performance, across all assets, and throughout the asset's lifecycle.

AMS is a pre-cursor to several key components of the Asset Management System. For example, implementation of AMS shall be a mandatory requirement prior to:

- Initiating an Asset Register (AR)
- Launching Condition Assessment (CA) Programs

2.0 SCOPE

This document describes the steps an Entity should take toward establishing AMS, and the minimum requirements that AMS shall meet, including functional characteristics. Other key topics that are covered include:

- AMS Operating Model
- Data Management Methodology for successfully deploying AMS
- A supporting IT-framework that is necessary to implement AMS
- Selection criteria for the Enterprise Architecture, that are associated with AMS

Given that that guidance contained here is based on relevant standards and best-practices, Entities should use this document as a foundation upon which to build AMS, specifically tailored to the Entity's needs.

3.0 DEFINITIONS

Term	Definition
Asset Class	A group of assets having a similar nature or function in the operations of an Entity, and which, for purposes of disclosure, are shown as a single item without supplementary disclosure.
Asset Data Policy	This mandates the asset data structure and the asset class metadata rules to be adopted across the asset lifecycle, from concept to disposal.
Asset Lifecycle	The phases an asset transitions through, from inception to disposal.
Asset Management	The coordinated activity of an organization to realize the full potential of any asset.
Asset Management Policy	A statement that sets out the principles by which the organization intends to apply the Asset Management System, to achieve its organizational objectives.
Asset Management Process	The method used to implement an Asset Management System.
Asset Management System	Set of interrelated or interacting elements to establish Asset Management Policy, Asset Management Objective, and processes to achieve those objectives. (i.e. management systems for the management of assets).
Lifecycle	The cycle of activities that an asset (or facility) goes through while it remains an identity as a particular asset, i.e. from planning and design to decommissioning or disposal

Term	Definition
Middleware	Software that acts as a bridge between a network operating system and applications.
Operating Context	The circumstances in which a physical asset or system is expected to operate.
Quality Management	The act of overseeing all activities and tasks needed to maintain a desired level of excellence.
Acronyms	
AI	Artificial Intelligence
AM	Asset Management
AMS	Asset Management Software – Also known as an asset management tool or solution, is a dedicated application that is used to record and track an asset throughout its lifecycle, from procurement to disposal.
AMP	Asset Management Plan
AR	Asset Register – A list of all assets containing pertinent details about each asset to track the value, physical location, operating cost, condition, utilization, and all other necessary details, to better manage the asset.
BIM	Building Information Modelling
BMS	Building Management System
CA	Condition Assessment – The process of periodic physical inspections, assessments, measurements, and interpretation of the resultant data, to indicate the condition of a specific asset.
CAD	Computer Aided Design
DQ	Data Quality
EDMS	Electronic Document Management System
FAR	Fixed Asset Register
FRACAS	Failure Reporting, Analysis, and Corrective Action System
GIS	Geographic Information System
ISMS	Information Security Management System
PID	Piping and Instrumentation Diagrams
QMS	Quality Management System
RACI	Responsible, Accountable, Consulted, Informed
SAMP	Strategic Asset Management Plan
SCADA	Supervisory Control and Data Acquisition
SIT	System Integration Testing
SLA	Service Level Agreement – Performance Contract signed between the Entity and Service Providers.
UAT	Functional/User Acceptance Testing
VST	Volume/Stress Testing

Table 1: Definitions

4.0 REFERENCES

- International Standards Organization (ISO) 55000:2014 – Asset Management, Overview, Principles and Terminology
- ISO 55001:2014 – Asset Management, Management Systems – Requirements
- ISO 55002:2014 – Asset Management, Management Systems – Guidelines for the Application of ISO 55001
- ISO 41001:2018 – Facility Management, Management Systems — Requirements with Guidance for Use
- ISO/TS 55010:2019 – Asset Management – Guidance on the Alignment of Financial and Non-Financial Functions in Asset Management
- ISO 9000:2015 – Quality Management Systems
- ISO 31000:2018 – Risk Management Guidelines
- ISO 8000-8:2015 – Data Quality – Part 8, Information and Data Quality, Concepts and Measuring

- BS EN 62508:2010 – Guidance on Human Aspects of Dependability
- PAS 280:2018 – Through-life Engineering Services – Adding Value Through a Common Framework, Guide
- BS EN 16991:2018 – Risk-based Inspection Framework

5.0 RESPONSIBILITIES

Role	Description

Entity Asset Management Function	An Asset Management function shall be established within the Entity and mandated by the Entity's Leadership, to develop and implement an effective Asset Management System for the Entity. Responsibilities undertaken by the Entity include, but are not limited to, the following:
	• Developing, deploying, and monitoring the Asset Management System.
	• Establishing standards and performance measures for the Asset Management System.
	• Suitably identifying, controlling, and mitigating hazards which affect the Asset Management System.
	• Establishing the impact of future requirements on the Asset Management System.
	• Planning and managing a program of Condition Assessments (CA) as necessary, in line with the guidelines laid out within National Manual for Assets and Facilities Management (NMA&FM) – Volume 3.
	  ○ Manage compilation of an Asset Condition Assessment Report.
	  ○ Manage the establishment of an Asset Hierarchy, including criticality of assets.
	  ○ Plan and implement recommendations established by the Condition Assessment Report.
	• Sourcing appropriate Asset Management practitioners to formulate the Entity's Asset Management Team.
	• Training and briefing personnel as applicable, such that the Asset Management System can be successfully developed, deployed, and maintained.
	• Managing data quality such that information derived from the data is used to inform the Asset Management Strategy, and intelligent decision-making regarding the Entity's assets.

Service Providers	Responsibilities which are likely to be outsourced to Service Providers are as follows:
	• Collaborate with the Entity to develop an Asset Management Policy.
	• Develop Asset Management System requirements.
	• Understand, develop, prepare, and deploy AMS requirements.
	• Develop the Entity's Asset Management System such that it meets the Entity's existing, and likely future needs.
	• Successfully undertake Change Management such that Entity operations are not negatively impacted by a change process.
	• Train Entity personnel to support the implementation of the Asset Management System.
	• Effectively Manage Risk (i.e. through Risk Assessments and Method Statements – RAMS).
	• Deliver a program of Condition Assessments (CA), including:
	  ○ Compilation of an Asset Condition Assessment Report.
	  ○ Establishing an Asset Hierarchy (showing criticality of assets based on data provided by the Entity).

Corporate Risk Manager	The Risk and Compliance Manager works with the organization to advise Management of any potential risks that may affect the reputation, safety, security, financial sustainability, and existence of the organization. He is expected to provide a better assessment of the risk management policies

	and protocols, in order to produce policies and recommendations to avoid threats, reduce or transfer risks and/or mitigate the effects of those which are essentially unavoidable. This responsibility includes managing the risks associated with the organization's employees, customers, reputation, assets, and interests of its stakeholders. As such, he will be working in a variety of sections, and specialize in several areas including: • Business Continuity • Corporate Governance • Enterprise/Operational Risk • Information and Security Risk • Market and Credit Risk • Regulatory and Legal Risk • Technology Risk
Corporate Management Systems Manager / Coordinator	• Assist and take responsibility for a variety QMS and ISMS activities such as document control activities, associated internal and external audit activities, risk reporting activities, management reviews' preparation and follow-up, reporting, and awareness sessions. • Provide administrative support for the implementation and maintenance of ISO 27001:2013. • Represent either the quality manager or information security manager at relevant meetings, or working parties as required. • Create, maintain, and develop any specific documentation in relation to the activities undertaken by the role holder. • Assist the quality manager or information security manager in any other tasks that may arise from time to time. • Participate in internal auditing activities. • Support with the introduction of new Asset Management Processes.
Management System Cyber Security	• Monitor all operations and the IT infrastructure. • Maintain all security tools and technology. • Monitor internal and external policy compliance. • Monitor regulation compliance. • Collaborate with different departments within the organization, to reduce risk. • Support the evaluation and implementation of modern technology. • Continually audit policies and controls. • Ensure the organizations' cybersecurity is addressed with top priority. • Develop and manage the security incident-response program.
Chief Information Officer	Develops and deploys the IT Policy. Accountable for managing the risk and performance of Information Technology Systems, and IT. Responsible for the development of the IT strategy and to ensure that all required systems are in place to support its operations and objectives.
Business Analyst - Middleware	• Understand applications from the business perspective, and how the application itself, delivers the business requirements. • Understand the technical design of the AMS systems and interface applications. • Responsible for various system functions including application installations and configurations, patching and upgrade maintenance, system design, interfaces, infrastructure monitoring, and disaster recovery. • Manage incident items by problem solving, coordinating, escalating, and documenting through to resolution, validation of service restoration, and root cause. • Responsible for troubleshooting of firewalls, middleware, server, database, data transmissions, and access issues, making recommendations for improvements and changes. • Responsible for resolving information security and cyber security threats and vulnerabilities at the operating system and application levels. • Responsible for AMS upgrades, patches, and issue resolutions.

	• Responsible for new or enhanced AMS change management and customization requests.
Business Analyst – Add Drop Multiplexing	• Planning, creating, testing, and deploying AMS. • Responsible for automating internal business processes. • Responsible for workflow and automation tools. • Compiles with the IT Policy. • Ensure the Service Delivery Processes of AMS are compliant with the Service Level Agreement (SLA). • Manages the AMS release process. • Manages the resolution process for incident management. • Manages the resolution process for problem management.
Business Analyst – Geographical Information Systems (GIS) Applications	• Responsible for managing the geographic information systems. Engages with AM to develop and deploy the GIS, and location-based strategies. • Responsible for tracking and managing GIS tools for geo location and geo fencing surveys, both outdoor and indoor navigation. • Responsible for collaborating with computer-aided design (CAD) technicians, developing web apps and tools, and integrating GIS with other technologies.
Business Analyst – Tagging	• Responsible for tagging requirements and developing the tagging procedure and documentation. Responsible for tagging equipment selection, and carrying out tagging at the site. • Responsible for data validation to ensure data integrity, monitors the deployment and management of tags, coordinates and triages tagging issues.
Business Analyst – Mobile application	Responsible for developing the AM mobile application and translating AM requirements to design and development of mobile applications to: • Create and deliver user-centric interfaces. • To design wire frames, graphics, screen mock-ups and participate in usability evaluations. • To perform due diligence in selection of mobile device and mobile platforms for deployment of AR and CAS. • To develop the business case in collaboration with purchase and contracts team. • To develop the mobile application's licensing strategy, support the business case and the IT operations-plan, with accurate cost estimations (+/- 5 to 7 % accuracy).
Business Analyst – Data Management	• Identify, capture, and elicit the data requirements for AMS functional modules, and ensure the deployment of DQ rules in line with the Asset Data Policy. • To develop the Data Flows, Enterprise Relationship Diagrams, Logical Data Model to represent the data requirements of AMS. • Develop the integrated flow of information across various systems, based on the IT Landscape. • Engage and conduct Data Management audits. • Support IT Due Diligence. • Interface with AM, IT Architects, AM Database Analysts, and AMS. The Configuration Team should understand current data usage, current data issues as well as desired data requirements. • Conduct data analysis against current systems, and assess the feasibility of replacing or integrating AMS as part of the Entity's amalgamation program. • Design and Deploy KPI'S, and support data Parametric and Non-Parametric analysis, for Asset Performance and Reliability analysis. • Conduct impact analysis of existing reports, dashboards, and queries, while performing upgrades. • Develop and Support Data management plans for AMS functional modules, upgrades/ decommissioning.
Business Analyst – Helpdesk IT	• Responsible for AMS technical Help Desk, and to ensure prompt management of the tickets, as per SLA.

	• Engages and works with AMS configuration team and performs routine system and user administrative tasks. • Follows the configuration procedures for system specification changes or the addition, change, or deletion of AMS users. • Ensures necessary documentation is obtained and properly authorized for Help Desk requests. • Supports the incident response team in the event of a technology emergency or breach in confidential information. • Assists in analyzing and deploying AMS updates and patches. • Ensure the Service deliver processes of AMS is compliant with the SLA. • Manages AMS release processes. • Manages the resolution process for incident management. • Manages the resolution process for problem management.
Business Analyst Internet of Things (IoT), Operations Technology	Responsible for all AMS IoT technical support: • SCADA and Operations Technology integration with AMS. • Develops and manages the Input/ Output listings, in line with Control Systems / P&I diagrams: • Manages authorizations and permits for shutdowns and IoT devices energization. • Ensure necessary documentation is obtained and properly authorized, for such IoT requests. • Supports incident response team in the event of a technology emergency or breach in cyber security. • Assists in analyzing and deploying AMS updates and patches to support IoT device updates and online configuration.
Business Analyst - Artificial Intelligence	• Responsible for all AI tool deployment and System Identification activity. • Engages and works with the AM and Enterprise Architects, for design selection /evaluation and deployment of AI tools. • Responsible for designing the pilot projects, and demonstrating the feasibility of the solution(s). • Responsible for developing the business case along with the benefit realization road map, jointly with the AM. • Assists in analyzing and deploying updates and patches to support the continuous operations of the advance systems.
Business Analyst – AMS	• Responsible for AMS functional analysis. • Engages and works with the AM to develop AMS road map. • Engages with AMS IT team, to develop the road map for AMS functional deployment. • Supports the development of functional processes and sub-processes, including the workflow of functional modules. • Details the functional and nonfunctional specifications for AMS. • Ensures necessary documentation is developed, obtains proper authorization, and hands it over to the IT configuration team, as per Expro AMS Project Methodology.
Business Analyst – BMS	• Responsible for all BMS software functional analysis. • Engages and works with the AM to develop the BMS road map. • Engages with the AMS IT team, to develop the road map for BMS functional deployment. • Supports the development of functional processes and sub-processes, including the workflow for the functional modules. • Details the functional and nonfunctional specifications for BMS. Ensures necessary documentation is developed, obtains proper authorization and hands it over to the IT configuration team, as per Expro AMS Project Methodology.
Business Analyst – PMS, Niche AM applications	• Responsible for all AM Niche software functional analysis, to support Asset Performance. • Engages and works with the AM to develop the Asset Class Performance road map.

	• Engage with AMS IT team to develop the road map for performance improvement program deployment. • Supports the development of functional processes and sub processes, including the workflow for the functional modules. • Details the functional and nonfunctional specifications for Performance Management. Ensures necessary documentation is developed, obtains proper authorization and hands it over to the IT configuration team, as per Expro AMS Project Methodology.
Business Analyst – Data Assurance	• Responsible for all AMS Data Assurance programs. • Engages and works with the AM Team to develop the Asset Data Policy road map and deployment program. • Develops the management system interface for deploying the Data Assurance program. • Engages with DQ Analyst to develop the Data Quality profiling methods. • Develops the guidance to deploy the Asset Data policy with Meta Data rules and guidelines, at the module level. • Supports the incident response team in the event of functional failure of the Data Profiling tools, or breach in confidential information. • Assists in analyzing and deploying Data Profiling tool updates and patches.
Business Analyst – Data Quality	• Responsible for all AMS IoT technical support. • Engages and works with the AMS configuration team, and performs routine system and user administrative tasks. • Follows the configuration procedures for system specification changes or the addition, change or deletion of AMS users. • Ensure necessary documentation is obtained and properly authorized for such requests. • Supports the incident response team in the event of a technology emergency, or breach in confidential information. • Assists in analyzing and deploying AMS updates and patches.
Head of Asset Management	• Develops the team and demonstrates leadership and vision in AM. • Responsible for Managing the AM section, and has control of the budget and resources to deliver the Entity's business plan, and also in-charge of Capital and Operations programs of work. • Accountable for Asset Management Systems compliance, in line with the Entity's management systems. • Accountable for the development and deployment of asset management policy, strategy, and asset data policy. • Accountable for development and deployment of AM programs, in line with the AM road map. • Accountable for developing the AM technical road map. • Accountable for assessing, selecting and procurement of AMS products. • Accountable for assessing, selecting and procurement of Condition Assessment technologies, methodology, and equipment. • Develops training and assessment programs, including development of new entrants to the discipline.
Asset Information Systems Manager	Responsible for Performance and Configuration of AM IT systems. This role reports directly to the Head of Asset management with a dotted-line for performance with the Head of IT. Responsible for approving the AM IT business case. This Role is the single gateway between AM and IT. All the activity between AM and AMIS team shall be task-based, and follow the IT Project Management.
Geographical Information Systems (GIS) Manager	• Responsible for all GIS integration with AMS. • Responsible for outdoor and indoor navigation and support work management with a high degree of accuracy (Outdoor <1 to 3 Meter; Indoor using beacons < 1 Meter).

	• Responsible for developing and deploying location-based strategies for the AM. • Responsible for the optimization of contract work allocation, including routing of the mobile work-force team, to carry out the work in the most cost-effective manner, and support carbon reduction. • Manages the tools for developing apps and integrating GIS with other Entity software systems.
Help Desk Functional Asset Information Systems	• Ensure the service delivery processes of AMS are compliant with the SLA. • Manages the AMS release processes. • Manage the resolution processes for incident management. • Manages the resolution processes for problem management.

Table 2: Responsibilities

6.0 PROCESS

Establishment of the Asset Management System shall follow the process outlined in Figure 1, below, which features six phases. The AMS component of the process, highlighted within the diagram, shall be explained within subsequent sections.

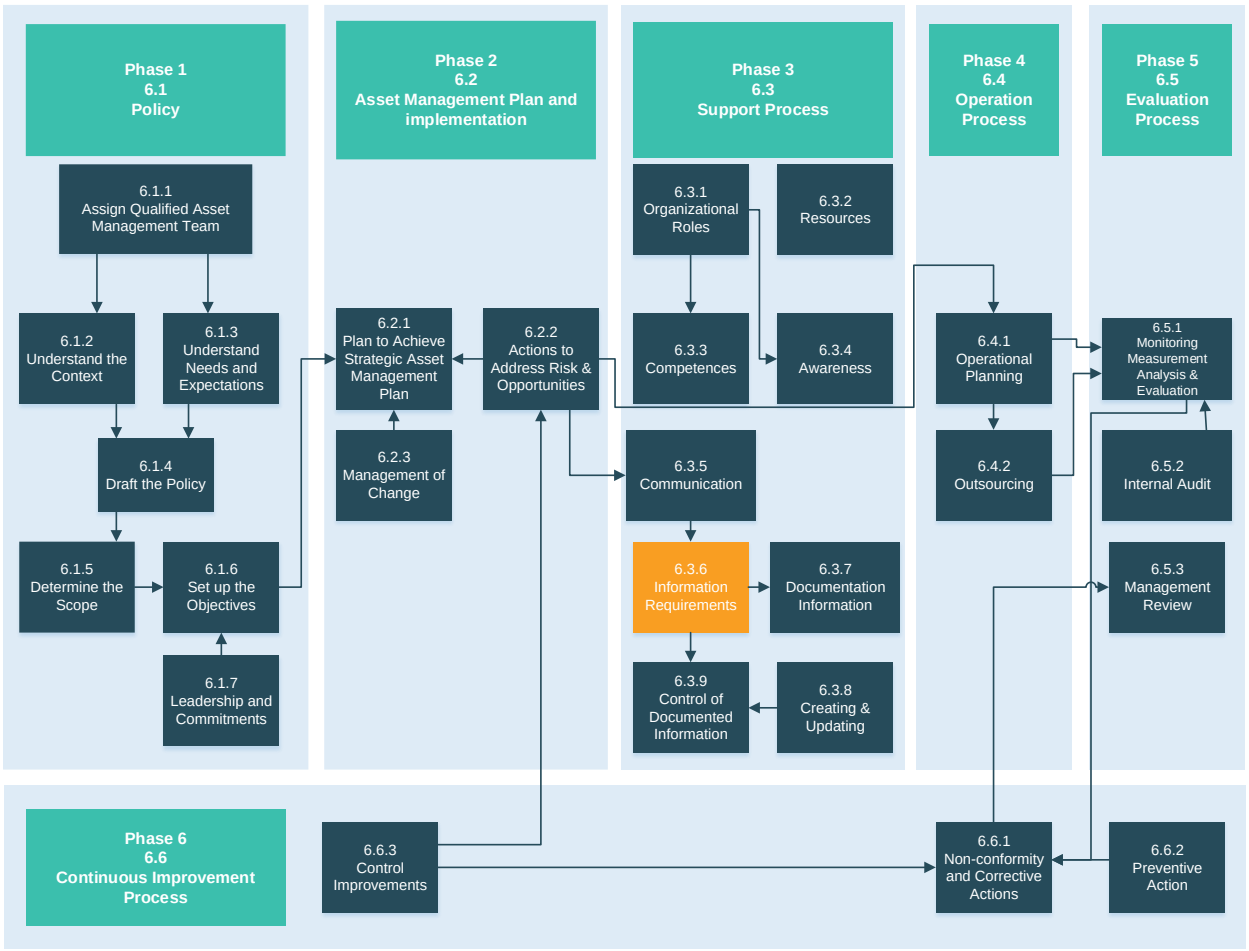


Figure 1: Establishing an Asset Management System

Table 3 (below) cross-references other documents throughout the NMA&FM specifically related to the components of the Asset Management System that is described in Figure 1 (above).

Implementation Phase of the Asset Management System	Relevant Component of the NMA&FM
Phase 1 – Asset Management Policy	Volume 2, Chapter 2 of the NMA&FM – Policy and Planning
Phase 2 – Asset Management Planning & Implementation	Volume 2, Chapter 2 of the NMA&FM – Policy and Planning
Phase 3 – Asset Management Support Process	Covered within this document
Phase 4 – Asset Operation Process	Covered throughout Volume 5 of the NMA&FM – Operations Management
Phase 5 – Evaluation Process	Volume 2, Chapter 2 of the NMA&FM – Continuous Improvement
Phase 6 – Continuous Improvement Process	Volume 2, Chapter 2 of the NMA&FM – Continuous Improvement

Table 3: Asset Management System Reference Sections

6.1 Asset Management Support Process

This section addresses the requirements for implementation of AMS solutions. The Asset Management Support Process features six (6) procedures as outlined in Table 4 (below), while the Asset Management Support Process is outlined within Attachment 1 – Asset Management Support Process.
The document map given below in figure 2, explains the navigation process for the end to end implementation of AMS. (WBS references relate to Figure 7 and subsequent figures.)

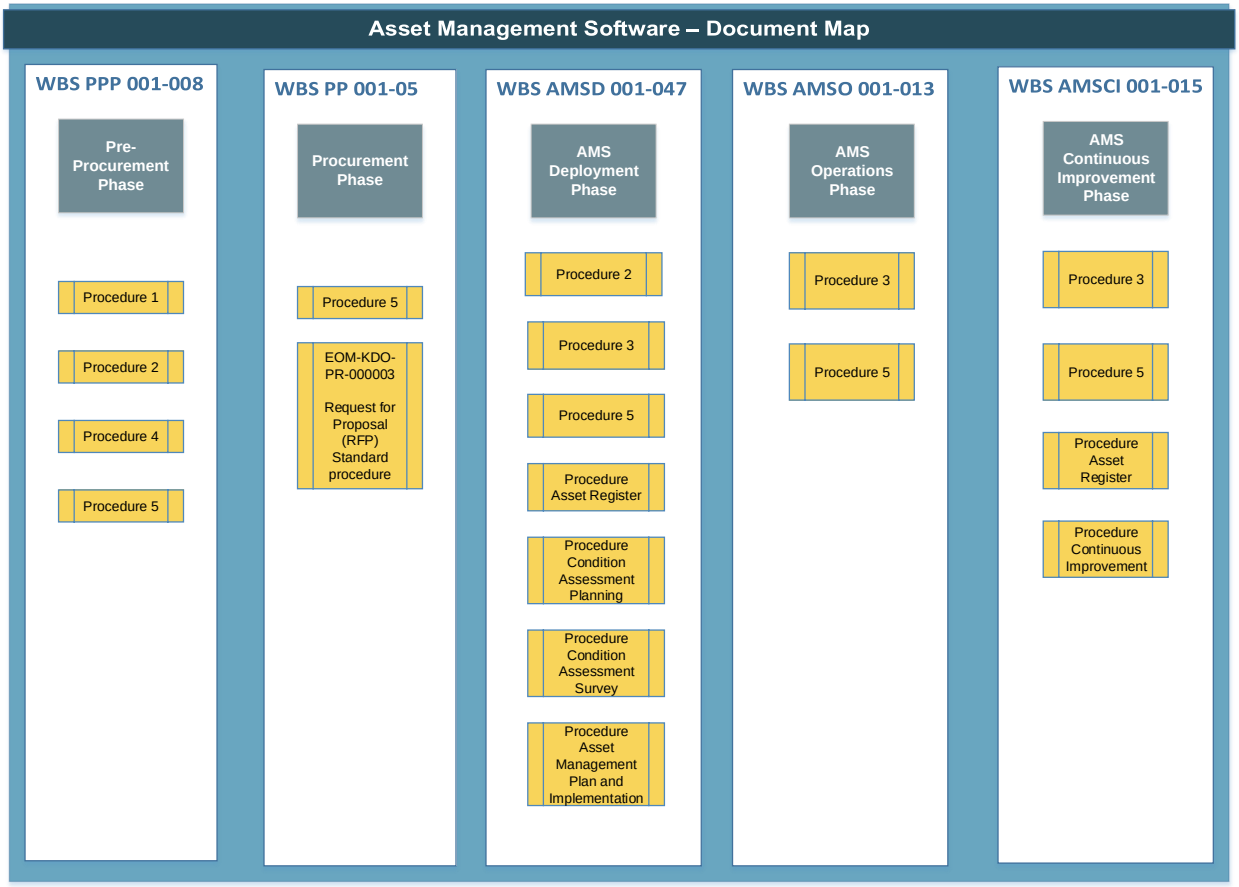


Figure 2: AMS Document Map

Asset Management Support Process	Procedure Name
Procedure 1	Developing AMS implementation requirements
Procedure 2	Developing an Operating Model to support AMS deployment
Procedure 3	Data Management methodology for Asset Data Policy deployment
Procedure 4	Assessing existing IT Systems
Procedure 5	Selecting Enterprise architecture for AMS
Procedure 6	Project Methodology to support AMS development

Table 4: Procedures Comprising the Asset Management Support Process

The Entity should follow procedures outlined in Table 4 (above), in order to implement AMS throughout its Facilities.

6.1.1 Procedure 1 – Developing AMS Implementation Requirements

Figure 3 (below), outlines the components of Procedure 1, which guides the Entity in developing AMS implementation requirements.

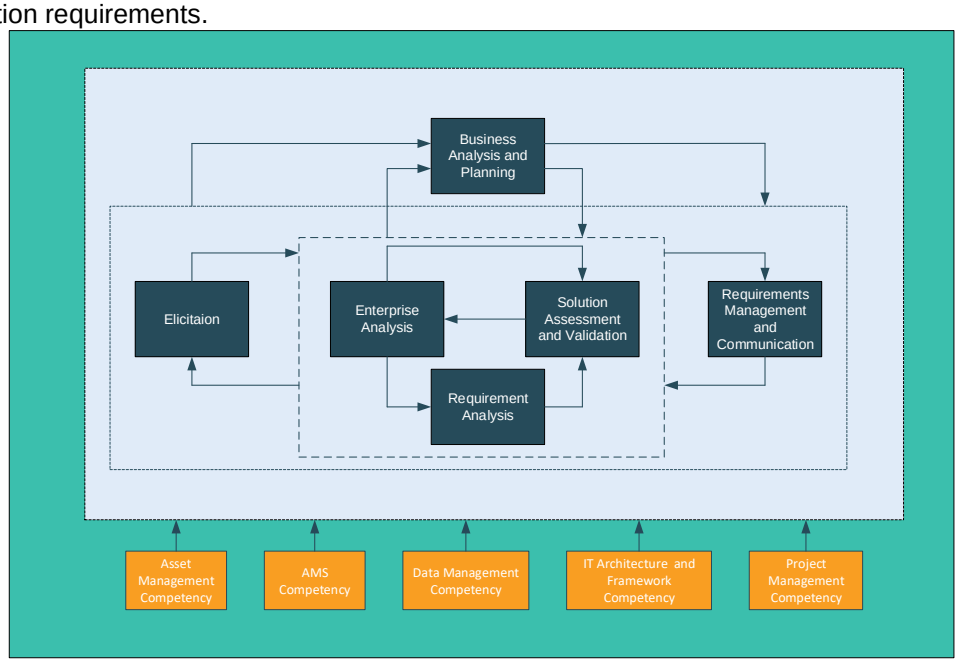


Figure 3: AMS Business Analysis Dependencies

6.1.1.1 Business Analysis and Planning

The Entity should determine which activities are necessary to complete business analysis and planning, such that AMS can be successfully developed and enabled. This stage involves:

- Deploying Asset Management policy (EOM-ZA0-PR-000007)
- Managing stakeholder requirements
- Selection of business analysis techniques and requirements
- Monitoring progress

6.1.1.2 Elicitation

The purpose of Elicitation is to ensure that the stakeholder's needs are fully understood and reflected within AMS. Unrealistic requirements shall be identified, and suitable action taken by the Entity to mitigate any risks associated with unclear scope.

At this stage, Asset Management personnel and IT professionals should work collaboratively with Entity stakeholders, to identify and understand their needs. Particular focus shall be given to the deployment environment (including AMS user's supply chain, and the delivery system).

6.1.1.3 Requirements, Management and Communication

This stage features development of a plan to determine project-critical components, such as how:

- Conflicts shall be managed
- Requirements are established, met by AMS, and communicated
- Stakeholders shall remain in agreement
- Knowledge is gained and shared (including lessons learned)

6.1.1.4 Enterprise Analysis

Enterprise Analysis involves Asset Management personnel and IT professionals, carrying out tasks such as:

- Identify the business need for AMS
- Refining and clarifying the need
- Defining a solution-scope that can be feasibly implemented

Deliverables include, for example:

- Problem definition and analysis
- Business case development
- Feasibility studies
- Specifications
- Concept system architecture design
- Scope definition

6.1.1.5 Requirements Analysis

Requirements Analysis should enable an AMS solution, which best meets the needs of the Entity. When undertaking Requirements Analysis, Asset Management personnel and IT professionals shall:

- Review and prioritize stakeholder requirements, determined at other stages in the process
- Develop AMS solutions
- Alternatively update and develop solutions, based on stakeholder requirements

6.1.1.6 Solution Assessment and Validation

This stage describes how Asset Management personnel and IT professionals evaluate proposed AMS solutions (including the IT environment and the deployment framework) by:

- Determining which AMS solution best fits the business needs
- Identifying gaps and shortfalls in the AMS solutions
- Determine necessary changes to the solutions

Deployed solutions shall also be subjected to Solution Assessment and Validation, with particular attention paid towards the impact of the existing infrastructure on the AMS solution.

During this stage, scenario analysis shall be used to test and validate future demand, and validate how well the proposed AMS solution meets the original intent.

The final step at this stage is for the Entity to establish a Benefits Realization Plan, which will assess the performance and effectiveness of the AMS solution.

6.1.2 Procedure 2 – Developing an Operating Model to Support Deployment of the AMS

The Asset Management Systems Operating Model defines a standardized approach to using AMS for all Entity stakeholders, and enables optimized AMS implementation. The Asset Management Systems Operating Model features three key components:

1. People
2. Processes
3. Technology

The Operating Model is a pre-requisite to AMS implementation and shall comprise of, or feature reference to, the following:

- Design Principles.
- Asset Management Policies.
- End-to-End AMS Processes capturing ‘As Is’ and ‘To Be’.
- AMS Configuration Guidelines.
- Assessment of IT Infrastructure and Operating Costs (Refer to Section 6.3.3 of this document).
- Data Management Methodology for AMS (Refer to Section 6.3.4 and 6.3.5 of this document).
- AMS Responsible, Accountable, Consulted and Informed (RACI) Matrix.

Further details are provided within Attachment 2 – Asset Management Systems Operating Model.

6.1.3 Procedure 3 – Data Management Methodology for Deployment of Asset Data Policy

Entities shall employ a Data Management Methodology focusing on Asset Data Quality (DQ), such that the Asset Data Policy can be successfully deployed throughout each Entity.

The following guidance shall be adhered to when establishing a Data Management Methodology:

1. Promote and create entity-wide awareness of DQ and its relevance to AMS.
2. Develop and enforce DQ rules to be applied at the point of transaction, for each AMS module.
3. Establish DQ Process governing continuous improvement of DQ rules.
4. Seamlessly integrate the Data Management Systems with Quality Management Systems.
5. Develop a DQ Plan for each AMS module, including associated integrated Asset Information derived from, for example: GIS, SCADA, BIM, BMS.
6. Implement standardized workflows for addressing DQ within each AMS module.
7. Implement standardized workflows for addressing DQ associated with Asset data collection, registration, and processing.
8. Implement DQ analysis and metrics, and capture DQ trends.

Implement monitoring, control, and cleansing of data.

6.1.4 Procedure 4 – Assessing Existing IT Systems

Figure 4 (below), shall be used as a basis upon which to establish a procedure for assessing the Entity’s Asset Management and Facility Management Systems.

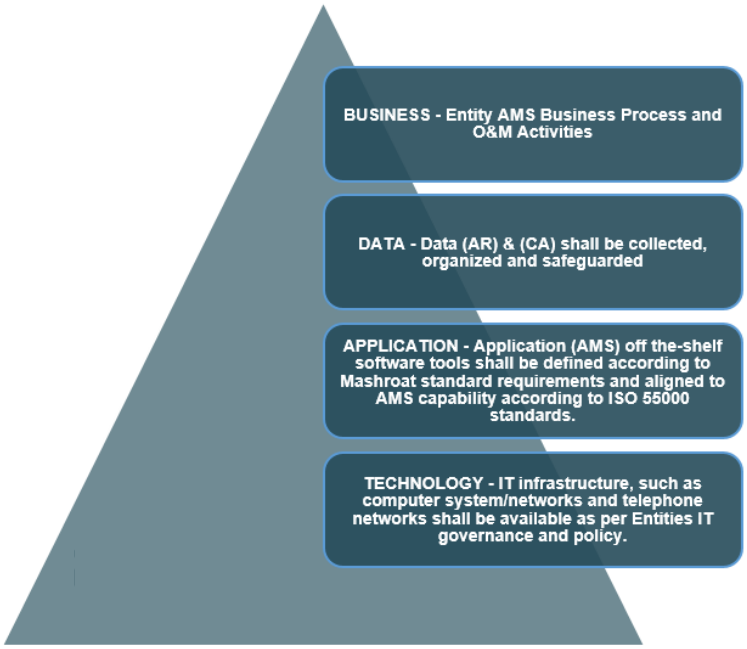


Figure 4: IT Architecture in AMS Implementation

Entities shall assess IT systems, considering the following aims:

1. Limit, as far as is reasonably practicable, fragmented applications and processes (i.e. target full integration).
2. Optimize processes which are agile, and enable accomplishment of business strategies.
3. Manage the complexity of the IT landscape, lower operational costs and maximize flexibility.

6.1.4.1 IT Due-Diligence overview

The objective of an AMS IT due diligence is to identify and qualify several key factors which includes Risk, Opportunity, Business issues with technology implications and transition plan for business as usual.

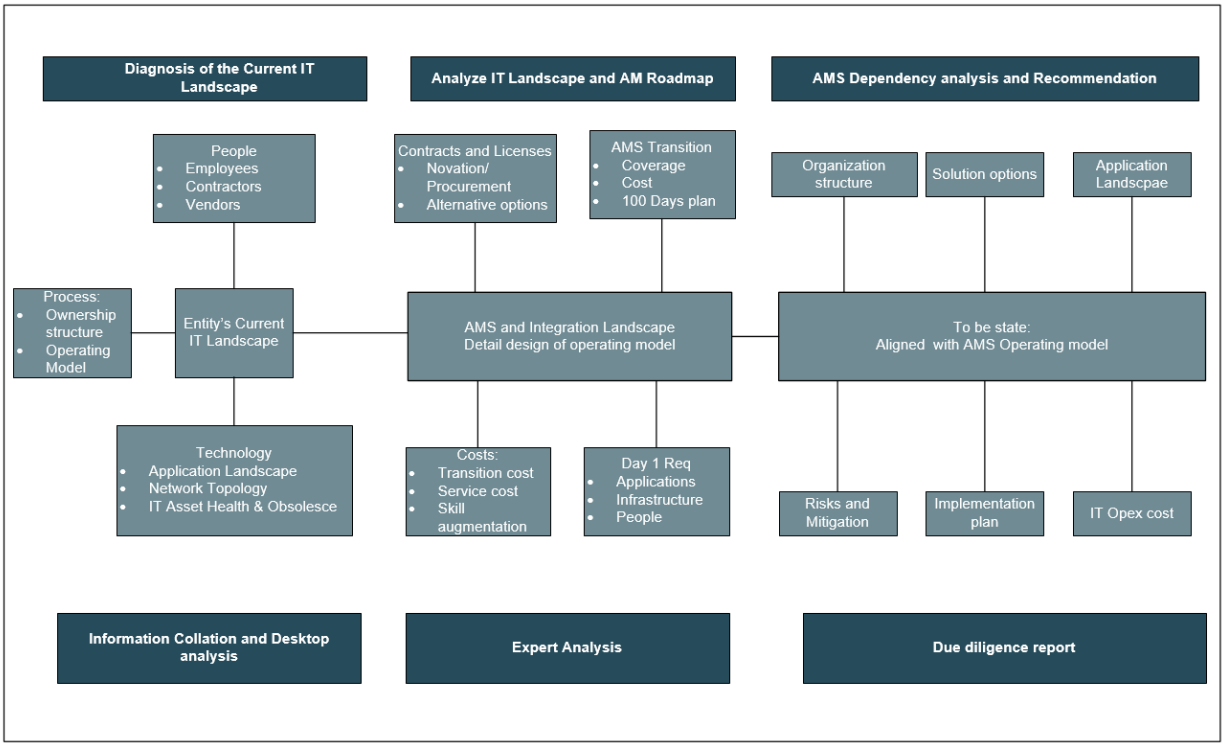


Figure 5: IT Due Diligence Process

AMS success criteria depends on “How the technology” is leveraged using a process-based approach to deliver AMS objectives. The two types of IT Due Diligence will be conducted for AMS program;

Pre-AMS procurement which enables to accurately procure and develop the first 100 days’ deployment with details.

- This will enable a joined up approach for procurement with AM, O&M and Contract team enabling to establish the first 100 days’ success criteria
- Define the Outcome of the AMS program.
- Provide inputs for AMS budget estimation and detail business case
- Agree on the Benefit realization process for AMS

For Entity’s who have an AMS / Post procurement of AMS all the above with detail cost model and AMS IT operating cost 3-5 % accuracy

The key points that will be covered are given below in Table 5;

Due Diligence Type	Description
Pre - AMS Procurement	The focus shall be to analyze the Entity's IT landscape and develop the High-level cost estimation for • Software, hardware and services • Non-IT infrastructure, hardware and services • Verify and agree on the quantity of software licenses for AMS based on AMS roadmap • Verify and propose the Non- AMS software licenses and services to be procured to support the deployment in the existing IT Landscape • Verify and recommend the modification to the Hardware and Network communication devices to be procured to support the deployment • Validate and verify the Hardware Sizing for AMS • Develop the Vendor Technical assessment criteria for Tender/ RFP • Develop the project plan for the first 100 days in line with Expro AMS Methodology, the IT framework adopted by the Entity • Develop the AMS IT Operations cost to support the AMS business case for budget approval • Develop the AMS Cost model for the first 100 days with an accuracy level of 5-10% • Support the contract team to publish the RFP
Existing IT / Post procurement	The focus will be to carry out detail analysis of the IT landscape to develop the detail project plan for the program in line with the IT framework adopted by the Entity. 100 Day plan • Deployment plan for Software, hardware and services • Deployment plan Non-IT infrastructure , hardware and services • AMS work plan and contract work packages • Assessment of the inventory of interfaces to be implemented for AMS • AM and IT Roadmap • Develop the Cut over and the transition plan including the cost model

Table 5: IT Due Diligence Type

6.1.5 Procedure 5 - Selecting Enterprise architecture for AMS

The following key items mentioned below will be covered as part of the AMS Enterprise architecture assessment

- The principles around which the future architecture strategy for Entity's AMS will be based.
- Review of the goals of these principles in order to build a stable, flexible Information Services architecture which will best support AR/CAS and AMS strategy. The review of the architecture guiding principles will underpin and inform the Entity about it's, Information, Technology and Security domain principles. This will lay the foundation on which the Entity shall provide guidance specific to AMS and Integration with the National Asset Register (NAR)
- The assessment will focus on the key attributes of the Entity's Enterprise architecture, mainly its Flexibility, Sustainability, Scalability and Governance to support the AMS and Asset Data Policy deployment
- The assessment will include the business continuity aspect of the AMS interfaces both at the application level and at the middleware level
- The assessment will include identifying: How the entities have implemented Information systems solutions, infrastructure and how the enabling solutions have meet user-defined requirements for functionality, service levels, cost, and delivery timing.

- The review shall cover the Information service architecture key elements namely Data Management, Application Management, Systems Integration and Communication protocols
- The review will include the Security architecture principles pertaining to AMS and AMS interfaces including the proposed Mobile device management capabilities

The EA assessment report shall be used as the baseline to design and develop the first 100 Days of the AMS deployment plan.

6.1.6 Procedure 6 – Project Methodology to support AMS development

Figure 6 outlines the principles of a Project Methodology for AMS development.

Figure 6: IT Methodology for AMS Development

- **Continued Business Justification** – Update critical documentation at project milestones.
- **Defined Roles and Responsibilities** – Structure should include program management, project board, project manager, and team levels.
- **Learn from Experience** – Maintain a Lessons Learned Log.
- **Managing by Stages** – Plan and control each project stage-by-stage (understanding key milestones, resource requirements, and inter-dependencies).
- **Managing by Exception** – If performance tolerances (e.g. scope, timescale, risk, quality, benefits and cost) are exceeded, implement escalation procedure.
- **Focus on Products** – Specifically on their flexibility, integration, and quality.
- **Tailor to Suit Project Environment** – Adapt the methodology to each facility as required (i.e. complexity, importance, size, time, criticality, risk).

6.1.6.1 AMS Project Processes for Entity Project Board

Entity Project board shall apply the following process as part of the AMS project methodology;

- Provide project directions that includes the procedures, which enable the project board to be sure that projects proceed as planned.
- Projects shall be started with all the authorized business case/ procedures to initiate CAS/AR and AMS project process
- Projects shall be started with all authorized procedures to support the deployment of the AMS operating model
- Project initiation shall be carried out with all corresponding procedures and business case approvals

- Project stage boundaries including gate controls process analysis shall be used by the project board to make key decisions.
- Project board shall follow procedures for controlling funds and to track project budgets for any escalating commitments.
- Project board to monitor AMS delivery management and to ensure that it complies with all the needs of the Entity's Management systems
- Project board to follow procedures and rules to close the CAS/AR/AMS project
- Project board shall manage the AMS program benefits realization including the tracking and reporting process

6.1.6.2 AMS Project Methodology including Benefits Realization

Entity shall achieve the benefits of the AMS Project Methodology by ensuring that it meets the project goals in a logical and systematic way;

- Dividing projects into different stages making them easy to manage
- Drive improved communication between all project members and with all stakeholders, internal and external
- Stakeholder will give contribute to the decision making
- Consistent approach from all stakeholders
- Focus on business justification
- Providing greater control of planning by regular reviews of project progress
- Identifying competences according to the role in the project
- Embedding continuous improvement and benefit tracking process

6.1.6.3 AMS System Development Life Cycle (SDLC)

It is important for the Entity to apply a SDLC process in implementing or developing, a current or new AMS as it breaks down the entire life cycle of Asset Management Software development. It makes it easier to evaluate each part of the AMS development and it makes it easier for a solution provider to work concurrently on each phase. Planning and analysis is the most critical phase of SDLC and the value of the time spent in this part of the process should not be underestimated.

Process	Description
Business Need Identification	Determine Entities business objectives. Objectives may include cost reduction, growth, synergies and optimization of business processes across Entities.
Business and System Requirements definition of (AMS)	Identifying, aligning the Entities business and technical requirements of current or new systems. Entity shall capture business/user requirements and align this requirement in developing or implementing new AMS; • Asset information requirements as per AR and CA methodology • Work Management as per O&M standards • Integration to internal or external systems e.g. SCADA, BMS or NAR and NDB • Inventory and procurement that supports O&M activities • Reports & KPI
High Level System Design (AMS)	Aligning and defining the high level and detailed design of current or new system. The high level design focuses on what programmers require and how they are going to interact. The detailed level design focuses on how the individual programmers are going to work, what interfaces are going to look like (Interface) and what data will be required (Data Design). During this phase, the overall logical structure of the application software (AMS) is defined. This is the critical phase as part of the SDLC and the three components, conceptual model, physical model and the logical model are developed as part of this phase to capture the business requirements. This document also takes into account various scenarios and the interaction between AMS and the Entity's various business systems.
Detailed System Design (AMS)	This is where the translation of business and functional requirements into codes or customization happens. Most applications e.g. EAM, CMMS, CAFM in the market are Commercial of the Shelf Systems (COTS). Meaning, ready

	to use but requires alignment to a specific organization to suit their requirements.
Test Cases Development	This is where AMS test cases shall be developed according to the SDLC methodology. The purpose of test cases is to verify and validate the compliance of AMS against the requirements.
System Testing (AMS)	AMS testing verifies that the system satisfies user and business requirements or functions as it was designed. Various types of tests are performed e.g. System Integration Testing (SIT) ensuring that interfaces between modules work. Volume/Stress testing (VST), ensures that AMS works on the intended platform and with the expected volume of data. User Acceptance Testing (UAT) ensures that the system does what the user requires.
System Implementation (AMS)	System implementation also involves legacy data conversion and migration (transfer of data from an old system) and preparation of training materials or guides for user training to ensure AMS is used correctly.
System GO Live, Support and AMS Service Delivery Management	Go Live and Support phase moves from a project oriented, pre-production environment to a live production operation. The most important elements are; • Production support set-up • System transactions monitoring • System performance optimization AMS Service Processes Delivery SLA are; • L1 – Production issue to be closed within (1hr, 4hrs or 8hrs) changes can be done in production (PRD) itself or changes moved from Development to Quality Assurance (QAS) production • L2 – Medium changes to be closed within the timeframe based on the change request, it might be (2 days, 4 days or 1 week) changes will be test in Development (DEV) and move to (QAS) for (UAT) and then it will be move to (PRD) • L3 – Set of changes which lead to a mini project, all the changes will be done within the duration e.g. 2 months. The changes will be moved to (QAS) for (UAT) and integration testing. Finally all changes will be moved to (PRD).

Table 6: AMS System Development Life Cycle (SDLC)

6.1.6.4 AMS Business Requirements and Identifying Gaps

Implementing AMS is the enabler in the Asset Management System towards the Entities goal of embedding best practice in asset management. The business requirements for AMS have been derived based on requirement analysis from the NMA&FM. The functional requirements for AMS and further elaboration of specific requirements and the guidance for gap analysis is given below.

AMS functional requirements begins with the identification of user requirements. A series of workshops should be conducted by a specific Entity, together with the business Subject Matter Experts (SME's), Vendor/Contractor, Solution Provider or System builder and Asset Management team to identify the requirements and business processes that are related to AMS;

- Fixed Asset Register
- Asset Creation (adding new assets to the system)
- Work Management
- Inventory Management
- Purchasing Management
- Document Management (Electronic Document Management System)
- Mobility
- Reports
- KPI

Identifying the gaps is to assess the identified requirements against the standard capabilities of the Entities current or future AMS in order to establish any gaps between what the system can do and what it is required to do.
Any requirement which is not met by the out-of-the-box functionality of the product is considered a gap. Each gap shall have a unique GAP ID which can be used for reference and addressed before system

testing for compliance with the Entities requirements prior to going live. Listed below in Table 6 are the key functional requirements for AMS implementation.

6.1.6.5 Fixed Asset Register (FAR) Business Requirements

The Fixed Asset Register (FAR) should be an integral part of the AMS. This functionality should use the physical asset hierarchy structure to enable the calculation of the book value of the assets registered in the AMS. The AMS shall provide the ability to capture the current equivalent asset value at the asset level. The depreciation shall be calculated on the basis of the information held in the AMS FAR module. The FAR should be automatically updated through the Physical Asset register as and when the Assets/Facilities are energized or put into service. The FAR should be integrated with the asset creation process and should be managed only through AMS. The Entities shall comply with the Expro White Book processes, including declaration of data quality, data assurance model, the lag time for the asset creation and the asset capitalization in the FAR. The data from FAR should be used for Asset Portfolio level analysis and Life Cycle costing. FAR KPI's should provide information required for the development of the Yearly and 5-year O & M plan.

FAR should have provision to link with Facility Condition Index and Asset Condition Index in AMS and perform depreciation calculations based on Entity's business rules. The FAR reports shall be reviewed quarterly by the Entity and the AMS shall generate an automated report for FAR based on the rules approved by the Entity.

Requirements	AMS Key attributes /Functions	AMS Modules /Process/Systems	Source
Ability to calculate the book value of the Asset	• Asset ID • Asset Portfolio • Asset Class • Work Pack ID • Cost estimation • Program of Work Estimated cost • Program of Work planned cost / Approved budget • Program of Work Actual cost • Work packaging • Standard Task • Perform Statistical analysis • Asset / Asset system/ Asset Portfolio level analysis • Cost center • Cost groups • Cost Categories • Work center • Trade based rates • Contract Number • Service Level Agreement • Task Warranty	• Asset Creation • Asset Hierarchy • AMS configuration • Work management • Inventory • Warehouse • Fair Value process • Data Management • Capital plan development process • O&M plan and budget development process • Cost accounting module	• EOM-ZA0-PR-000002 Asset Management Plan and Implementation Procedure • EOM-ZA0-PR-000004 Asset Register • EOM-ZL0-PR-000001 Life Cycle Costing • EOM-ZA0-PR-000003 Continuous Improvement

Requirements	AMS Key attributes /Functions	AMS Modules /Process/Systems	Source
	• Insurance cost		
Ability to apply depreciation rules for each Asset class	• Asset capitalization • Asset valuation • Book value • End of life treatment rules	• Asset Creation • Asset Hierarchy • AMS configuration • Work management • Inventory • Warehouse • Fair Value process • Data Management • Financial systems	• EOM-ZA0-PR-000004 Asset Register • EOM-ZL0-PR-000001 Life Cycle Costing
Ability to define cost categories in line with Entity's Life cycle costing rules	• Cost center • Cost groups • Cost Categories • Work center	• AMS configuration	• EOM-ZL0-PR-000001 Life Cycle Costing • EOM-ZA0-PR-000004 Asset Register
Ability to capture cost against various cost categories in line with LCC rules at the Asset level	• Cost center • Cost groups • Cost Categories • Work center	• AMS configuration • Financial systems • Financial rules • Configuration and change control • Work packaging	• EOM-ZL0-PR-000001 Life Cycle Costing • EOM-ZA0-PR-000003 Continuous Improvement • EOM-ZA0-PR-000002 Asset Management Plan and Implementation Procedure • EOM-ZA0-PR-000004 Asset Register
Ability to capture cost incurred at the Asset Portfolio level and perform investment optimisation	• Establish Work optimization process and work flow • Capture FCI • Capture ACI • Perform Risk based prioritization • Asset group level intervention task analysis • Establish and record task priority score	• Asset Hierarchy • AMS configuration • Work management • Inventory • Warehouse • Fair Value process • Data Management • Financial systems • Investment optimization • Life cycle analysis	• EOM-ZL0-PR-000004 Budget Principles • EOM-ZA0-PR-000002 Asset Management Plan and Implementation Procedure • EOM-ZA0-PR-000004 Asset Register • EOM-ZL0-PR-000001 Life Cycle Costing
Ability to seamlessly integrate FAR with Asset creation process	• Establish Work optimization process and work flow	• Capital delivery process • Asset Creation process	• EOM-ZA0-PR-000004 Asset Register • EOM-ZL0-PR-000001 Life Cycle Costing

Requirements	AMS Key attributes /Functions	AMS Modules /Process/Systems	Source
	• Middleware integration function	• Data Management • IT integration rules	• Procedure 5 AMS Developing an IT Methodology for AMS Development Project in Controlled Environment
To be able to capture the Asset Creation details and carry out Asset Capitalisation	• Asset register	• Asset registration process	• EOM-ZA0-PR-000004 Asset Register
FAR to be used for review and verification of the 5 year Operations work plan	• Establish Work optimization process and work flow	• Work management	• EOM-ZA0-PR-000002 Asset Management Plan and Implementation Procedure
Ability to calculate Facility condition index	• Establish FCI process and work prioritization	• Work management • Financial systems	• EOM-ZA0-PR-000002 Asset Management Plan and Implementation Procedure
Ability define and deploy asset class rules for managing the book value and depreciation	Establish FAR process and work flow	• Asset Creation • Asset Hierarchy • AMS configuration • Work management • Inventory • Warehouse • Fair Value process • Data Management • Capital plan development process • O&M plan and budget development process • Cost accounting module • Maintenance KPI • Financial indicators and KPI • Operations and Maintenance delivery KPI's • Capital delivery KPI's	• EOM-ZA0-PR-000002 Asset Management Plan and Implementation Procedure • EOM-ZA0-PR-000004 Asset Register • EOM-ZL0-PR-000001 Life Cycle Costing • EOM-ZA0-PR-000003 Continuous Improvement
Ability to define and deploy rules for managing condition triggered Asset depreciation			
Ability to manage and implement Data Quality rules and controls for FAR			
Ability to seamless integrate across various systems to provide the FAR capability if the information is held in various systems			
Ability to deploy Data quality tools to monitor and collect FAR metrics			

Table 7: FAR Requirements

6.1.6.6 Asset Creation Business Requirements

As part of the social transformation programs the amalgamation of entities in KSA is likely and to be expected. The AMS design shall support these transitions and support the adoption of AMS. This includes alignment and application of the Asset Data Policy of the Entity post amalgamation. This shall be applied by adopting the due diligence processes mentioned in this document. This should include;

- Asset Numbering
- Asset Classification - Asset Hierarchy re-definition
- Work package naming conventions
- Changes to cost and work centers
- Data quality assurance
- Data migration rules
- Fixed asset register alignment
- Re-design of report post amalgamation
- Redesign and integration of KPI's

This will also facilitate costs of IT Operations being kept under control.

The Asset Creation will permit the creation of Location/Functional location and Asset/Item for the Entity. This functionality shall be used to record the movement of assets from stores, to service, from one parent to another and ultimately to disposal. AMS asset creation requirements are listed below in Table 7.

Requirement	AMS Terminology	Description	Source
Able to identify the Asset; • Asset identification • Location identification • Text based asset descriptors • Visual asset descriptors	• Asset Identifier	Asset attributes used to identify the asset in its relevant operating context. It describes where exactly it is located using a well-structured classification system	EOM-ZA0-PR-00004 - Asset Register
Able to identify the unique Asset engineering information	• Technical data • Nameplate attributes	Asset attributes used to identify asset specifications including name plate details which enable the understanding of the asset and provides the means to compare it with similar assets/ asset class	EOM-ZA0-PR-00004 - Asset Register
Know how the asset is related and connected to the other Assets/Asset systems/ Sub systems	• Functional Location • Physical location • Asset Hierarchy	• Functional Location • Physical location • Asset Hierarchy	EOM-ZA0-PR-00004 - Asset Register
Rapidly locate the asset (Fixed, Movable and Mobile assets) quickly	• Location Geo Spatial data • Location Geo fencing • Location internal beacons	Asset data attributes that support both external navigation using GPS and internal navigation within the buildings using beacons	EOM-ZA0-PR-00004 - Asset Register

Requirement	AMS Terminology	Description	Source
Know the details of asset procurement and contract details	• Procurement documentation • Business case • Date of Purchase • Supplier details • Service provider details • Performance criteria • Service level arrangement • Warranty details • Cost Estimation	Asset data attributes supports the analysis of the performance and service level arrangements. It supports the review and analysis of the asset's business case and procurement information including cost. This enables improvement of Cost Estimation maturity and establishes the baseline Cost indices for each asset class and associated work types.	EOM-ZA0-PR-00004 - Asset Register
Know the asset valuation information	• Valuation data • Fair Value • Market Equivalent Asset Value	Asset based valuation data will enable the entity to perform asset valuation at the Entity level. This also enables identifying anomalies at the asset group and asset portfolio level. This data supports asset portfolio level investment decisions.	EOM-ZA0-PR-00004 - Asset Register
Know the maintenance and asset augmentation carried out at the asset level	• Work Completion • Retrofitting • Strategic spares • Strategic spare procurement lead time • Tools used	Asset data attributes which support the optimal life cycle management of physical assets to sustainably deliver the maintenance plan. This includes tools, spares, resources and strategic spares. Strategic spares are critical assets with long procurement lead time.	EOM-ZA0-PR-00004 - Asset Register
Know the condition of the asset	• Asset Condition • Condition parameters • Alarms and limits • Visual Inspection • Value based inspections • Deterioration profile • Functional failure • Failure mode • Facility condition index • Asset condition Index • On line inspection	These attributes support the computation/ aggregation of Facility Condition Index and Asset Condition Index. This data reveals the "State of the Infrastructure" and provides the necessary insights to deliver the required performance.	EOM-ZA0-PR-00004 - Asset Register
Know the risks associated with the asset	• Risk Index • Functional failure • Failure modes	Asset data attributes used to analyze and carry out assessment of failure to determine the risk of Asset /Asset systems failure	EOM-ZA0-PR-00004 - Asset Register

Requirement	AMS Terminology	Description	Source
Know the risk due to deferred maintenance	• Work completion • Work pending • Work order • Work deferred • Risk Index • Facility Index • Asset Condition Index	Asset data attributes used to analyze the risk due to maintenance deferral and reprioritize the work based on risk index	EOM-ZA0-PR-00004 - Asset Register
Know and manage the performance of the asset and the sub systems	• Performance criteria • Service Level Agreement Leading indicators • Lagging indicators	Asset performance attributes that enable to capture the assets/ asset systems functional performance using leading and lagging indicators	EOM-ZA0-PR-00004 - Asset Register
Know and manage safety needs of the machinery	• Asset / Facility lock down • Safety of Machinery • Safety case • Critical Assets	Asset data attributes used to analyze, and support the safety of machinery including start up/shutdown and support safety case development	EOM-ZA0-PR-00004 - Asset Register
Know about the asset level Statutory, Mandatory and legal compliance	• Pressure Vessel Safety Systems Regulations (PSSR) • License obligation	Asset data attributes used to analyze the asset/asset systems and develop written schemes of work	EOM-ZA0-PR-00004 - Asset Register
Know the whole life cost of the Asset and the Asset portfolio	• Asset life cycle • Investment optimization • Reliability • Availability • Maintainability • Serviceability	Asset data attributes used to determine the whole life cost of the Asset and Asset portfolio. This depends on a wide range of Asset attributes from concept to disposal.	EOM-ZA0-PR-00004 - Asset Register

Table 8: AMS Asset Creation Requirement

All new AMS implementation projects shall follow the NMA&FM standards of Asset Classification. Existing systems within the Entity shall be converted to the NMA&FM standards in an agreed timeframe. Table 9 below provides the guideline to develop the gap analysis.

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Work Flow / Interface / Report / Custom*
AM001	New fields will be added to Assets application for: Acquisition Date, Reception Date, Commission Date, and Warranty Expiry Date.	Configuration to be applied in Assets application.	X	

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Work Flow / Interface / Report / Custom*
AM002	Disposal Date does not have to be added to the screen, but will be available as the date of disposal status change, which can be queried using ad hoc reports. To add the Asset Status object in the ASSETS object structure with relationship to find the date of asset disposal.	Relationship and object structure to be added.	X	
AM003	Asset number will contain asset type prefix 'AAAAA' for the Entity. The sequence number will start with '0' e.g. 001 (8 digits) 'ELECT001'.	Auto number to be configured.	X	
AM004	Change label of 'Priority' field to 'Criticality'.	Configuration to be applied in Locations and Assets application.	X	
AM005	Add value list for location Criticality field with the following values: 1. High 2. Medium 3. Low	Configuration to be applied in Locations application.	X	
AM006	The following asset / location statuses will be required: • NOT READY (this is the default status for new records) • NOT IN SERVICE (synonym of not OPERATING) • IN SERVICE (synonym of OPERATING) • DECOMMISSIONED	Configuration to be applied in Locations and Assets application.	X	
AM007	Add value list for asset Criticality field with the following values: 1. High 2. Medium 3. Low	Configuration to be applied in Assets application.	X	
AM008	Add new field 'Manufacturer's Part #'.	Configuration to be applied in Assets application.	X	
AM009	Add 'View Asset Status History' action in the Select Action menu to allow users to view the history of status changes.	Configuration to be applied in Assets application.	X	
AM010	Add "Permit Required?" field in Location app	Configuration to be applied in Locations application.	X	
AM011	A structural asset will be created in each location to record the cost of work done on fittings, etc. These structural assets should not be allowed to be moved away from their original location	Configuration to be applied in Assets application. Customization required on Asset Move functionality in Assets and Work Order Tracking applications.	X	X

Table 9: Asset Creation Gap Analysis against Functional Requirements

The Asset Creation Process provides the detailed workflow and it entails the responsible role, detailed process and output.

The Create Location Process flow entails user to create location records and track assets that exist at the location. It can also use to build hierarchical or networked systems.

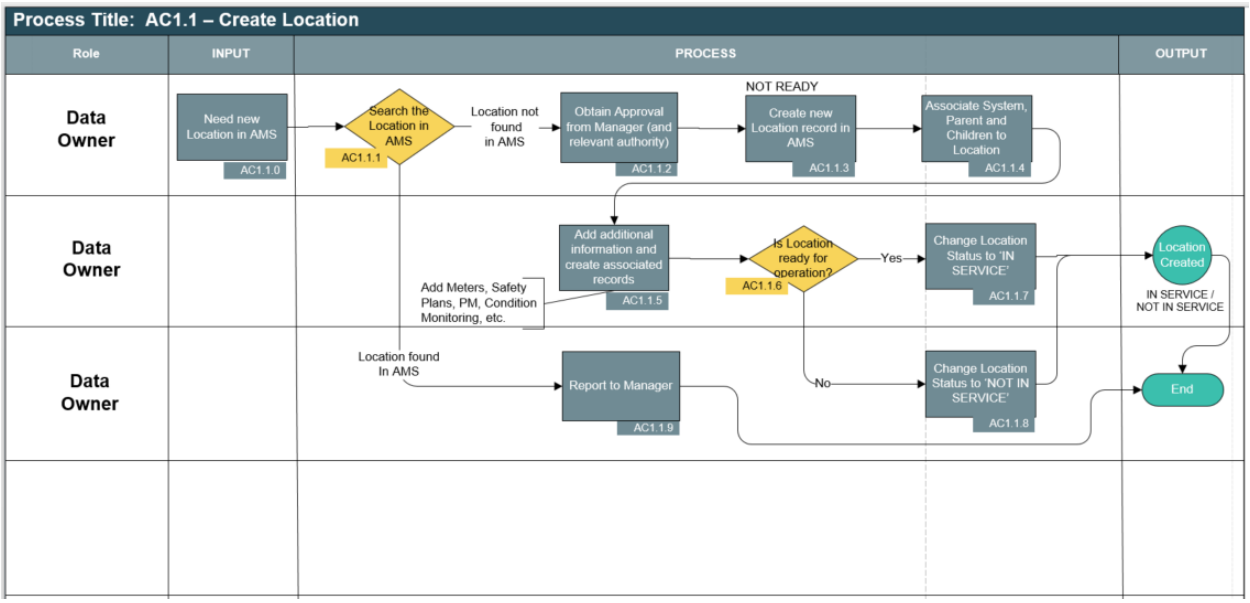


Figure 7: AC1.1 - Create Location Process

The Modify/Decommission Location process will guide accountable persons to rectify or change location and be able to retire or decommission a certain location. From system perspective, before decommissioning a location ensure that;

- Purchase Orders are closed
- Work Orders are closed
- Move assets to different location

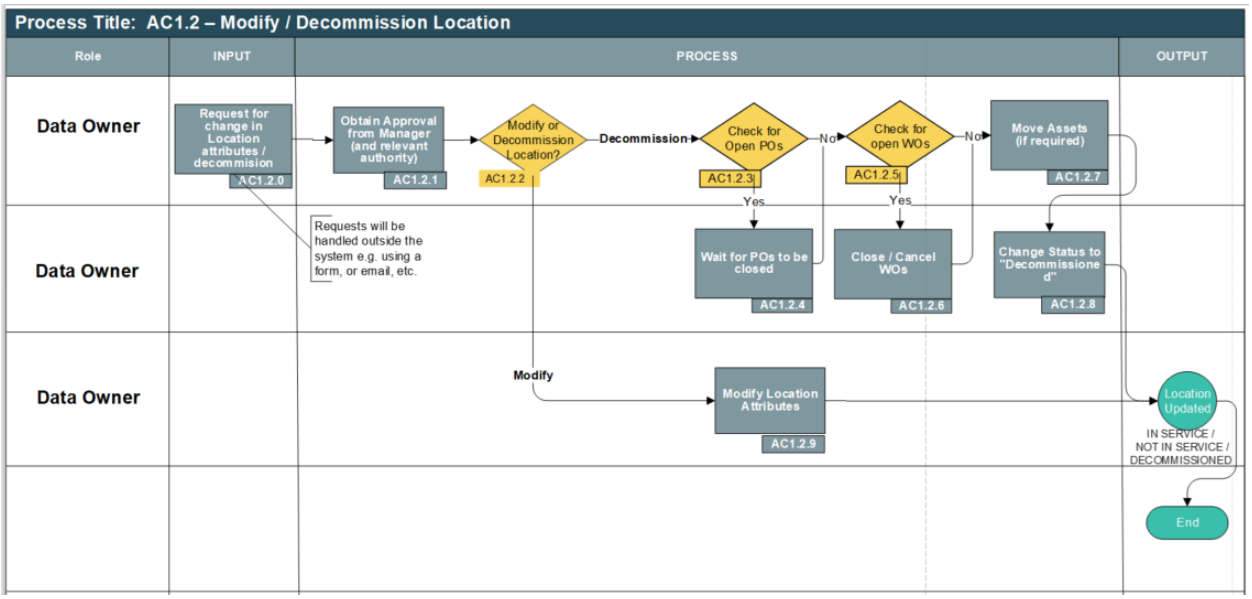


Figure 8: AC1.2 - Modify/Decommission Location Process

The Create Asset process will guide the accountable person or data owner to create and manage assets records, be able to associate attributes and maintenance activities and track down maintenance history.

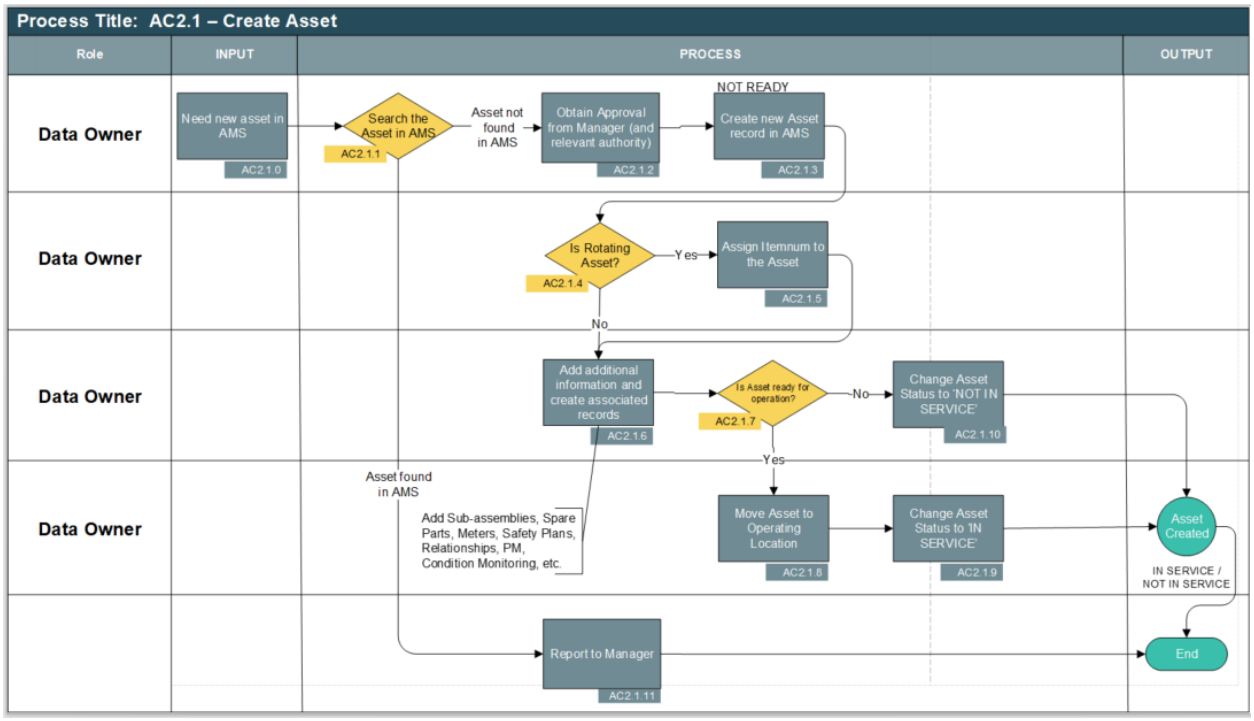


Figure 9: AC2.1 - Create Equipment Process

The Move/Modify/Decommission/Dispose Asset process will guide accountable persons to rectify or change assets and be able to retire or decommission a certain asset. Before decommissioning an asset ensure that;

- Purchase Orders are closed
- Work Orders are closed
- Obtain approval before finally retiring the asset

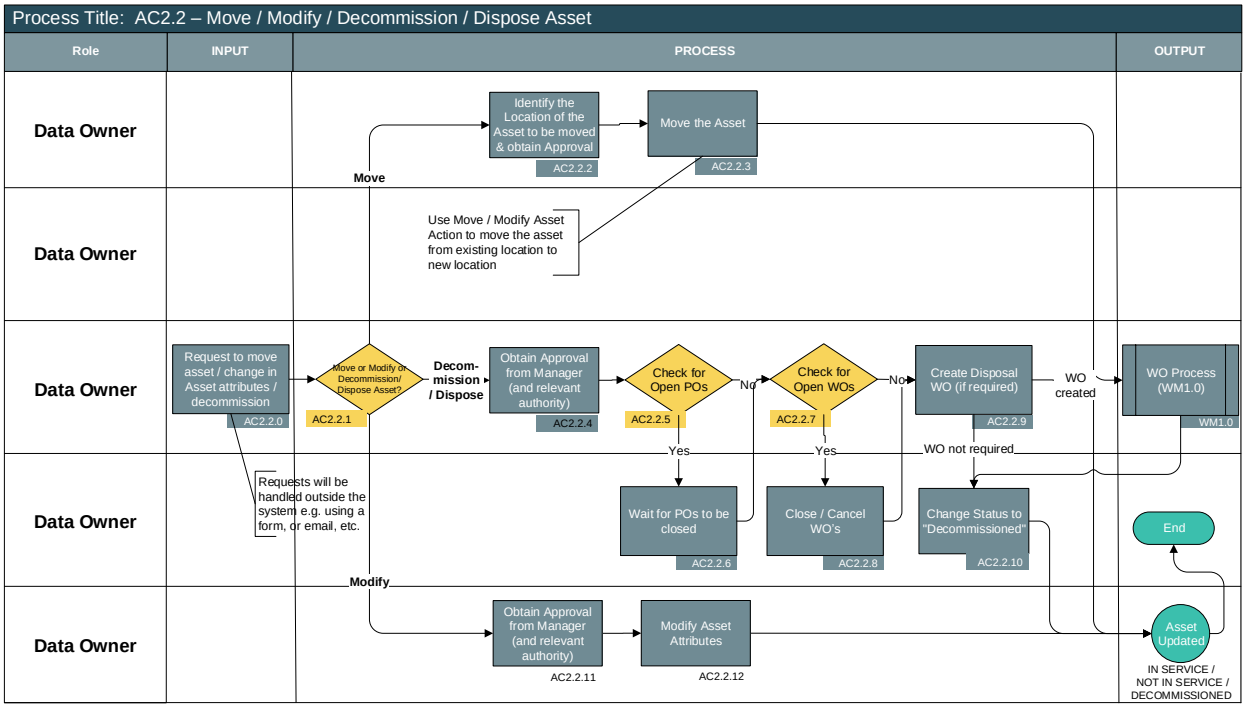


Figure 10: AC2.2 - Move/Modify/Decommission/Dispose Asset Process

6.1.6.7 Work Management Requirements

The following business requirements for work management have been derived from the NMA&FM. Refer to 6.6 for Derived Maintenance Requirements list.

Req ID	Requirement	AMS Terminology	Description	Source
1	To be able to manage and perform work for individual assets and asset systems	• Asset Creation • Asset Hierarchy • AMS Asset system configuration	• Asset creation • Work management	
2	To be able to manage parts and spares for maintenance through the use of inventory management systems	• Spare parts • Consumables • Tools • Equipment	• Asset creation • Work management • Inventory • Warehouse	
3	To be able deploy maintenance strategy for each asset class in line with Asset / Asset Class strategy	• Run to fail • Intervention strategy	• Asset creation • Work management • Inventory • Warehouse	
4	To be able to perform periodic time based replacement of assets	• Asset Replacement • Time based maintenance activity	• Asset creation • Work management • Inventory • Warehouse	
5	To be able to perform periodic Inspection of assets	• Visual Inspection • Value based inspection • Online inspection	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS	
6	To be able to manage special parts and special spares across life cycle	• Strategic spares • Spares condition • Shelf life triggered maintenance activity as part of warehouse and maintenance	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS	

Req ID	Requirement	AMS Terminology	Description	Source
7	To be able to perform predictive maintenance	• Maintenance task • Task type • Task priority • Task ID • Task Hierarchy • Task sequence • Cost estimation • Planned cost • Actual cost • Planned task time • Actual task time • Task packaging • Task Analysis • Task and Task Type analysis • Compliance reporting • Task Status • Work packaging • Standard Task • Work flow for allocation and authorization of resource • Work flow for allocation and authorization of personnel • Plan and schedule work for general shift and regular shifts • Plan and schedule work for Internal and external resources • Perform reliability analysis • Perform statistical analysis • Asset / Asset system/ Asset Portfolio level analysis • Plan Work • Schedule work • Planned date and time • Scheduled date and time • Started data and time • Completed date and time • Task completion feedback • Reinstatement approval	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS • Reports • KPI • Fixed Asset Register	

Req ID	Requirement	AMS Terminology	Description	Source
		• HSE Documents • Permit to work • Job risk assessments • Work Risk Index • Planner details • Cost center • Work center • Cost capture and rates • Contract Number • Service Level Agreement • Task Warranty • Insurance		

Req ID	Requirement	AMS Terminology	Description	Source
8	To be able to perform Planned maintenance	• Maintenance task • Task type • Task priority • Task ID • Task hierarchy • Task sequence • Cost estimation • Planned cost • Actual cost • Planned task time • Actual task time • Task packaging • Task analysis • Task and Task Type analysis • Compliance reporting • Task Status • Work packaging • Standard task • Work flow for allocation and authorization of resource • Work flow for allocation and authorization of personnel • Plan and schedule work for general shift and regular shifts • Plan and schedule work for internal and external resources • Perform reliability analysis • Perform statistical analysis • Asset / Asset system/ Asset Portfolio level analysis • Plan work • Schedule work • Planned date and time • Scheduled date and time • Started data and time • Completed date and time • Task completion feedback • Reinstatement approval	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS • Reports • KPI • Fixed Asset Register	

Req ID	Requirement	AMS Terminology	Description	Source
		• HSE Documents • Permit to work • Job risk assessments • Work Risk Index • Planner details • Cost center • Work center • Cost capture and Rates • Contract number • Service Level Agreement • Task Warranty • Insurance		

Req ID	Requirement	AMS Terminology	Description	Source
9	To be able to perform condition based maintenance	• Condition based maintenance task • Task type • Task priority • Task ID • Task hierarchy • Task sequence • Cost estimation • Planned cost • Actual cost • Planned task time • Actual task time • Task packaging • Task analysis • Task and Task Type analysis • Compliance reporting • Task status • Work packaging • Standard task • Work flow for allocation and authorization of resource • Work flow for allocation and authorization of personnel • Plan and schedule work for general shift and regular shifts • Plan and schedule work for internal and external resources • Perform reliability analysis • Perform statistical analysis • Asset / Asset system/ Asset Portfolio level analysis • Plan work • Schedule work • Planned date and time • Scheduled date and time • Started data and time • Completed date and time • Task completion feedback • Reinstatement approval	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS • Reports • KPI • Fixed Asset Register	

Req ID	Requirement	AMS Terminology	Description	Source
		• HSE Documents • Permit to work • Job risk assessments • Work Risk Index • Planner details • Cost center • Work center • Cost capture and rates • Contract number • Service Level Agreement • Task Warranty • Insurance • Tool calibration • Calibration due date • Special instrument's • Intrusive inspection work flow • Non-Intrusive inspection work flow • Perform Asset Portfolio analysis		
10	To be able to apply Run To Fail maintenance strategy for Asset /Asset systems	• Define maintenance strategy • Develop maintenance strategy • Deploy maintenance strategy • Plan and schedule the maintenance strategy • Conduct risk analysis • Capture asset level risk index • Capture FCI • Capture ACI • Perform Risk based prioritization • Plan intervention	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS • Reports • KPI • Fixed Asset Register	

Req ID	Requirement	AMS Terminology	Description	Source
		task post Run To Fail		
11	To be able to apply Corrective Maintenance strategy for Asset /Asset systems	• Define maintenance strategy • Develop maintenance strategy • Deploy maintenance strategy • Plan and schedule the maintenance strategy • Conduct risk analysis • Capture asset level risk index • Capture FCI • Capture ACI • Perform risk based prioritization • Plan intervention task • Establish and record task priority score	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS • Reports • KPI • Fixed Asset Register	
12	To be able to carry out Optimization of tasks	• Define maintenance strategy • Develop maintenance strategy • Deploy maintenance strategy • Plan and schedule the maintenance strategy • Conduct risk analysis • Capture asset level risk index • Capture FCI • Capture ACI • Perform risk based	• Asset creation • Work management • Inventory • Warehouse • Condition Management • Mobile device work management • AMS interface with SCADA/BMS • Reports • KPI • Fixed Asset Register • Investment optimization • Life cycle costing • Customized work flow for Deferred maintenance	

Req ID	Requirement	AMS Terminology	Description	Source
		prioritization • Plan intervention task • Establish and record task priority score • Establish and comply to optimization process and work flow • Manage deferred maintenance		
13	To be able to carry out statutory maintenance for all asset class	• Define statutory compliance work flow • Configure statutory task with approved frequency and schedule the task in line with maintenance strategy • Establish and record task priority score • Comply with statutory reporting and publish KPI	• Asset creation • Work management • Inventory • Document management • License obligation mapping • Reporting • KPI	
14	To be able to perform maintenance planning for all assets with resource allocation	• Map the work planning process and work flow in AMS • Configure standard tasks in line with NMA&FM • Manage tools resources • Manage material parts • Manage and keep document current	• Work management • Inventory • Document management • Contract Management	

Req ID	Requirement	AMS Terminology	Description	Source
15	To perform Maintenance scheduling and dispatch work program	• Map the work scheduling process and work flow in AMS • Configure Standard tasks in line with NMA&FM • Manage tools resources • Manage material parts • Manage and keep document current • Manage field worker mobile devices • Manage job allocation and optimize route	• Work management • Inventory • Document management • Contract Management	
16	To be able to manage work permits including authorization and statutory documents, entry management	• Allocate permit number • Track and close permit • Synchronize permit Fortress Key/ Dual/ Triple lock key codes • Workflow for work permit and authorization • Work flow for statutory documents, entry management	• Work management • Document management	
17	To be able to perform shut down maintenance	• Workflow for planning and task allocation • Activity and trade grouping • Work sequence and permit allocation • Task and parts allocation • Work packaging and work sequencing • Cost estimation • Standard job/ task • Condition score • FCI • ACI	• Work management • Document management • Inventory • Contract Management • Reports • Project planning	

Req ID	Requirement	AMS Terminology	Description	Source
18	To be able to perform outage maintenance	• Workflow for planning and task allocation • Activity and trade grouping • Work sequence and permit allocation • Task and parts allocation • Work packaging and work sequencing • Cost estimation • Standard job/ task • Condition score • FCI • ACI • Single outage tasks • Multiple outage task and work sequencing	• Work management • Document management • Inventory • Contract Management • Reports • Project planning	
19	To manage maintenance documents	• Work control and compliance • Manuals • Check lists, forms, drawings • Test result and reports • Type test reports • Test certificates • Performance reports • Work history • Reliability documents • Safety case • Human factors report • Technical data • Operation manual • Functional block logic documents • Single line diagram • Circuit diagram • Layout • Test program reports • Maintenance cost history records • Maintenance reinstatement evaluation • Calibration documents	• Work Management • Inventory • Document management	

Req ID	Requirement	AMS Terminology	Description	Source
		• Calibration plan • Maintenance planning documents • Internal Audit reports • Maintenance records • Maintenance log book • Maintenance Statutory log book		
20	Maintenance reports	Maintenance Performance reports Maintenance KPI	• Reports	

Table 10: Work Management Business Requirements

Work Management will permit the creation of job plans or maintenance plans to describe the regular and breakdown tasks required to maintain the Entity's assets. The AMS shall have a work order module and shall be used to manage work through the creation of Work Orders. A work order shall specify a particular task to be accomplished and the labor, materials, services and tools needed to complete the work. The following table will be the guideline to develop the gap analysis.
The specific information given in the gaps such as maintenance types and priorities may vary from one Entity to another, based on the nature of the work being performed by the Entity.

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
WM001	Planned Maintenance work orders will not be allowed to be created directly (on ad hoc basis) in Work Order Tracking application. They should only be generated using PM records.	Configuration to be applied in Work Order Tracking application.	X				
WM002	Job Plan field to be mandatory in Planned Maintenance application.	Configuration to be applied in Preventive Maintenance application.	X				
WM003	Work order processes are required for:	Workflow to be configured.		X			

Gap ID	Description	Recommended Resolution	Database / Application Configuration	Workflow	Interface	Report	Custom
	i) Corrective Maintenance Process ii) Emergency Maintenance Process iii) Preventive Maintenance Process						
WM004	Custom code will be developed to generate service requests or work orders from SCADA events / alarms. It should incorporate the functionality to activate/deactivate the generation of SR/WO for each event/alarm category, to prevent the AMS from being flooded with too many SR/WO due to too many events/alarms received from SCADA, especially in the initial stages of operation.	Custom interface will be created. Separate workshop to be conducted later.			X		X
WM005	The following work priorities will be used: 1 Immediately or less than 1 hour 2 Within 8 hours 3 Within 24 hours 4 Within 1 week 5 Within 2 weeks 6 Within 4 weeks	Configuration to be applied in Work Order Tracking application.	X				
WM006	Change label of 'Asset/Location Priority' field to 'Asset/Location Criticality'.	Configuration to be applied in Work Order Tracking application.	X				
WM007	Meter readings for continuous meters will be sent once a day from SCADA. Data will include date/time, functional location code, event class description (i.e. Meter Name), and meter value. The data will be stored in the METER READINGS table in AMS. Generation of work orders will be handled by standard Preventive Maintenance	Custom interface will be created. Separate workshop to be conducted.			X		X

Gap ID	Description	Recommended Resolution	Database / Application Configuration	Workflow	Interface	Report	Custom
	functionality. Events/alarms will be sent real-time to the AMS. Service requests and work orders will be generated real-time as well. Events/alarms received from SCADA are to be stored in a new custom table, the MEASUREMENTS table in AMS will not be used. Data received will contain date/time, functional location, event class, event value, and event severity. Another table is to be created to specify the required action to be taken for each event/alarm class such as create SR, create WO, or no action, and the associated Job Plan to be used on the corresponding WO.						
WM008	Add a value list lookup on the Priority field in Job Plans using the same values as work order priorities.	Configuration to be applied in Job Plans application	X				
WM009	Job Plan field to be mandatory.	Configuration to be applied in Preventive Maintenance application.	X				
WM010	Work Type to be defaulted to PM.	Configuration to be applied in Preventive Maintenance application.	X				
WM011	Add a value list lookup on the Priority field in PM using the same values as work order priorities.	Configuration to be applied in Preventive Maintenance application.	X				
WM012	Service request number will be auto numbered on system level (since Service Request in	Auto number to be configured.	X				

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
	AMS is system level object). The sequence format will be **SR-NNNNNN,** starting at SR-000001. (Number of digits after SR- is 6)						
WM013	Set the value of the Site field to the default insert site of the user creating the service request (the Site is blank by default in AMS). Access to Service Requests is to be restricted to the user's authorized sites only (users can access all Service Requests regardless of the Site value on the record by default in AMS).	Configuration to be applied in Service Requests application.	X				
WM014	Work Type field is to be mandatory.	Configuration to be applied in Work Order Tracking application.	X				
WM015	The following Work Type are required: • CM (Corrective Maintenance) • EM (Emergency Maintenance) • PM (Preventive Maintenance) • CP (Capital Project) • SE (Special Event) • MD (Modification) • CL (Cleaning)	Values will be added to Work Type table.	X				
WM016	Location field is to be mandatory.	Configuration to be applied in Work Order Tracking application.	X				
WM017	The size of the Location field on the screen shall be increased to 50 characters in order to fit the entire location code without scrolling to the right. The description of the location will be moved to the line below the Location field.	Configuration to be applied in Work Order Tracking application and other relevant applications	X				

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
WM018	Failure Class on work order is not to be modified by users if the Failure Class is available on Asset / Location record. If Failure Class is not specified on the Asset / Location of the work order, then users will be allowed to select one manually.	Configuration to be applied in Work Order Tracking application.	X				
WM019	Asset / Location Priority field is to be read-only.	Configuration to be applied in Work Order Tracking application.	X				
WM020	Priority field is to be mandatory.	Configuration to be applied in Work Order Tracking application.	X				
WM021	Failure Reporting is mandatory to be completed for CM and EM work orders.	Configuration to be applied in Organizations application.	X	X			
WM022	Target Start field to be defaulted to the date the work order is created and can be modified by the user (this does not apply to work orders created from Preventive Maintenance, where the Target Start date is set to the PM due date by standard PM work order generation functionality).	Configuration to be applied in Work Order Tracking application.	X				
WM023	Downtime should not be started automatically for events from SCADA. Downtime reporting will be done manually. Downtime Start Date is to be defaulted to the Reported Date of the work order on the Report Downtime dialog.	To be configured in Organizations application (Work Order Options)	X				

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
WM024	Add "Event Set Date" and "Event Reset Date" new DATETIME fields in Work Order application. These are to capture the subsystem events actual down and up time and help to calculate the downtime of an asset.	Configuration to be applied in Work Order Tracking application. Customization required on Downtime Reporting functionality.	X				X
WM025	Work order numbers will contain prefix 'WO-' and will be auto numbered at site level using the sequence **WO-NNNN,** starting at WO-0001.	Configuration to be applied in Work Order Tracking application.	X				

Table 11: Work Management Gap Analysis

The Work Management process and sub-processes provide the detailed workflow and define the responsible roles, approval process, detailed process and the creation of various work orders (WO) that encompass all the work types required. WM processes and sub processes will drive the configuration customization based from the functional requirements and gaps identified during the business process gathering activities such as; Creation of Job Plans, PM schedule, Preventive Maintenance work order, Corrective work order, Emergency work order and complete/close work order.

The Service Request (SR) process flow describes the creation of customer requests including the integration system e.g. workflow from SCADA and the work management functional requirements.

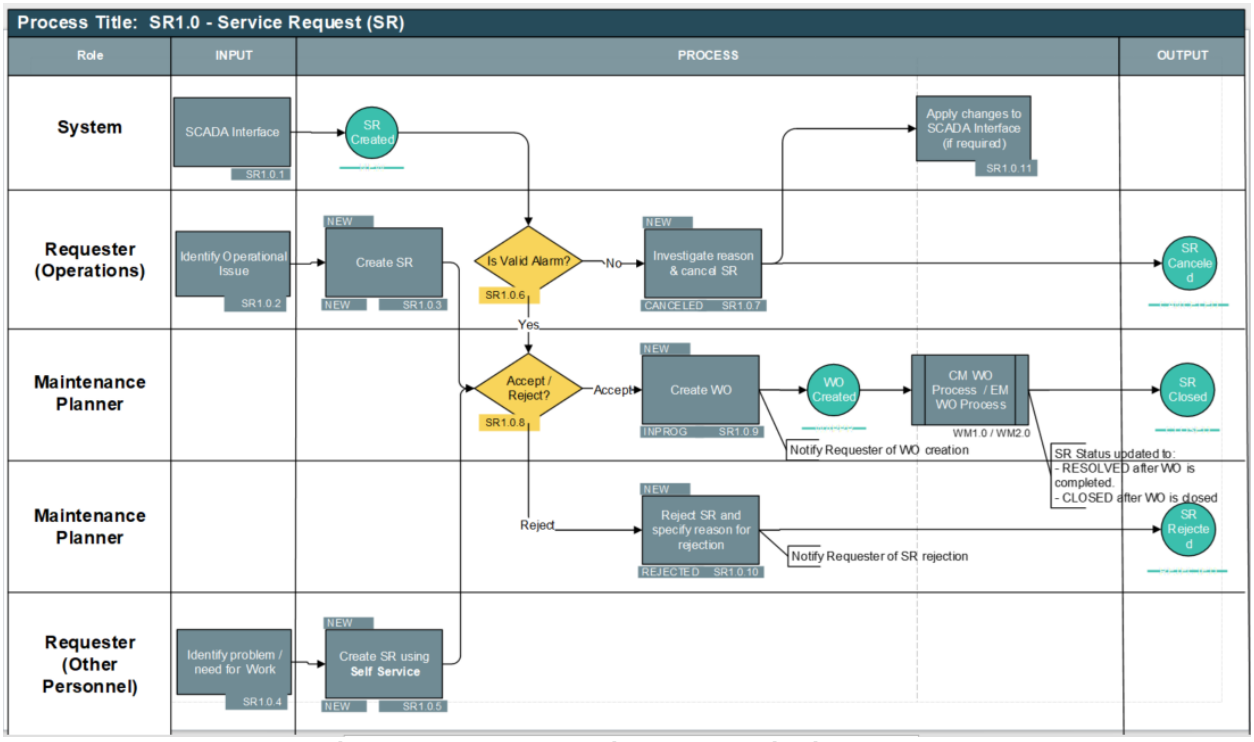


Figure 11: SR1.0 - Service Request (SR) Process

The Corrective Maintenance (CM) process flow entails direct creation of work orders based on the identified problem and through integration system from automated Service Request (SR) from e.g. SCADA.

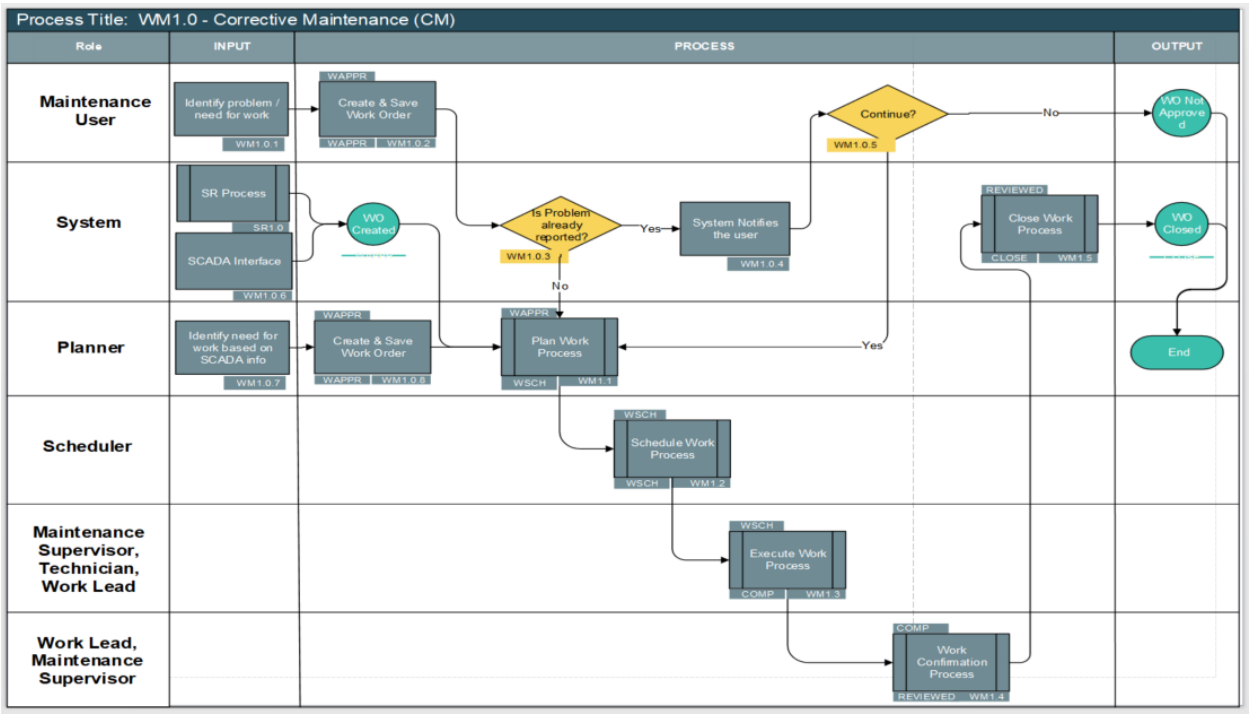


Figure 12: WM1.0: Corrective Maintenance (CM) Process

For Emergency Maintenance work, similar to CM, a process flow entails direct creation of an Emergency work order and this is generated when equipment breaks down or a facility failure occurs and creates an unsafe environment, or a critical asset needs to be repaired immediately.

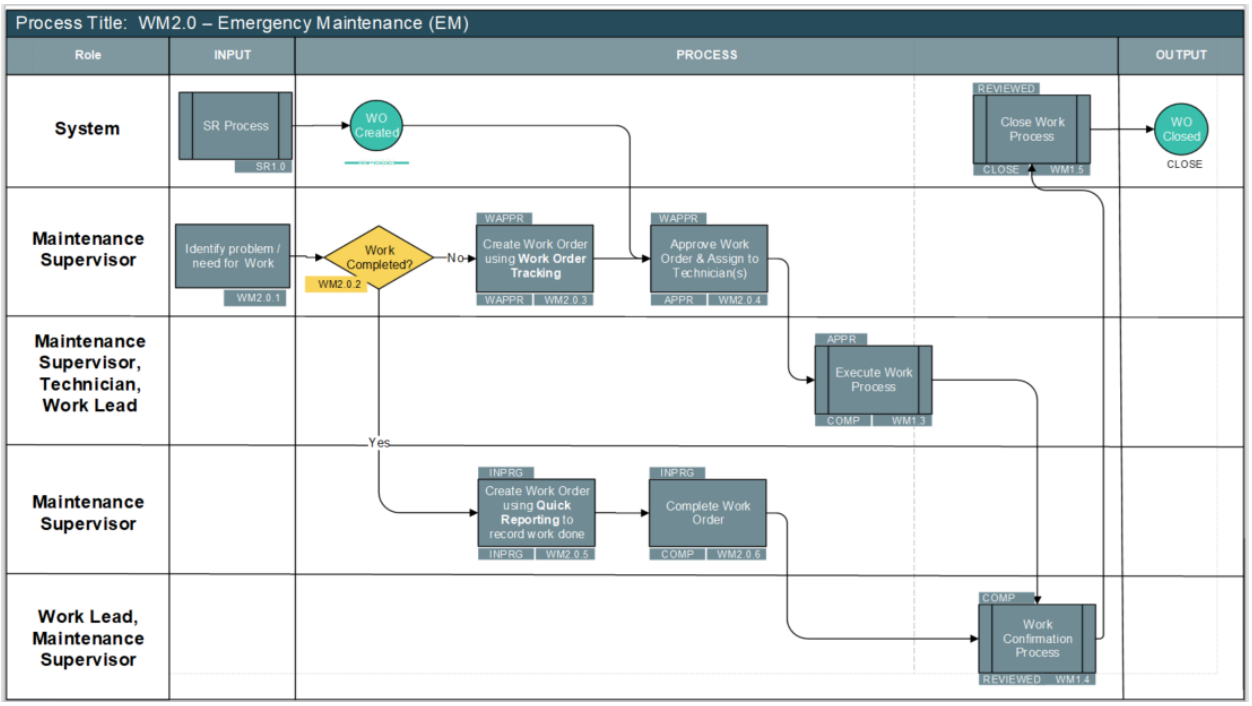


Figure 13: WM2.0 - Emergency Maintenance (EM) Process

The Preventive Maintenance Process entails the creation of PM work orders from an auto generated/configured system as well as from manual creation. The PM work order is an essential tool for the Entity to ensure the effectiveness of their equipment or facility and to extend the life of their assets.

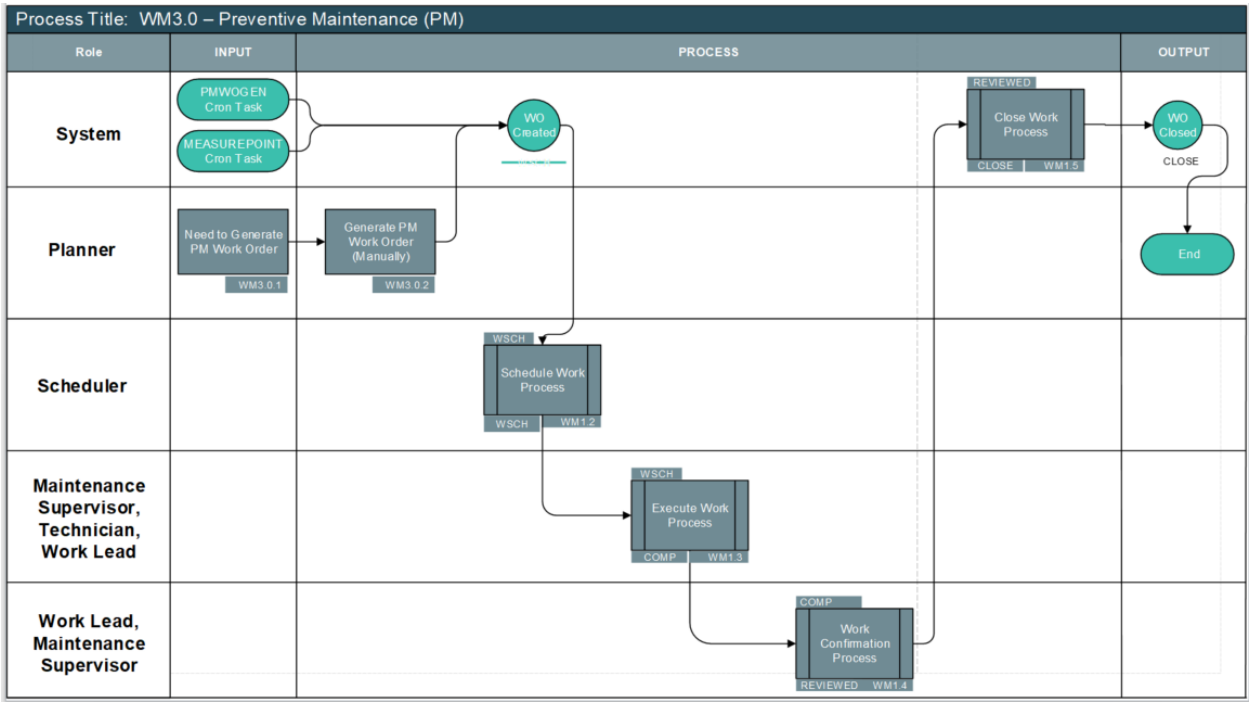


Figure 14: WM3.0 - Preventive Maintenance (PM) Process

Work Planning is a sub process that entails the creation of job plans or task (procedures) along with list of estimated labor, labor hours, materials, services and tools required to work.

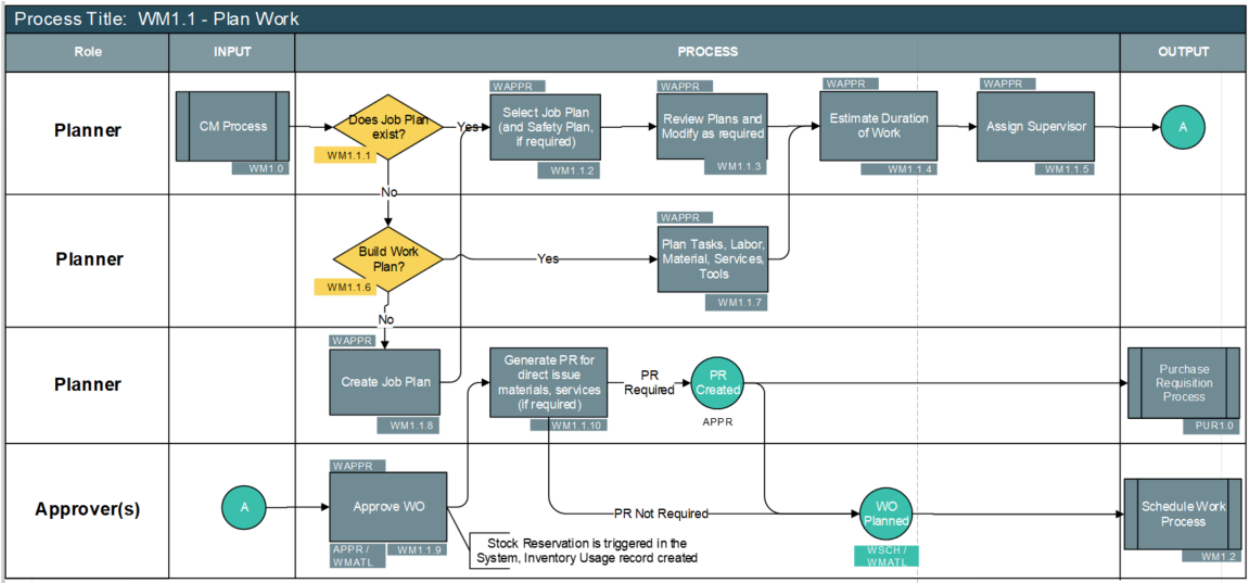


Figure 15: WM1.1 - Plan Work (Sub Process)

Work Scheduling is a sub process that requires the Scheduler or Planner to assess closely all scheduled work or to modify any changes required to a particular scheduled work. It is also an important tool to maintain close control of the budget.

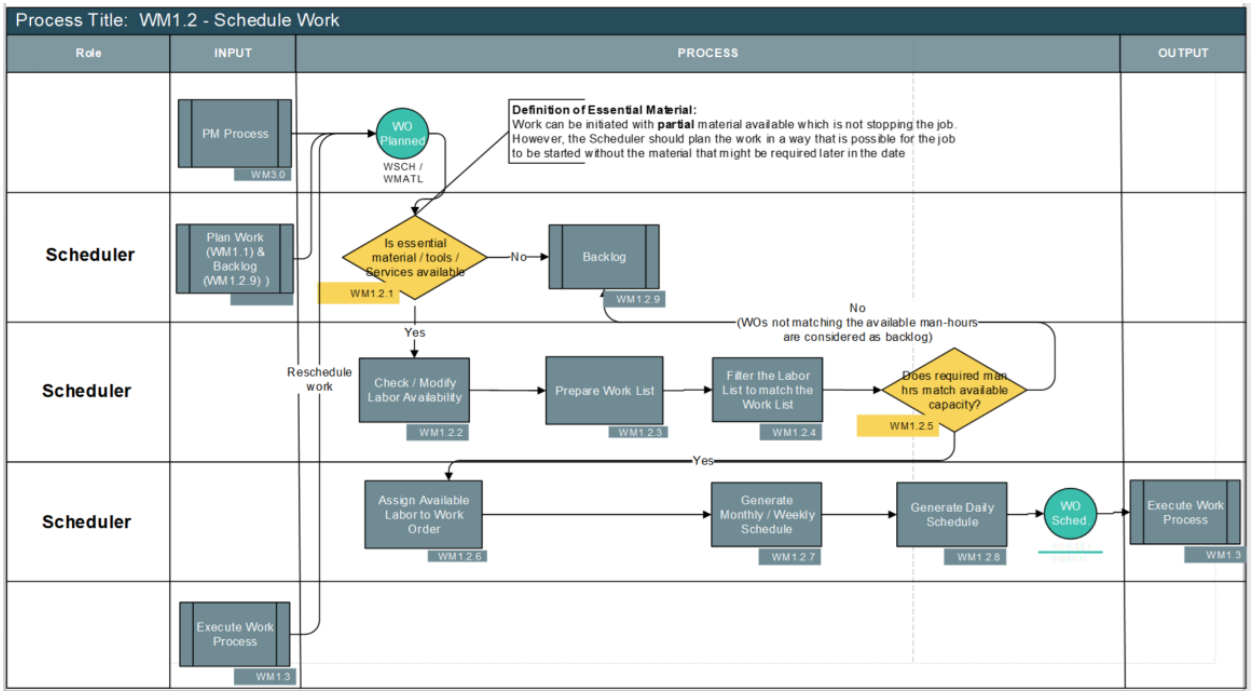


Figure 16: WM1.2 – Schedule Work (Sub Process)

The Execute Work process entails the execution of work orders and provides a way to access the work order data that is most relevant to completing a task.

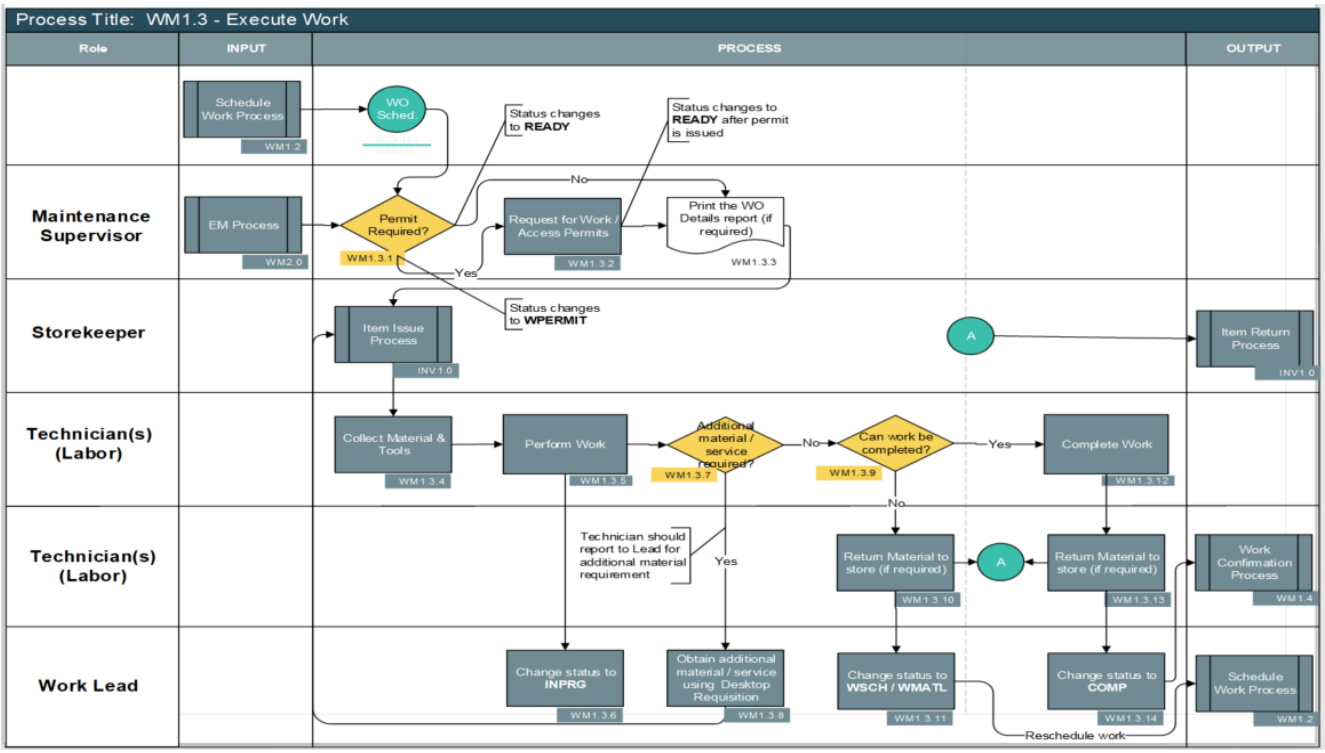


Figure 17: WM1.3 – Execute Work (Sub Process)

The Work Confirmation process demonstrates how maintenance staff can access an executed work order to update any requirements or to have a complete review before closing a work order.

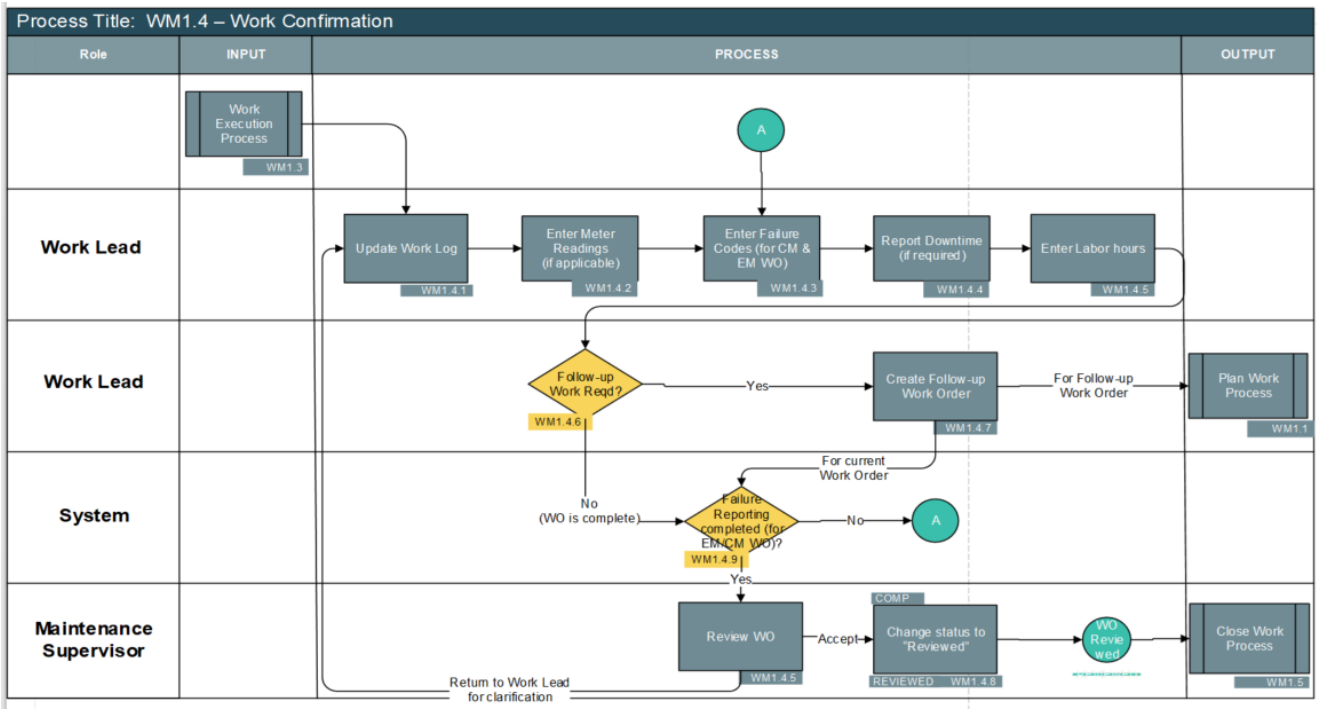


Figure 18: WM1.4 – Work Confirmation (Sub Process)

The Close Work process entails how the system will close the work order completely.

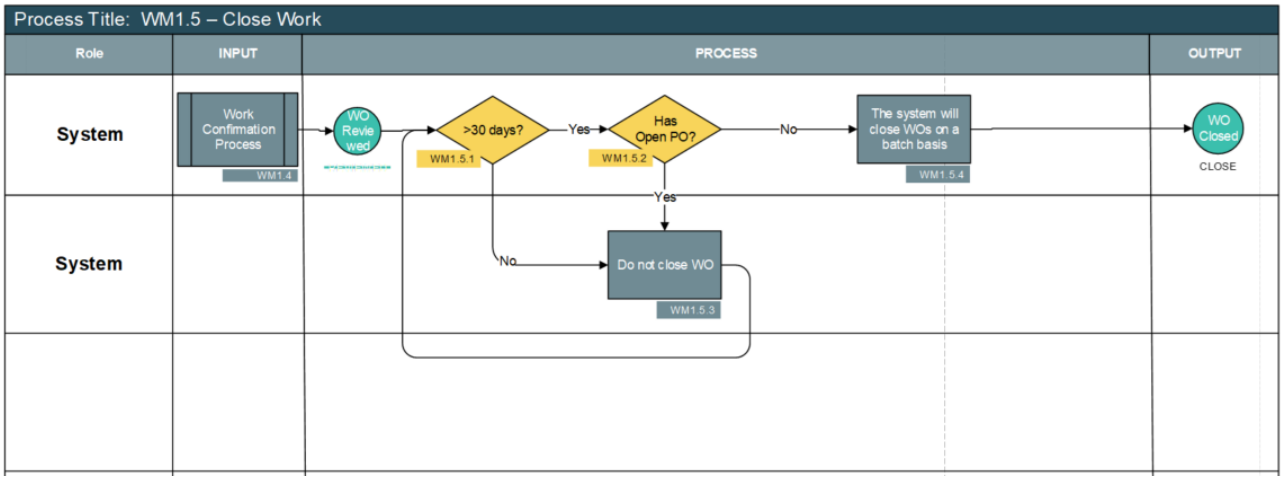


Figure 19: WM1.5 – Close Work (Sub Process)

6.1.6.8 Inventory Management Business Requirements

The following business requirements for inventory Management has been derived from the approved Inventory Management volume of the NMA&FM.

Req ID	Requirement	AMS Terminology	Description	Source
1	Able to accurately track parts for the equipment maintenance.	• Parts Tracking	Accurate inventory tracking preventing duplicates in ordering.	EOM-ZI0-PR-000014 - AMS Inventory Integration Procedure
2	Able to know up front the level of stock in the storeroom.	• Stock Levels	Having the right amount of stock and minimum stock of necessary parts for critical equipment.	EOM-ZI0-PR-000014 - AMS Inventory Integration Procedure
3	Ability to reorder and establish minimum stock levels.	• Reordering	Establish minimum stock levels and measure overall maintenance activities and all their financial impact.	EOM-ZI0-PR000014 - AMS Inventory Integration Procedure
4	Able to access the resources to multiple locations.	• Multiple Locations	Entities shall have access to resources from multiple locations - saves time in case of emergency	EOM-ZI0-PR-000006 - Warehouse Management
5	Able to add Manufacturer Part Number and Vendor Part Number.	• Item Master	User shall have the access to add spare parts details.	EOM-ZI0-GL-000007 - Inventory Control Management
6	Able to apply 'Average' costing method for item issuance.	• Item Master	User shall follow process as per the requirements.	
7	Able to reserve items that are required for planned work orders.	• Item Master	User shall follow process as per the requirements.	EOM-ZI0-GL-000007 - Inventory Control Management

Table 12: Inventory Management Requirements

The Inventory Management process will be used for managing the receipt, issue and auditing of material stock levels. It shall have a comprehensive material management function which includes catalogue, purchasing, stores management and other necessary functions to support all the activities and transactions amongst the main store, maintenance sections and the supplier. Table 12 below will be the guideline to develop the gap analysis;

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
IM001	Add Manufacturer Part Number and Vendor Part Number to the Item Master application.	Configuration to be applied in Item Master application.	X				
IM002	'Average' costing method will be used for item issuance.	To be configured in Organizations application (Inventory Options)	X				
IM003	Internal PO will not be required for item transfer within the same site. Internal PO will be used for transfer between storerooms of different sites.	To be configured in Organizations application (Inventory Options)	X				
IM004	Approved Purchase Requisitions will be created for external requests (stock reorder and direct issue from approved Work Orders).	To be configured in Organizations application (Inventory Options)	X				
IM005	On the Select Reserved Items dialog, open the Filter row by default whenever the dialog is opened.	Configuration to be applied in Inventory Usage application.	X				
IM006	The 'Issue To' field is to be made mandatory.	To be configured in Inventory Usage application	X				
IM007	Inventory usage record will be created automatically for new reservations (from approved work orders and desktop requisitions). This can be set in Organizations Inventory Defaults.	To be configured in Organizations application (Inventory Options)	X				

Table 13: Inventory Management Gap Analysis

The Inventory Management Process provides detailed workflow, defines the responsible roles and describes outputs in detail. Inventory management is a critical function in AMS as it tracks materials needed for maintenance. It monitors items in stock and it indicates when stock falls below the Entity's O&M defined reorder points.

The Stock replenishment process, below, involves two options; system automatic reorder (user defined/configured) or manual order. When the balance of an item on an inventory record falls below the reorder point threshold, the automatic reorder process begins. Manual reordering can also be performed as shown in the process below, regardless of current balance.

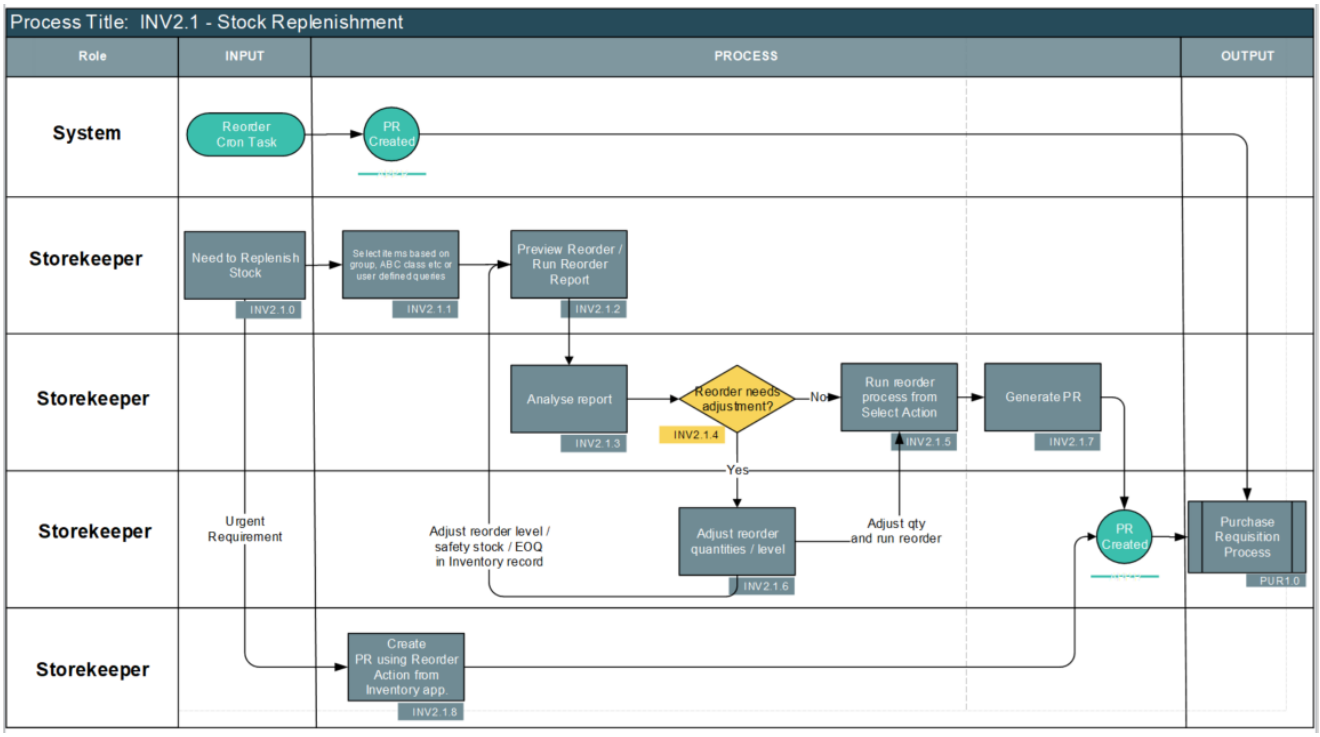


Figure 20: INV2.1 – Stock Replenishment

The Item Issuance process describes the operation of the work flow associated with issuing an item, including to a specific work plan, or for transferring an item to other store for issuance.

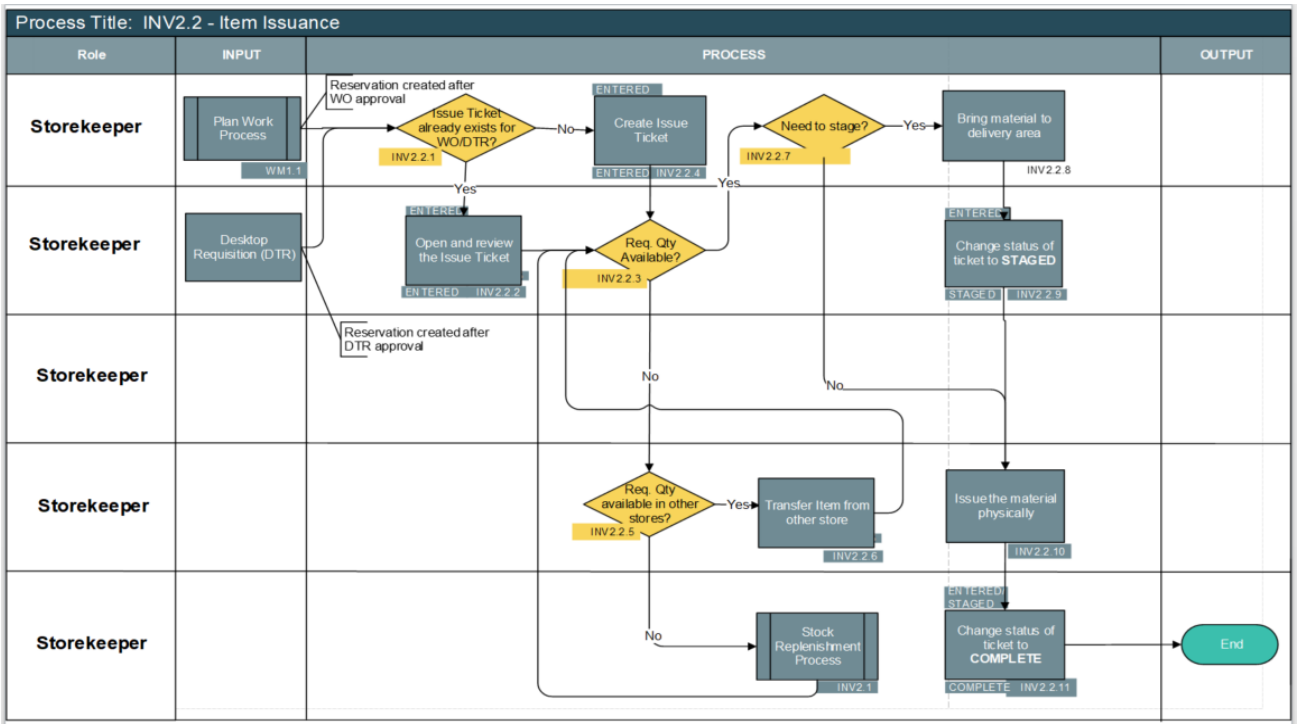


Figure 21: INV2.2 - Item Issuance

The Item Return process workflow entails the return of un-used materials, which are inspected and issued with a return ticket in the AMS.

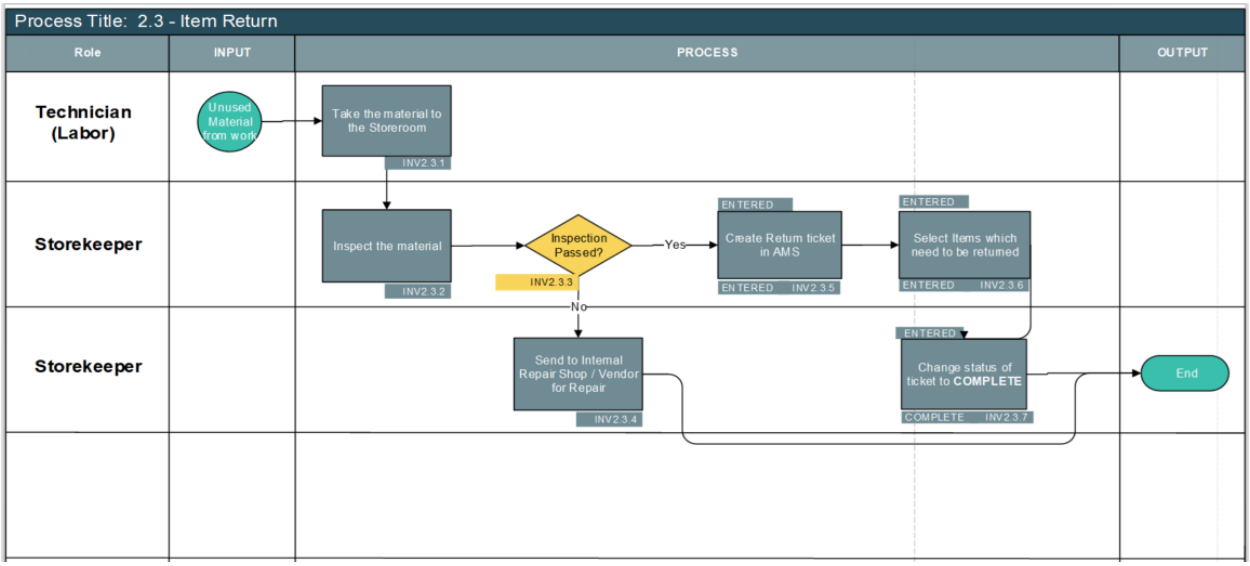


Figure 22: INV2.3 – Item Return

6.1.6.9 Purchasing Management - Business Requirements

Based on the analysis carried out in-line with the AMS Project Methodology, the following business requirements have been derived from the approved Procurement Methods and Procedures Chapter of the NMA&FM.

Req ID	Requirement	AMS Terminology	Description	Source
1	Able to raise purchase requisitions to the procurement team and able to provide purchase order upon approval.	• Procurement	User shall raise a purchase requisitions if parts, materials, tools and equipment are un-available in the store or warehouse.	EOM-ZI0-PR000001 - Procurement Methods & Procedures
2	Able to track down approved purchase requisitions for external requests (stock reorder and direct issue from approved work orders)	• Procurement	Individual user or current role (RACI) based access allows tracking down status of purchase requisitions and associated approved work orders.	EOM-ZI0-PR000001 - Procurement Methods & Procedures
3	To be able to request and manage vendor quotations.	• Procurement	User shall follow process as per the requirements.	EOM-ZI0-PR000001 - Procurement Methods & Procedures
4	To be able to purchase materials or services from an external vendor or another internal Storeroom	• Procurement	User shall follow process as per the requirements.	EOM-ZI0-PR000001 - Procurement Methods & Procedures
5	To be able to record and approve invoices, and reconcile line items against the Purchase Orders and Purchasing receipts.	• Procurement/Invoice	User based on access role (RACI) shall be able to approve invoices within his/her financial delegation.	EOM-ZI0-PR000001 - Procurement Methods & Procedures

6	Able to receive materials/receipt of services.	• Procurement/Invoice	User based on access role (RACI) shall be able to approve invoices within his/her financial delegation.	EOM-ZI0-PR000001 - Procurement Methods & Procedures

Table 14: Purchasing Management Business Requirement

Purchasing Management shall be responsible for ensuring that materials and equipment are procured at the right time, and in the right quantity. The AMS shall generate automatic purchase requisitions and purchase orders based on spare usage, minimum stock levels and lead times. The following table serves as a guideline to develop the gap analysis;

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
PUR001	PR number will be auto numbered using the sequence **PR-NNNN,** starting at PR-0001.	Configuration to be applied in Purchase Requisitions application.	X				
PUR002	Add a value list to the Priority field with the following values: 1 Within 8 hours 2 Within 24 hours 3 Within 1 week 4 Within 2 weeks 5 Within 4 weeks	Configuration to be applied in Purchase Requisitions application.	X				
PUR003	Change the label of the 'Supervisor' field to 'Work Supervisor'.	Configuration to be applied in Purchase Requisitions application.	X				
PUR004	Add new field for 'Department' of the requester. The value of the field should be taken from the requester's Personnel record. A value list is to be provided for the field.	Configuration to be applied in Purchase Requisitions application.	X				
PUR005	RFQ number will be auto numbered using the sequence **RQ-NNNN,** starting at RQ-0001.	Auto number to be defined.	X				
PUR006	Add a value list to the Priority field with the following values: 1 Within 8 hours 2 Within 24 hours 3 Within 1 week 4 Within 2 weeks 5 Within 4 weeks	Configuration to be applied in Request for Quotations application.	X				

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
PUR007	PO number will be auto numbered at site level using the sequence **PO-NNNN,** starting at PO-10000001.	Auto number to be defined.	X				
PUR008	Add a value list to the Priority field with the following values: 1 Within 8 hours 2 Within 24 hours 3 Within 1 week 4 Within 2 weeks 5 Within 4 weeks	Configuration to be applied in Purchase Orders application.	X				
PUR009	Company code will be auto numbered using the sequence **COM-NNNN,** starting at COM-0001.	Auto number to be defined.	X				

Table 15: Purchasing Management Gap Analysis

The Purchasing Management Process provides the detailed workflow and defines the responsible roles, and output. The purchasing module will track requests for and purchases of materials and services. Below is an example of a purchase requisition process.

The Purchase requisition process workflow entails how to raise purchase requisition where stock or services required and other scenario where materials are un-available.

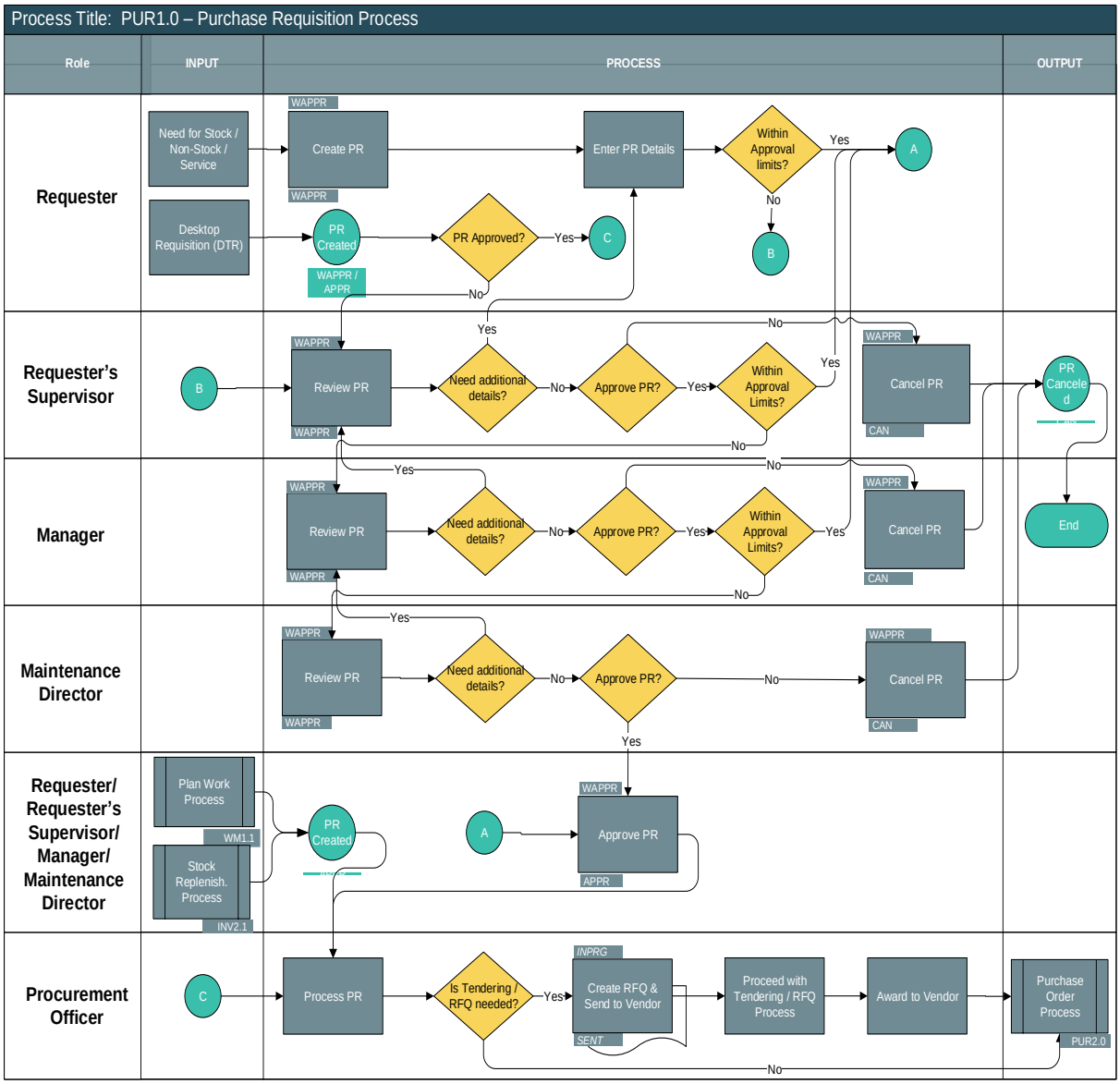


Figure 23: PUR1.0 – Purchase Requisition (PR) Process

The Purchase Order process flow describes how purchase orders are created after the purchase requisition process and where (PR) has been approved.

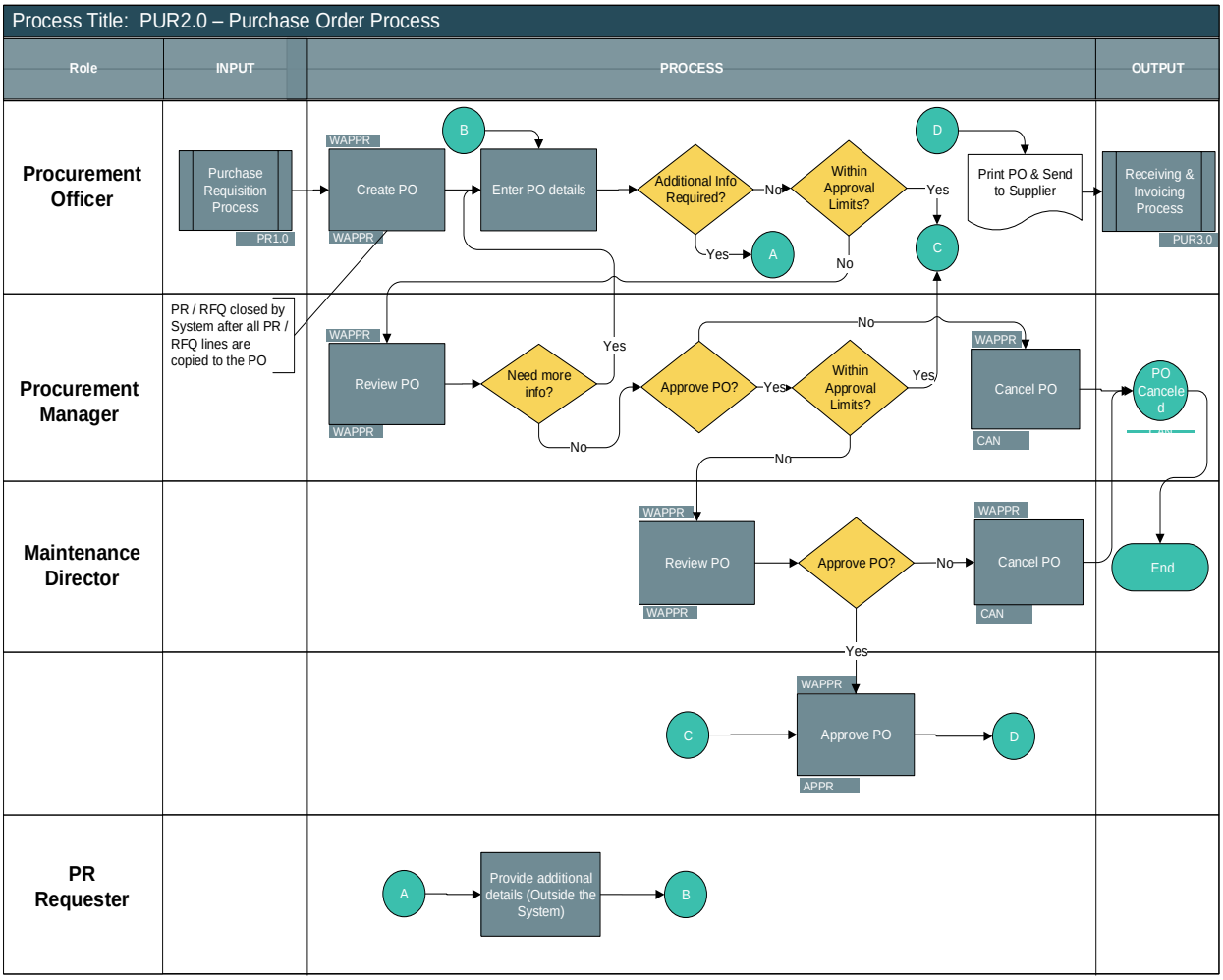


Figure 24: PUR2.0 – Purchase Order (PO) Process

The Receiving and Invoicing process flow describes how accountable staff manage the process from receiving ordered items and paying the associated invoice through the system.

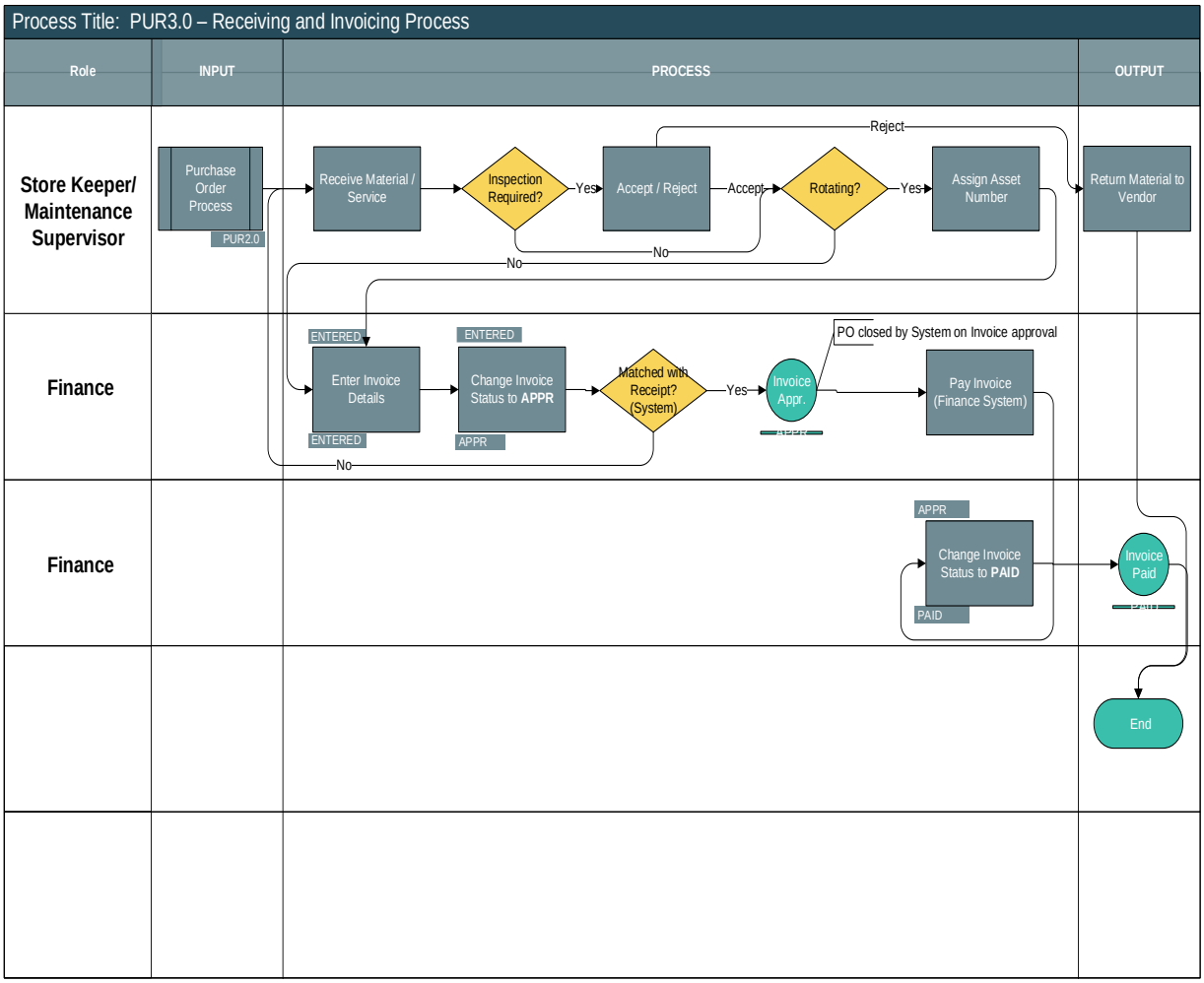


Figure 25: PUR3.0 – Receiving and Invoicing Process

6.1.6.10 Electronic Document Management System (EDMS) Business Requirements

Based on the analysis carried out in-line with the AMS Project Methodology, the following business requirements have been derived from the approved AMS and mandatory integration requirement volume of the NMA&FM.

Req ID	Requirement	AMS Terminology	Description	Source
1	AMS user is able to read, edit, copy & save, print of documents based on functional roles, user authentication and authorization from external integrated electronic document system.	• EDMS	AMS integration to Electronic Document Management Systems e.g. Aconex and able to access related documents or drawings etc.	EOM-ZA0-PR-000005 - Asset Management Software
2	AMS user is able to create store, access of documents and their classification, offering a wide range of document types e.g. Specifications, Technical Drawing, Schematics, Report, Safety Inspection and Project meeting minutes from external integrated electronic document system.	• EDMS	User shall have access or from existing current role (RACI) can track down status of purchase requisitions and associated approved work order.	EOM-ZA0-PR-000005 - Asset Management Software
3	Able to manage, administer integrated electronic document system to set up the document's lifecycle associated to it at the time of creation. Consists of statuses which mark the various stages of the work reflecting the evolution of documentation.	• EDMS	User shall follow process as per the requirements.	EDMS product specific implementation and configuration
4	Able to enforce of version control of documentation. Once a document reaches its final status it can no longer modified. The new version shall follow the predefined lifecycle.	• EDMS	User shall follow process as per the requirements.	EDMS product specific implementation and configuration

Table 16: Electronic Document Management System Business Requirements

The EDMS shall be a mandatory part of AMS integration to support the Entity for storing, indexing, cataloging, managing and tracking relevant plant and operational documentation such as NMA&FM, Training Manuals, Specifications, Technical Manuals, Drawings, Quality Assurance processes, collaborative aspects of work and long term data preservation. The following table will be the guideline to develop the gap analysis;

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
ED001	AMS allows users to read, edit, copy, save and print off documents based on the functional roles user authentication and authorization.	Configuration to be applied in both application	X		X		
ED002	Allows the creation, storing, access to documents and their classification, offering a wide range of document types e.g. Specifications, Technical Drawing, Schematics, Report, Safety Inspection and Project meeting minutes.	Configuration to be applied in both application	X		X		
ED003	Documents shall have a lifecycle associated with them at time of creation. Consisting of statuses which mark the various stages of the work reflecting the evolution of the documentation.	Configuration to be applied in EDMS	X				
ED004	Allows the enforcement of version control of documentation once a document reaches a final status it can no	Configuration to be applied in EDMS	X				

	longer be modified. The new version shall follow the predefined lifecycle.						

Table 17: Electronic Document Management System Gap Analysis

6.1.6.11 Mobility Business Requirements

Based on the analysis carried out in line with the AMS Project Methodology, the following business requirements have been derived from elsewhere in this volume of the NMA&FM.

Req ID	Requirement	AMS Terminology	Description	Source
1	Able to change status of work order on the mobile devices will be limited to the following only: - INPRG - WSCH - WMATL - COMP	• Mobile App	AMS apps on the mobile device that can access work orders and are able to change status of work.	EOM-ZA0-PR-000005 - Asset Management Software
2	Able to modify the existing query to limit the downloaded work orders to those where Scheduled Start >= (Current date - 7 days) and Scheduled Start <= (Current date + 7 days). This is to ensure that not too many work orders will be displayed in the mobile app.	• Mobile App	AMS add-ons to a mobile app that can access work orders and are able to change status of work and limit the viewing of active work orders.	EOM-ZA0-PR-000005 - Asset Management Software
3	Able to view the following fields and to be made read-only in the Work Order Details screen (not on the Create Work Order or Create Follow Up Work Order): - Asset - Location - Priority - Work Type - Scheduled Start - Scheduled Finish	• Mobile App	AMS users can view work order details and able to create a follow up work order if required.	EOM-ZA0-PR-000005 - Asset Management Software
4	Able to scan a bar code of an asset and display the main attributes.	• Mobile App	Users can utilize the mobile device to scan a bar code label of an asset and display the main characteristics or attributes.	EOM-ZA0-PR-000005 - Asset Management Software
5	Able to take photo and upload/save, attached to work order.	• Mobile App	Users can utilize the mobile device to take photo and upload, save to local PC's or to EDMS.	EOM-ZA0-PR-000005 - Asset Management Software

Table 18: Mobility Business Requirements

The Mobility process shall provide remote access from most mobile devices to AMS asset classification, work management and inventory. The following table will be the guideline to develop the gap analysis;

Gap ID	*Description*	*Recommended Resolution*	*Database / Application Configuration*	*Workflow*	*Interface*	*Report*	*Custom*
MM001	The status changes that can be made on the mobile devices will be limited to the following only: - INPRG - WSCH - WMATL - COMP	Modify Work Execution and CA Work Execution app	X				
MM002	In the 'My Assigned Work' query, need to modify the existing query to limit the downloaded work orders to those where Scheduled Start >= (Current date - 7 days) and Scheduled Start <= (Current date + 7 days). This is to ensure that not too many work orders will be displayed in the mobile app. (This is in addition to the existing query for WO status and supervisor)	Modify Work Execution and CA Work Execution app	X				
MM003	The following fields to be made read-only in the Work Order Details screen (not on the Create Work Order or Create Follow Up Work Order): - Asset - Location - Priority - Work Type - Scheduled Start - Scheduled Finish	Modify Work Execution and CA Work Execution app	X				
MM004	On the Work Order list screen: - Add Priority field at the bottom left corner of the work order - Move Scheduled Start field so that it doesn't block the work order number - Replace Asset number and Asset Description with	Modify Work Execution and CA Work Execution app	X				

Gap ID	Description	Recommended Resolution	Database / Application Configuration	Workflow	Interface	Report	Custom
	Location and Location Description (for Work Execution app only)						
MM005	Add Priority to the Sort-by list on the work order list main screen.	Modify Work Execution and CA Work Execution app	X				
MM006	Change the 'Scan Bar Code' functionality (in the application Menu) to filter by Location instead of Asset whenever bar code is scanned.	Modify Work Execution app	X				
MM007	Add Build Item, Label, Position fields on the work order list main screen.	Modify CA Work Execution app	X				
MM008	Add Build Item, Label, Position fields on the Work Order Details, Create Follow Up Work Order and Create Work Order screens.	Modify CA Work Execution app	X				
MM009	In the Search Asset Hierarchy screen, change the label 'Part Number' to 'CM Item'.	Modify CA Work Execution app	X				
MM010	Add new fields 'Permit Required?' and 'Permit' on the Work Order Details screen (no need in Create Work Order or Create Follow Up Work Order). Both fields will be read-only.	Modify Work Execution and CA Work Execution app	X				
MM011	The following priorities are required: 1 Immediately or less than 1 hour 2 Within 8 hours 3 Within 24 hours 4 Within 1 week 5 Within 2 weeks 6 Within 4 weeks	Modify Work Execution and CA Work Execution app	X				
MM012	Failure reporting must be completed before work order can be	Modify Work Execution and CA	X				

Gap ID	Description	Recommended Resolution	Database / Application Configuration	Workflow	Interface	Report	Custom
	changed to COMP status using the mobile device for CM and EM work orders.	Work Execution app					
MM013	The following priorities are required: 1 Immediately or less than 1 hour 2 Within 8 hours 3 Within 24 hours 4 Within 1 week 5 Within 2 weeks 6 Within 4 weeks	Modify Service Request app Update: Values come from the **TICKET PRIORITY** domain.	X				
MM014	Rename the label "Complete Work" to "Complete Task".	Modify Work Execution and CA Work Execution app	X				

Table 19: Mobility Gap Analysis

6.1.6.12 Report

The AMS shall have the ability to create reports and templates to produce either tabular or graphical reports or on screen displays.

The following reports shall be developed or as per Entities detailed requirements;

- Work Order Details Report
- Linear Work Order Detail
- Service Request Detail
- Inventory Balances
- Inventory Issue/Return
- Purchase Requisition Detail
- PO Receiving Detail
- Work Order Forecast for next X days/weeks/months
- Work Orders Waiting Approval by priority/time/work group/owner group
- Work Orders Overdue
- Interface e.g. SCADA event summary sorted by time, filtered by various fields
- Interface e.g. SCADA Frequency analysis events for the las X days
- Asset Number Barcode label
- Location Barcode label

6.1.6.13 KPI Maintenance Key Performance Indicators

Maintenance Key Performance Indicators will provide visibility of the Maintenances Function and its sub processes. These indicators enable users to understand how the physical assets are managed and supported by the Entity's Maintenance organization. The indicators act as a measure to track, analyze and improve the effectiveness of the maintenance strategies deployed by the Entity. For development and deployment of the maintenance indicators as mentioned below into organization KPI's refer to NMA&FM, Volume 15, KPI Framework. The Entities should deploy the Key Performance Indicators to:

- Measure the status and performance of their maintenance functions
- Compare and analyze their performance versus their historical values and benchmarking against their peers both in KSA and internationally
- Identify and diagnose their strengths and weaknesses

- Identify objectives and define rolling targets to consistently deliver the AM Policy
- Define and plan improvement actions;
- Continuously measure changes over time and update the maintenance strategy to incorporate the changes in the business and operating context
- Analyze and improve the capability and competence of the maintenance team

Managing the maintenance business process needs various leading and lagging indicators in the form of Key Performance Indicators. Entities should at a minimum develop and deploy the following KPI's to manage maintenance functions and its integration with following sub functions

- Management of maintenance business process
- Management of Health and Safety
- Engineering and technical standards compliance
- Organization and support for maintenance delivery
- Administration and supply of resources and spares
- People and competence
- Physical asset management
- Financial management
- Contract management
- Information technology and maintenance process automation
- Asset Performance Management and Asset Health Monitoring
- Risk Management and reliability improvements

Managing the maintenance business process across the above mentioned twelve sub functions needs leading and lagging KPI's. The AMS should provide the self-service functionality for the maintenance users to configure and manage the KPI's and reports with very minimal involvement from the AMS product team. The following combination of reports and KPI's will enable the Entity to manage assets in a more proactive way and improve the speed of adoption of the AMS.

Item no	Group	Description
1	KPI	• Maintenance cost (per year) • Corrective maintenance (in time and/or costs) • Preventive maintenance (in time and/or costs) • Condition-based maintenance (in time and/or costs) • Maintenance assigned to a service provider (in cost and number of hours) • Down time due to maintenance (corrective, preventive) • Unscheduled (and scheduled) unavailability due to maintenance successful starts • Unscheduled maintenance costs • Maintenance cost due to staff costs • Cost due to spare parts (and materials) • Spare parts stock value
2	Reports for Failure analysis	• Identified undesirable events (failures, malfunctions due to Evident or hidden faults) • Change in the number of identified undesirable events over a given period • Identified undesirable events which have occurred and are not identified in the initial list of • Identified failures • Identified undesirable events which have not occurred over a given period and are included in the list of identified failures • Identified undesirable events which effects were not expected

Item no	Group	Description
		• Equipment covered by a maintenance plan • Maintenance plans revised or created per year • Date of the last version of the maintenance plan • Recommendations made to improve the equipment (financial impact) • Non-detected failures (although CBM is applied) in relation to total number of faults • Non-detected failures because of lack of CBM (although available) • Events to be fixed in the next given period of time
3	Reports for Prioritization	• Criteria for ranking • Estimated maintenance time and actual maintenance time • Spare parts planned and spare parts used • Corrective and preventive maintenance tasks performed without maintenance procedure • Revision of the maintenance procedures
4	Reports for Task Analysis	• Tasks not done according to the preparation of tasks • Tasks organized • Tasks to be organized • Tasks not done according to the organization of tasks • Tasks pending scheduling • Tasks delayed in relation to the request • Backlog of preventive maintenance work orders • Planned time schedule and realization time of the tasks • Actual active maintenance time per task • Actual logistic and administrative delay per task • Actual down time due to maintenance per task • Unplanned outages following preventive maintenance tasks • Repeated tasks (inadequate maintenance quality) • Actual man hours per tasks • Remaining corrective maintenance tasks on critical items • Tasks pending completion • Estimated maintenance time and actual maintenance time
5	Reports for Fault Diagnostics and Maintenance process analysis	• Fault diagnosis time • Failures considered repetitive in the context (incorrect root cause analysis) • Unnecessary work orders • Repetitive failures without root cause analysis • Diagnostics work orders • Improvements of items (number, costs) • Late delivery of item improvements • Unavailability and cost overruns

Item no	Group	Description
		• Conformity of the result of item improvements • Reliability improvement • Maintainability improvement • Safety Improvement • Rate of maintenance-related accidents • Severity of maintenance-related accidents • Medical care without interrupting work time • Rate of near- miss -accidents • Masses or volumes of waste generated by the maintenance task • Masses or volumes of discharges generated by the maintenance task • Days off taken by maintenance staff because of work accidents and work-related illnesses • Days without accident since the last accident • Tasks with Maintenance procedure • Tasks without Maintenance procedure • Tasks with isolation procedures • Task for coverage of risk assessment • Frequency of risk assessment updates • Compliance with pre-defined risk procedures
6	Reports for Costing and Internal Benchmarking	• Deviations detected during budget monitoring • Analyses following the deviations detected • Budget allocation to maintenance types (preventive, corrective, improvements) • Budget allocation to the indenture level of items • Budget allocation of cost types (labor, materials, fuel/energy, overhead, • Transportation/travel • Frequency of reporting • Fugitive gas accounting • Carbon accounting
7	Reports for Documentation	• Coverage of documents (overall and/or by type of maintenance, item, criticality, etc.) • Documents that do not exist when a need for them is expressed (overall and/or by type of • Maintenance, item, criticality, etc. • Documents updated late (overall and/or by type of maintenance, item, criticality, etc.) • Documents not up-to-date (overall and/or by type of maintenance, item, criticality, etc.) • Consistency, readability and understanding of documents maintenance reports
8	Reports and KPI Maintenance performance	• Asset health assessments of items on which preventive maintenance have been performed

Item no	Group	Description
		• Analysis of stock levels and management parameters (min. level, max. levels, reorder quantity, etc.) • Analysis of parts and items whose obsolescence is known and/or foreseeable and of a study of replacement solutions including Update of monitoring of methods, regulations, standards, etc. • Automatically produced indicators • Asset class maintenance plans report • Data management plan (existing/non-existing, updated/need update) • Coverage of the data collection, storage and update (items, maintenance history) • Analysis of items on which corrective maintenance is performed • Analysis and update of the list of critical items • Late delivery of item investments, modifications • Lead time and cost overruns • Compliance with engineering-related procedures (number of deviation reports) • Conformity of the result of item modifications and investments • Specifications produced with help from maintenance managers • Coverage of maintenance plans, skill specification and logistical resource plans • Tasks pending or delayed because tools are unavailable
9	Report for Tools and Special Equipment's	• Maintenance costs of tools • List of specialty tools not available • Down time rate due to tools • Unavailability (or production loss) due to lack of tools or equipment for maintenance • Non-compliant tools or equipment • Average waiting time to obtain tools or equipment needed for maintenance • Total cost of maintenance attributable to operational tools or equipment costs • Mean delay to deliver tools or equipment • Tools due for calibration and certification • Maintenance performed with not calibrated and not certified tools
10	Report for Spares and Special Equipment's	• Unavailability (or production loss) due to a stock shortage • Spare item requests not fulfilled • Non-compliant spare items • Number of scrapped spare items compared to number of repairable spare items • Obsolescent spare items that shall be replenished • Deviation in the inventory (value and/or quantity) • Change in total value of stock (year N compared to year N-1)

Item no	Group	Description
		• Average value per spare catalogue number managed in stock • Change in total number of spare items in stock • Change in number of new spare items in stock (year N compared to year N-1) • Change in number of spare items eliminated • Change in number of direct purchases (purchase of spare items not placed in stock) • Average waiting time at storeroom to obtain spare items needed for maintenance • Total cost of maintenance attributable to spare item costs • Stock coverage rate (by category of materials) • Mean delay to order • Mean lead time (per spare parts categories) • Turnover of stock • Stock value in relation to plant replacement value • Stock value • Annual consumption of spares
11	Staff performance Report	• Turnover of internal maintenance staff (per year) • Absenteeism of maintenance staff, excluding work-related accidents • Change in workforce • Breakdown of maintenance staff by function (mechanical, boiler, electricity, automated systems, other functions, etc.) • Filled positions compared to open positions • Training time in relation to actual maintenance work time. • Delays due to staff unavailability • Maintenance overtime hours worked by internal staff • Unavailability due to poor quality in maintenance performance • Manpower plans (quantitative, qualitative, timing etc.) • Coverage of documented job profile requirements • Coverage of training plans
12	Service provider evaluation	• Service provider evaluations • Contracts signed with service providers • Time spent waiting for service providers to perform maintenance • Time spent by service providers waiting to perform maintenance • Unavailability due to poor quality in maintenance performance • Defined and documented management system and control for contracting • Conformity with quantitative objectives regarding contracting • Procedural conformity compared with requirements

Item no	Group	Description
		• Anomalies detected (premises not available on time or unsuitable, power or utilities required for maintenance not available, telecommunications networks, etc.) • Total cost of maintenance attributable to infrastructure costs

Table 20 – KPI Reports

6.1.6.14 Analyzing Gaps

The gaps are analyzed in order to determine the most feasible resolution based on the Process Design Principle outlined below;

Design Principle	Rationale
Re-use existing knowledge and processes	• Needs to attain a critical mass of adoption to become viable • The functionality must be repeatable and deliver value to reduce risk and implementation costs • Leverage on standard business process • Reduce cost • Reduce risk
Adopt a minimal customization approach	• Improve management of change • Permit localization to suit specific needs • Reduce risk (performance and upgrade)
Adopt best practices, where applicable.	• Adopt generally accepted best practices based on experience and/or lessons learnt from other companies • Standardize practices
If best practices are not applicable, adopt solutions brainstormed during client workshop discussions.	• Implement solutions suited to Entities business environment

Table 21 – Process Design Principle

6.1.6.15 AMS Testing

Upon implementation of the AMS, the Entity shall manage the performance of testing, including but not limited to the following types:

- **System Integration Testing (SIT)** – ensuring that interfaces between modules work.
- **Volume/Stress testing (VST)** – ensuring that AMS works on the intended platform, and with the expected quality and volume of data.
- **Functional/User Acceptance Testing (UAT)** – ensuring that the system does what the user requires.

The Entity shall manage the establishment of a Test Procedure for each part of the AMS, which requires to be tested. Each AMS Test Procedure shall feature:

- Unique Test Procedure ID
- Procedure Title and Author
- Description of the Function/Part to be validated in the test, and objectives of the test
- Version of the Test Procedure
- Prerequisites for Testing
- Testing Tools/Equipment, as required

- Risk Management and Safety Components, as applicable

Each step within the Test Procedure shall feature the following attributes:

- Unique Identifier
- Description
- Success Criteria
- Evidence of Test Completion

The Entity shall manage the establishment of a Test Report Template, applicable to different types of testing.

End-to-end testing shall be performed by the Entity, in order to ensure that:

- AMS can cater to the Entity's requirements
- Deviations are captured
- System integration is achieved such that the Entity's operations are not affected

The Entity shall employ the following, when managing the establishment of an AMS Test Procedure:

- Guidance contained within this section, specifically Table 22 (below)
- Attachment 4 – EOM-ZA0-TP-000002 – AMS Functional Testing Report Template
- Attachment 5 – EOM-ZA0-TP-000003 – AMS Integration Testing Report Template
- Attachment 6 – EOM-ZA0-TP-000005 – AMS Test Script Template
- Attachment 7 – EOM-ZA0-TP-000006 – AMS Risk Register Template

Description	Functional test procedure is to test AMS functional requirements.
Expected Test Duration	1 Month
Objective	To test if AMS is configured / customized to the requirements specified in AMS Gap Analysis and complies with Business/Users related requirements.
	This test together with the test steps are designed to ensure in an optimum way, that all AMS modules that are configured/customized to the Entity's requirements, are functioning as required, and without any bugs.
Prerequisite	Completion of all AMS development e.g. configurations, customizations, workflows and reports
Test Report Template	Please refer to Attachment Section.
Safety requirements to carry out the test	None
Test Owner	Entity AMS Project
Test Writer / Review	Vendor/Solution Provider
Tester	Vendor/Solution Provider
Witness	Entity AMS Project Representative
Testing Tools/Equipment (as applicable)	None

Table 22: AMS Test Procedure

Test Scripts/Steps – this test shall be carried out by Vendor/Solution Provider and Entity AMS Project testing team by logging into AMS from individual PC to thoroughly test the functionalities of each module. A final testing session to test and demonstrate each step shall be conducted in which specific Entity users participate and witness testing by Entity SME's.

Refer to Attachment 6 within this document as the guideline template to develop the AMS test scripts/steps.

6.2 AMS Training Plan

Training is one of the critical elements required to ensure that operation and maintenance of the Entity shall possessed the required competency for the provision of a safe work environment.

The Objective of training is to:

- Understand the linkages between asset data policy and data management (This links the Asset Data policy and its translation into AMS data management – guidelines and rules);
- Understand the asset class strategy deployment through AMS (This links to the Asset Policy and the Strategic Asset Management Plan);
- Understand the overall system features, functionalities and configuration of the AMS;
- Understand and apply the relevant rules and regulations for the operation of the AMS;
- Understand the interfaces between AMS and other integrated systems e.g. SCADA, BMS, GIS etc.

Training Strategy and approach:

The training will cover integration and knowledge requirements for operating AMS.

The following principles are used to guide the design, development, and implementation of the training:

- Training shall be relevant to the role and responsibilities of the trainee;
- Training shall be delivered to the appropriate level of detail for the selected key trainers and trainees;
- Training shall be developed in a flexible modular structure to enable it to be packaged easily for delivery;
- Classroom training shall be delivered using the “Training PowerPoint template”
- Training will incorporate “real life” operational examples (scenario training);
- Training sessions shall be delivered in English and Arabic;
- Training materials shall go through the review and approval process;
- All training materials shall be written in English and Arabic; and
- Training shall be delivered on a “just-in-time” basis.

Modular Training Program:

Training presentations shall be prepared using the “Training PowerPoint Template”, which shall reflect the corporate style, using a layout that promotes clarity and ease of learning.

A typical module may contain a series of lessons. Each lesson shall contain a broad aim and a defined number of specific, achievable and consequentially measurable training objectives.

Throughout the training, trainees can be assessed by employing the training methodology of ‘question and answer’ and by utilizing other training delivery techniques such as ‘trainee centered task groups’ or practical interactive demonstration formats. Learning can be paced at the ‘Key Instructor’ level.

To ensure the effectiveness of the training, the trainees may require completing a series of inter-related training modules before being certified to have the required competence of performing the activities as covered by those training modules.

Typical AMS training courses are shown in the Table 23. Entities specific training program will be detailed in the project initiation document.

List of Training Courses		
Training Course	Courses	
	No.	Course No.
AMS Training		**AMS-001**
Asset & Work Management Overview	1	AMS-001-01
Self Service Requestor	2	AMS-001-02
Navigation and Querying AMS Documentation	3	AMS-001-03
Work Management for Team Leaders and Operatives	4	AMS-001-04
Work Management for Supervisors and Planners	5	AMS-001-05
Inventory Management for Warehouse Operatives	6	AMS-001-06
Inventory Management for Warehouse Supervisors	7	AMS-001-07
Purchasing for Inventory Operatives and Supervisors	8	AMS-001-08
Purchasing for Procurement Operatives and Supervisors	9	AMS-001-09
Reporting & KPI	10	AMS-001-10
AMS Document Attachments	11	AMS-001-11
Electronic Document Management System (EDMS)	12	AMS-001-12
Mobile Work Management	13	AMS-001-13
Mobile Inventory Management	14	AMS-001-14
Asset Configuration Management	15	AMS-001-15
Asset Management Scheduler	16	AMS-001-16
AMS Administrators Training		**AMS-002**
AMS System Administration	17	AMS-002-01
Workflow Process & Programming	18	AMS-002-02
AMS Hardware Management	19	AMS-002-03

Table 23: AMS Proposed Training Courses

Refer to the following EXAMPLE training matrix and course outline as presented below.

Training Matrix for Asset Management Software							
List of Proposed Training Course			**Participants**				
Course	Training Location		Entity Asset Management System Team	Entity O&M SME's	Entity O&M Contractor Team	Warehouse Team	Remarks
Course No.	Theory	Practical					
AMS-001-01	X		X	X	X	X	ALL AMS user
AMS-001-02	X		X	X	X	X	All AMS user
AMS-001-03	X		X	X	X	X	ALL AMS user
AMS-001-04		X	X	X	X	X	Team Leader
AMS-001-05		X	X	X	X	X	Team Leader, Planners
AMS-001-06		X				X	Warehouse team
AMS-001-07		X				X	Warehouse team
AMS-001-08		X					Procurement team
AMS-001-09		X					Procurement team
AMS-001-10		X					Managers, Supervisors, Planners, etc.,
AMS-001-11		X					Managers, Supervisors, Planners, etc.,
AMS-001-12		X					Managers, Supervisors, Planners, etc.,
AMS-001-13		X					Planners, Schedulers, Supervisors, Team Leaders
AMS-001-14		X					Warehouse team
AMS-001-15		X		X			AMS System Management
AMS-001-16		X					Planners, Schedulers, Supervisors
AMS-002-01		X					AMS System Management
AMS-002-02		X					AMS System Management
AMS-002-03		X					AMS System Management

Table 24: Training Matrix

Each training course is designed to meet the specific needs of the subject matter.

• Asset Management Software (AMS) Training Course Outline				
Training Course	Course Objectives	Course Modules	Pre-training Criteria	Remark
Asset and Work Management Overview	To become familiar with the principles of the AMS Asset and Work Management Process	AMS System Overview AMS - Asset Management Overview AMS - Work Management Overview	Familiarity with and understanding of the Entity Infrastructure, including an overview of Building locations/main operational features.	
Self Service Requestor	To be able to raise and track a Self Service Request.	1. Self-Registration 2. Creation of a service request on-line 3. Tracking progress and completion of a service request		AMS System Overview
Navigation and Querying AMS Documentation	To become familiar with the Navigation and Querying functions in both AMS and the EDMS	1. Functional areas within AMS 2. Self-registration 3. Working with user profiles 4. The Start Center 5. Navigating in AMS 6. KPIs and reports 7. Navigating hierarchies 8. Database basics 9. Searching for records 10. Filtering records 11. Searching and Querying the EDMS		AMS System Overview, AMS Self Registration Use of and familiarity with Personal Computers, including keyboards, mouse/pointing devices. Familiarity with the MS-Windows operating system and applications.
Work Management for Team Leaders and Operatives	To understand and be able to effectively utilize the Work Management module including mobile work management on Portable Devices to the level normally required by team leaders and maintenance operatives.	1. Description of the relevant modules required for overall Work Management. 2. Use of Start Centre to receive work orders 3. Sorting and selecting relevant work orders 4. Retrieving Work Plans 5. Receiving/querying material lists 6. Starting, executing and completing Work Orders 7. Processing Work Orders using automated workflow functionality 8. Recording Failure Codes 9. Recording Meter Values 10. Recording Materials usage and updating asset records. 12. Retrieving attached Maintenance Manual documents 13. Creating Reactive Work Orders and Material requests.		Navigation and Querying in AMS

		14. Use of Mobile Work Management and Portable Devices.		

Table 25: AMS Training Course Outline 1

Asset Management Software (AMS) Training Course Outline			
Training Course	Course Objectives	Course Modules	Pre-training Criteria
Work Management for Supervisors and Planners	To understand and be able to effectively populate the Work Management module including creation of locations, Asset records, job plans, labor assignments, etc. Effectively encompassing the tasks of maintenance supervisors and planners.	1. Creating Locations and Location Hierarchies 2. Entering Asset Records and creating Asset Hierarchies 3. Linear Assets, Features and Relationships 4. Setting Up Job Plan templates 5. Processing Work Orders through the Work Order life cycle 6. Entering Supporting Records for Materials Management. 7. Setting Up Job Plan templates 8. Setting Up Scheduled/Routine Maintenance Activities 9. Generating Work Orders based on Time and Meter based Frequencies 10. Using Assignment Manager to assign Labour to Tasks 11. Creating Reactive Work Orders 12. Processing Work Orders through the Work Order life cycle 13. Entering Supporting Records for Materials Management. 14. Managing SCADA events (custom application)	Work management for Team Leaders and Operatives
Inventory Management for Warehouse Operatives	To understand and be able to effectively utilize the Inventory Management module especially the issue and receipt of items. Effectively encompassing the tasks of warehouse operatives.	1. Overview of the applications in the Inventory Module, and their interaction with other applications. 2. Re-ordering Items (Purchase Requisitions) 3. Assembling and dis- assembling kits 4. Issuing, transferring and returning items 5. Stock checking and auditing	Navigation and Querying in AMS Work Management for Team Leaders and Operatives
Inventory Management for Warehouse Supervisors	To understand and be able to effectively utilize the Inventory Management module to manage the stores including; setting up new stores, assigning items to stores, adjusting inventory counts, etc. Effectively encompassing the management tasks of warehouse Supervisors.	1. Setting up a storeroom 2. Using the item master application to create items, item kits, and item assembly structures. 3. Assigning items to a storeroom 4. Creating a new tool and adding it to a storeroom 5. Re-ordering Items (Purchase Requisitions) 6. Assembling and Disassembling kits 7. Adjusting inventory counts 8. Creating company masters, and using the company's application (to produce supplier lists)	Inventory Management for Warehouse Operatives

Table 26: AMS Training Course Outline 2

Asset Management Software (AMS) Training Course Outline			
Training Course	Course Objectives	Course Modules	Pre-training Criteria
Purchasing for Inventory Operatives and Supervisors	To understand and be able to effectively utilise the Purchasing for Inventory module to create purchase requisitions, receive materials, approve receipts, etc. Effectively encompassing the tasks of warehouse Supervisors and authorized operatives.	1. Overview of the applications in the Purchasing Module, and their interaction with other applications. 2. Re-ordering items from external vendors 3. Clearing re-order locks. 4. Creating Purchase Requisitions 5. Changing the status of Purchase Requisitions 6. Receiving Materials and Services 7. Approving Receipts 8. Changing the status of and closing POs. 9. Entering received invoices, copying line items for material receipts, service receipts. 10. Approving supplier invoices against received services and materials.	Navigation and Querying in AMS
Purchasing for Procurement Operatives and Supervisors	To understand and be able to effectively utilise the Purchasing for Procurement module to create RFQs, create and approve purchase orders, etc, Effectively encompassing the management tasks of Purchasing Supervisors and authorized operatives.	Navigation and Querying in AMS Work Management for Team Leaders and Operatives	
Reporting and KPI	To understand and be able to effectively create reports utilizing the reporting function.	Solid Knowledge of Windows platform usage, multi- window/palette application usage. Moderate Knowledge of report design, writing, functionality, administration, AMS applications, functionality, and navigation. Basic Understanding of web server architecture, functionality, connectivity, SQL coding, databases and connectivity between databases and reports.	

Table 27 – AMS Training Course Outline 3

6.3 AMS Risks Register

The Entity should capture risks from the early stages of the project and track issues and address them as they arise. It shall also be used to identify, assess and manage risks down to the acceptable levels through review and process as per the Expro AMS project methodology.

Refer to Attachment 7 within this document to develop the AMS risk log.

6.4 Derived Maintenance Requirements

The NMA&FM is the main driver in setting AMS business requirements and provides clear definitions and captures all the required functional requirements with regard to the end to end implementation process of AMS.

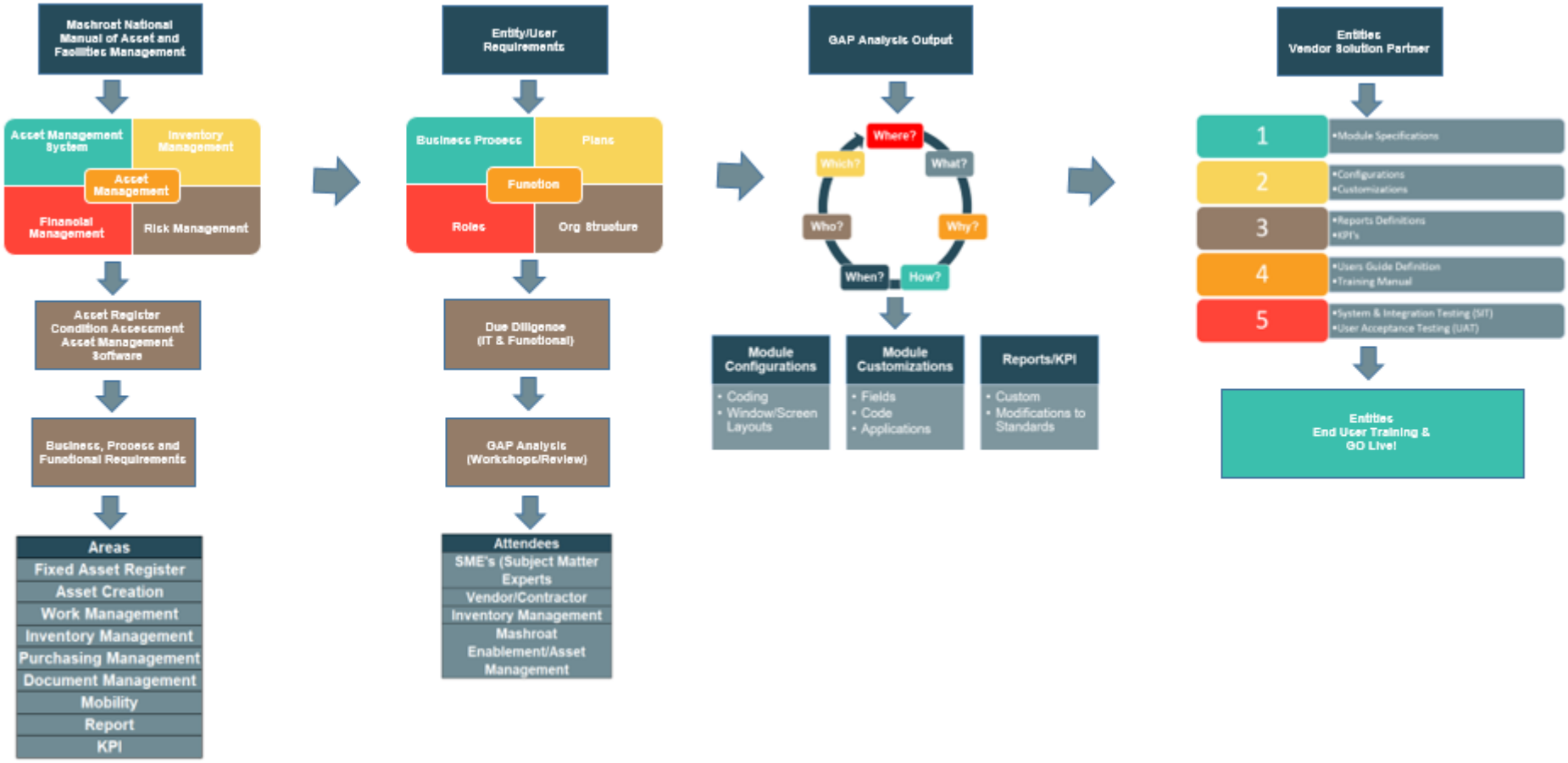
Volumes and Chapters Used to Derive the Maintenance Requirements		
Item No	**Volume No**	**Chapters**
1	2	2
2	3	2,3
3	4	2
4	5	2,4 to 21
5	6	2-18, 19 -27
6	7	1,2
7	8	8 to 10
8	9	6,7,8
9	13	2,4,5,6,7
10	14	1,2
11	15	1,2

Table 27: NMA&FM List

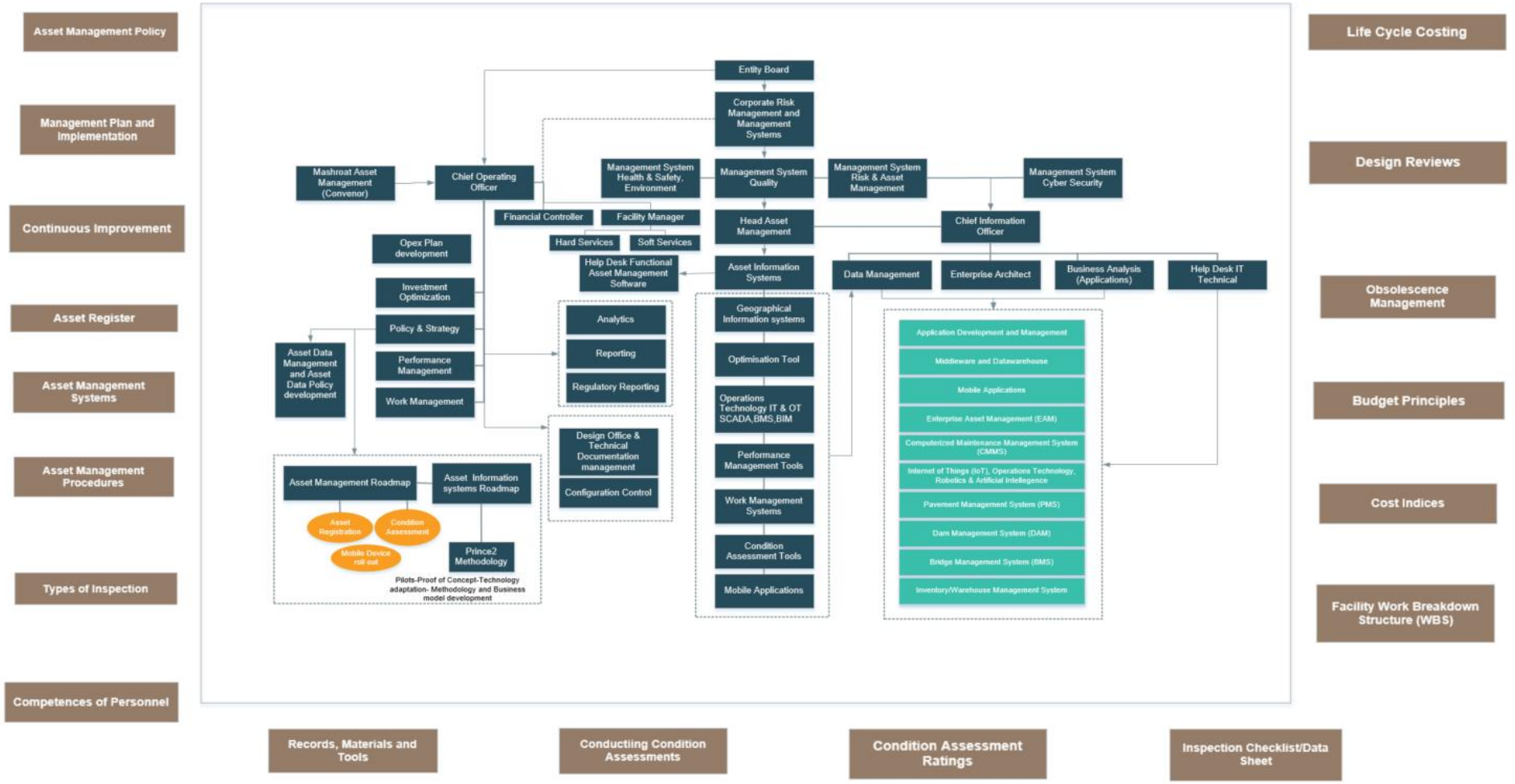
7.0 ATTACHMENTS

1. Asset Management Support Process
2. Asset Management Systems Operating Model
3. Site Asset Data Collection, Validation and AMS Asset Registration Process
4. EOM-ZA0-TP-000002 – AMS Functional Testing Report Template
5. EOM-ZA0-TP-000003 – AMS Integration Testing Report Template
6. EOM-ZA0-TP-000005 – AMS Test Script Template
7. EOM-ZA0-TP-000006 – AMS Risk Register Template

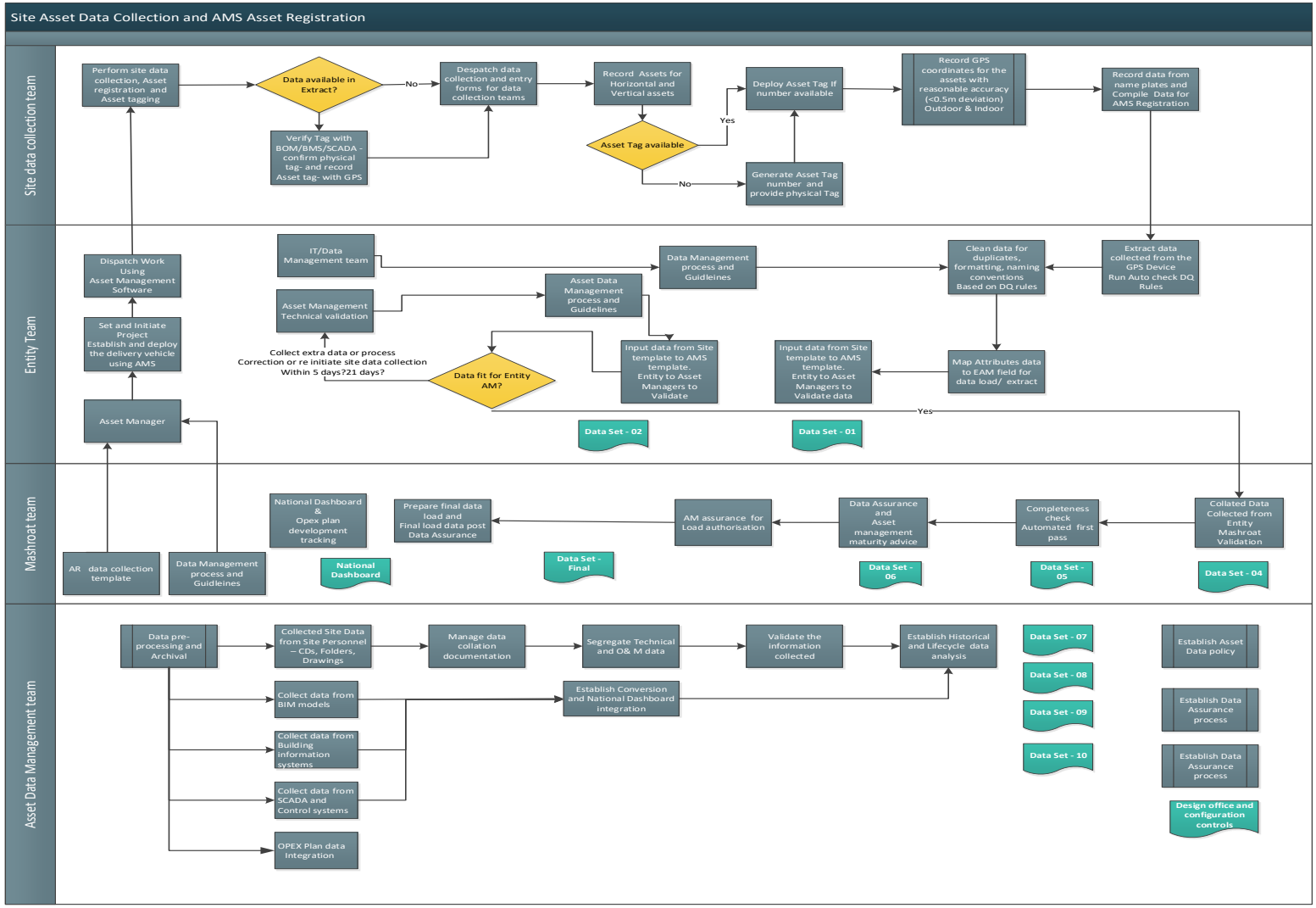
Attachment 1 – Asset Management Support Process
(Best viewed as A3 format for printing)



Asset Management Systems Operating Model



Attachment 3 – Site Asset Data Collection, Validation and AMS Asset Registration Process



Attachment 4 – EOM-ZA0-TP-000002 – AMS Functional Testing Report Template

AMS Functional Test			
Functional Testing			
Test Report		**Date**	**Revision No.**
Test Description	Functional test procedure is to test AMS Functional requirements. To test if the AMS is configured / customized as per NMA&FM Volume 2, Chapter 2 – Asset Management Software (EOM-ZA0-PR-000005) and complies with business/users related requirements.		
Test Result	**<<Passed / Failed>>**	<Green/Red>	
Conducted By Name/Position/ Sign			
Verified By			
Approved By			

Test Script						
Step No.	**Step /Task**	**Test Result (Passed / Failed)**	**Success %**	**Number of Defects**	**Status**	**Remarks**
1	**Asset Management** • Create Location • Create Asset • Perform Asset management functions to cover Asset Management Lifecycle • Run all new Asset Management Reports				<Green/ Red/ Yellow>	

2	**Work Order Management** • Create Job Plan • Create PM schedule • Create PM (Preventive Maintenance) Work Order • Create Service Request • Create CM (Corrective Maintenance) Work Order • Create EM (Emergency Maintenance) Work Order • Complete and Close Work Orders using Work Order Workflows covering the Work Order Lifecycle • Run all new Work Management Reports					
3	**Inventory Management** • Create Store Location • Create Items and Inventory Record • Create Inventory Transactions • Run all new Inventory Reports					
4	**Purchasing Management** • Create Company record (Supplier) • Sign Letter of Award • Perform item delivery until closing the Purchase Order • Create Contract and Contract Release • Run all new Inventory Reports					
5	**Asset Configuration Management** • Create Configuration Asset • Perform Configuration Asset Management functions to cover Asset Management Lifecycle • Run all new Asset Management Reports					
6	**Mobility Management** • Perform Work through Mobile application • Perform Work execution through Mobile Condition Assessment application					

7	**FRACAS** • Create a CM Work Order and route to FRACAS Workflow • Enter Fault code and related details • Perform RCA (Root Cause Analysis) • Close Work Order					
8	**EDMS** • View, copy, save and print documents (e.g. specifications, drawing, template etc.)					
9	**Arabic Language Features** • Application Navigation • Reports					

Defects

Defect ID	Description	Test Step ID	Priority (H/M/L)	Severity (A/B/C)	Open Date	Status	Action By
<Sequential No.>	< Provide description of defect, step to reproduce the defect, and other relevant details>	<Optional if common to all steps>				<Open/ Close>	

Evidence of Execution

Test Step ID	Evidence Description (Screen image / Log / Physical Witness / Picture / etc.)	Evidence Document Name	Witness Name and Sign (in case of evidence is "Witness")
<Sequential No.>		<name of the soft copy>	

Witness	
Name	
Signature	

Attachment 5 – EOM-ZA0-TP-000003 – AMS Integration Testing Report Template

AMS Functional Test			
Integration Functional Test Procedures - AMS - SCD Interface			
Test Report		**Date**	**Revision No.**
Test Description	Testing of interface between AMS and SCADA System. The test will be carried out using the sample data provided by Entity to test if the AMS is configured / customized as per NMA&FM Volume 2, Chapter 2 – Asset Management Software (EOM-ZA0-PR-000005) and complies with business/users related requirements.		
Test Result	<<Passed / Failed>>	<Green/Red>	
Conducted by Name/Position/ Sign			
Verified By			
Approved By			

Test Script						
Step No.	**# Step /Task**	**Test Result (Passed / Failed)**	**Success %**	**No of Defects**	**Status**	**Remarks**
1	**Interface between AMS and SCADA** • Copy the Input Event Log or use simulator to simulate the input data where possible • Execute SCD Interface from Entity AMS				<Green/ Red/ Yellow>	

Defects							
Defect ID	**Description**	**Test Step ID**	**Priority (H/M/L)**	**Severity (A/B/C)**	**Open Date**	**Status**	**Action By**
<Sequential No.>	< Provide description of defect, step to reproduce the defect, and other relevant details>	<Optional if common to all steps>				<Open/ Close>	

Evidence of Execution			
Test Step ID	**Evidence Description (Screen image / Log / Physical Witness / Picture / etc.)**	**Evidence Document Name**	**Witness Name and Sign (in case of evidence is "Witness")**
<Sequential No.>		<name of the soft copy>	

Witness	
Name	
Signature	

Attachment 6 – EOM-ZA0-TP-000005 – AMS Test Script Template

Step No.	Step / Task	Success Criteria / Expected Results	Evidence Required	Test Result	No. of Defects	Remarks
1	Asset Management Create Location Create Asset Perform Asset management functions to cover Asset Management Lifecycle Run all new Asset Management Reports	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			
2	Work Management Create Job Plan Create PM schedule Create PM (Preventive Maintenance) Work Order Create Service Request Create CM (Corrective Maintenance) Work Order Create EM (Emergency Maintenance) Work Order Complete & Close Work Orders using work order workflows covering the Work Order Lifecycle Run all new work management reports	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			
3	Inventory Management Create Store Location Create Items and Inventory Record Create Inventory Transactions Run all new inventory reports	Standard functionalities and the configurations/customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			
4	Purchasing Management Create Company record (Supplier) Create PR till PO Perform Item Delivery till closing the PO Create Contract and Contract Release Run all new inventory reports	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			

Step No.	Step / Task	Success Criteria / Expected Results	Evidence Required	Test Result	No. of Defects	Remarks
5	Asset Configuration Management Create Configuration Asset Perform Configuration Asset management functions to cover Asset Management Lifecycle Run all new Asset Management Reports	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			
6	Mobility Management Perform work execution through Mobile Work Execution application. Perform work execution through Mobile CA Work Execution application.	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			
7	Failure Reporting, Analysis, and Corrective Action (FRACAS) Create a CM work order and route to FRACAS workflow Enter Fault code and related details Perform RCA (Root Cause Analysis) Close WO	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			
8	EDMS View, copy, save and print various document e.g. specifications, drawing, template etc.	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots			
9	Arabic Language Features Application Navigation Reports	Standard functionalities and the configurations / customization done as per Asset Management Software document, EOM-ZA0-PR-000005	Screen Shots, Report printouts			

Attachment 7 – EOM-ZA0-TP-000006 – AMS Risk Register Template

AMS Implementation Phases					
Key Risks	**AMS Project Preparation**	**AMS Blueprint**	**AMS Functional Development**	**AMS Final Preparation**	**Go Live**
Business Environment Risks					
R1: Lack of Entities commitment and support in AMS solution design and implementation.	X	X	X	X	X
R2: The project is not organized and structured according to Expro AMS Project methodology, to enable delivery of a quality AMS solution.	X	X			
R3: AMS solution does not enable the requirements of business benefits.		X	X		
R4: The design and implementation of the AMS, including integration disrupts and negatively impacts the business operations (People, Process, Technology).		X	X	X	
R5: Lack of business ownership of the AMS solution processes and components during and post operational roll-out.					X
R6: Lack of buy-in and support from stakeholders into the AMS solution, design, and implementation.		X	X	X	
R7: The AMS solution is not used effectively as business users are not ready to operate the new system.		X	X	X	X
Project Management Risks					
R8: Poor definition of the AMS implementation project scope and underestimation of the implementation timeline.		X	X		
R9: Underestimation of AMS solution complexity, integration, and dependency requirements.		X	X		
R10: The AMS implementation project risks issues are not resolved in a timely manner.		X	X	X	

AMS Implementation Phases					
Key Risks	**AMS Project Preparation**	**AMS Blueprint**	**AMS Functional Development**	**AMS Final Preparation**	**Go Live**
R11: The AMS implementation project does not have the necessary resources e.g. (people, goods, services) to deliver a quality solution, within the agreed timeline and within the agreed budget.		X	X		
R12: Lack of sufficient knowledge skills, experience and abilities of the project manager and project team, to implement the AMS solution.		X	X		
R13: Project deliverables do not meet business requirements		X	X	X	
R14: Insufficient communication from the project team to project stakeholders.		X	X	X	
R15: Insufficient or a poorly controlled budget for the AMS solution, design, and implementation.		X	X	X	
Project Execution Risks					
R16: Poor understanding of the AMS solution capabilities	X				
R17: Business requirements are incomplete or not received in a timely manner.		X	X	X	
R18: Inadequate design of the AMS application security and user administration process.			X		
R19: Inadequate transfer of AMS skills and knowledge from vendors/contractors, to the Entity staff.			X		
R20: Failure to identify, convert, deliver data requirements and interfaces, to and from the AMS.			X		

AMS Implementation Phases					
Key Risks	**AMS Project Preparation**	**AMS Blueprint**	**AMS Functional Development**	**AMS Final Preparation**	**Go Live**
R21: Insufficient AMS integration and UAT.			X	X	