

# IMPLEMENTING ASSET MANAGEMENT IN THE FIRST WATER CYCLE COMPANY OF THE NETHERLANDS (WATERNET)

Geert Jan van Heck

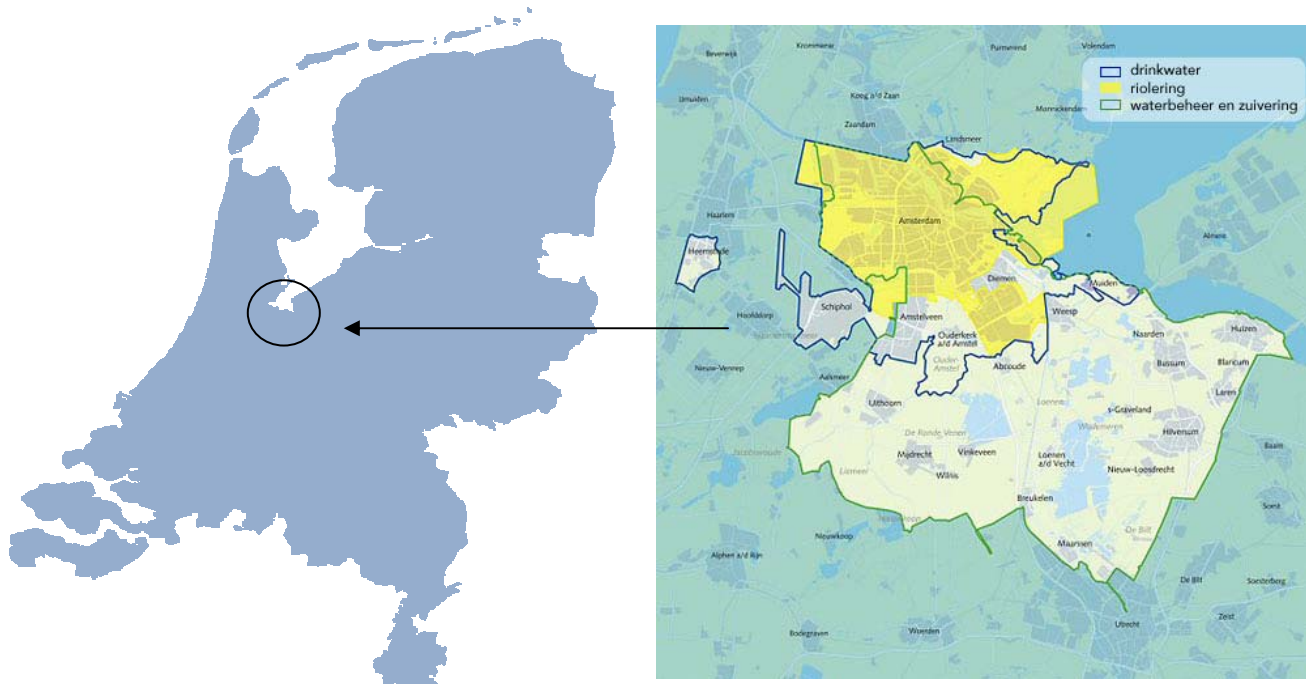
Asset management, Drinking Water Division, Waternet, Amsterdam, The Netherlands

[Geertjan.van.heck@waternet.nl](mailto:Geertjan.van.heck@waternet.nl), [www.waternet.nl](http://www.waternet.nl)

## Abstract

Waternet is the first Dutch water company that covers the complete water cycle and is responsible for drinking water, waste water, surface water and safety behind dykes. Waternet was officially launched on January 1, 2006 after a merger of Amsterdam Water Supply and the Water and Sewerage Department.

Figure 1: operational area of Waternet: Amsterdam and surroundings, The Netherlands



Waternet starts to implement company-wide asset management to increase the transparency in decision making, to reach optimal cost-benefit levels, and to increase trust and satisfaction of stakeholders, among others. After making an overview of the various asset management frameworks for (drinking water) infrastructures around the world and discussing those, Waternet aims at tailoring the world-class standards to a suitable desired asset management framework and policy for Waternet. An implementation strategy was formulated and one of the first steps of this strategy was to carry out a gap analysis between the company's current asset management practices and the desired asset management process. Waternet is defining which data, analyses, tools, procedures and information technology is needed and started developing and/or improving these elements.

This paper gives an overview of the gap analysis, the strategies for implementing asset management within Waternet, the obtained results and the next steps to take.

**Key Words: water cycle company, gap analysis, strategy for implementing asset management**

## Introduction

In 2006 Amsterdam Water Supply and DWR (the executive part of the water board for

Amsterdam and surroundings and the waste water company of the city of Amsterdam) merged into a new company called Waternet. Waternet is the first water cycle company in

the Netherlands taking care of the management of groundwater and surface water, wastewater collection and treatment, and drinking water winning, production and distribution in Amsterdam and surroundings. Waternet is a joint executive service of the City of Amsterdam and the Amstel, Gooi and Vecht Regional Water Management Board (AGV).

Implementing asset management is one of the main challenges of the company. The objectives for asset management are, among others, to increase the transparency in decision making, to reach optimal cost-benefit levels, and to increase trust and satisfaction of the stakeholders.

A literature review was carried out to produce an overview of the various asset management frameworks for (drinking water) infrastructures around the world. Waternet tailored the world-class standards to a suitable desired asset management framework. An implementation strategy was then formulated and one of the first steps of this strategy was to carry out a gap analysis between the company's current asset management practices and the desired asset management process. Waternet defined which data, analyses, tools, procedures and information technology would be needed and started developing and/or improving these elements.

After formulating a 'Waternet definition' of asset management, a vision was formulated and working groups were formed to produce the above mentioned elements.

### Some figures

The Waternet operational area covers the city of Amsterdam and a large area in the provinces of Utrecht and North and South Holland. A few key figures (Waternet, 2008):

- an operational area with well over a million people;
- treating 130 million cubic meters of waste water annually;
- 12 sewerage purification plants;
- 9,500 hectares of open water;
- 6,000 kilometres of polder locks;
- 3,500 kilometres of drainage system;
- average drinking water production of 26,000 cubic meters daily;
- drinking water network of 2,700 kilometres;

- management of thousands of hectares of nature reserves;
- annual turnover of some 300 million euros;
- a 1,700-strong workforce.

### Steps towards asset management

The way of moving towards asset management is divided into three phases: vision phase, creation phase and the operational phase. The first phase is partly based on the 'Value Driven Maintenance Methodology' (VDM) developed by Mainnovation (Waternet et al., 2007) and consists of the following steps: evaluation of the current situation of the maintenance and asset management organization, 'designing' the 'Most Valuable Asset Management Organisation' (MVAMO) and elaborating asset management processes.

VDM is aiming at answering the question 'What is the added value of maintenance?' According to this methodology, maintenance and asset management can add value through: asset utilization, cost control, management of safety, health and environment and resource allocation. The 2007 situation and the MVAMO are described using a matrix with four levels of maturity and eleven core competences, including the four value drivers already mentioned.

Figure 2: Asset Management "Value Drivers"



Source: Waternet, Mainnovation and MRO Software(2007)

### **The 2007 situation**

Partly due to the recent merger, the tasks, responsibilities and authorities are not clear, which has in some situations negative impact on the efficiency and effectiveness of the working processes. There is a strong drive to improve this situation and in general Waternet employers are open for improvement and in several departments process description are adapted to the new situation. However, the differences in culture and ambition between the different divisions might slow down improvement processes. The level of knowledge and experience is in general high. Part of the experts is relatively old and knowledge leakage is to be expected if no adequate knowledge transfer will be initiated.

The IT-landscape is diverse, which makes the available information in-transparent. This complicates the production of essential management reports and decision-making. A critical issue is the transfer of clear and complete guidelines, demands and information between the departments of policy & planning, projects, operation and maintenance. Proper analysis of infrastructure requirements and performance (incl. financial performance) is not possible and the Plan-Do-Check-Act (PDCA) cycle is not closed, in which the Check is the most critical part.

Multi-criteria risk matrixes and multi-criteria decision-making are sporadically used or used in a subjective way.

### **Waternet Asset Management Definition**

As result of different discussion sessions Waternet came with the following asset management definition and vision.

Definition: asset management is a connecting and structural approach, based on professional skills and searching for balance, while aiming at the company goals through

optimizing life cycle management of infrastructure systems and assets.

Vision: satisfying the company goals through optimum continuous improvement program, operation & maintenance strategies, joining forces and knowledge sharing and in line with the Waternet core values.

The successful implementation of asset management requires an approach with the following dimension (IAM & BSI, 2004): holistic, systematic, systemic, risk-based, optimal and sustainable (see also table 2).

Asset management includes:

- the operationalisation of stakeholder requirements;
- a life cycle approach;
- optimizing the water cycle.

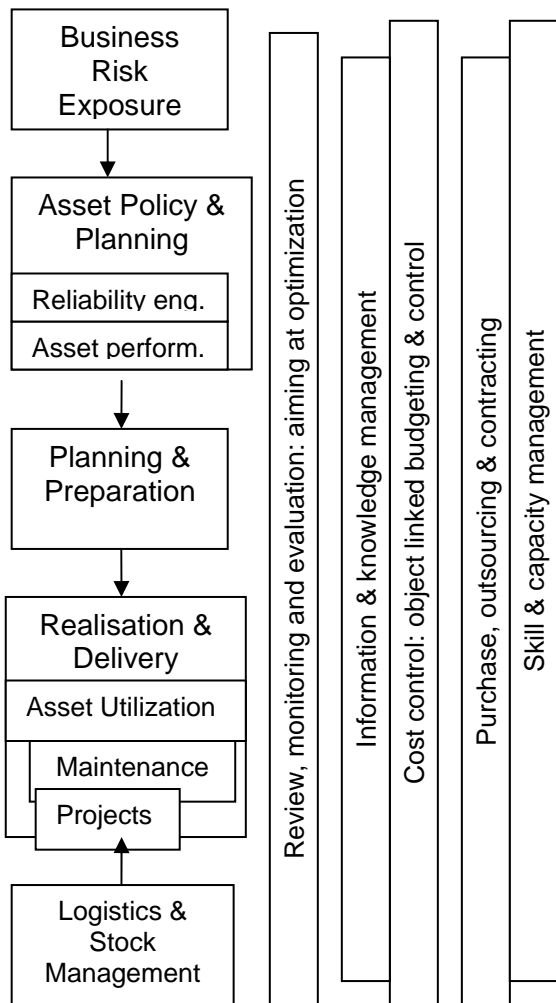
In the following chapters (Asset Management Framework, The Waternet Asset management Vision) the vision is worked out in detail.

### **Asset Management Framework**

Based on the MVAMO, literature review (Heck, 2008), the above mentioned discussions an Waternet asset management framework was elaborated. See figure 3. In the framework 4 main process (Business Risk exposure; asset policy & planning; planning & preparation; realisation & delivery) can be distinguished. The process Asset policy & planning forms the 'hart' of asset management and has two sub processes: reliability engineering and asset performance. The process realisation and delivery exists of three sub-processes: asset utilization, maintenance and projects.

Next to the main processes, several 'supporting processes' exists: logistics & stock management; review, monitoring & evaluation; information & knowledge management; cost control; purchase, outsourcing & contracting; and skill & capacity management.

*Figure 3: Asset Management Framework*



### The Waternet Asset Management Vision

Below the future characteristics of the Waternet asset management processes are highlighted (the vision).

#### Business risk exposure

Carry out SEPTTE (social, environmental, political, technological and economic), scenario and SWOT (Strengths, Weaknesses, Opportunities, Threads) analysis to formulate a vision and a strategy related to the water cycle. Business risk exposure approach will be applied, whereby core values (safe, customer focus, sustainable, innovative) and strategic goals are translated into risk categories and acceptable risk and cost levels in line with stakeholder requirements and expectations. For long term planning, adaptive policy making is applied. The core question to be answered is: what is the required sustained level of service?

#### Asset policy and planning

Core questions: Which assets are critical to sustained performance? What are the best minimum life-cycle-cost continuous improvement program and operation & maintenance strategies? Holistic risk (criticality) analysis of the infrastructure systems is carried out in order to define 5-year planning for the utilization, operation, maintenance, retrofitting and expanding of the assets. In order to optimize infrastructure performance multi-criteria decision-making and -optimization are used. Business case formats are developed and applied for project approval and prioritization, based on added value of interventions and asset lifecycle management. The feedback loop between realisation & delivery and policy & planning is essential for this process. Policy and planning specify information management deliverables. In case more information and knowledge for decision-making is needed, research is initiated.

#### Reliability engineering

Hereby, the focus is on defining, managing and monitoring maintenance concepts. Reliability Centred Maintenance is used in all the maintenance departments of the organization. For the registration, monitoring and evaluation of failure rates, repair rates, maintenance cost, maintainability, customer complaints and adjustment of maintenance concepts a Maintenance Management System is available and used.

#### Asset performance

Goal: optimizing performance and increasing knowledge about the infrastructure and assets. This process includes the evaluation of the infrastructure system, sub-systems and asset performance and reduction of uncertainties related to the performance. Developing (optimization) models is part the process. Information Management System is used to register and evaluate input (e.g. raw materials, energy) and output (e.g. water quality, water quantity) parameters of the different assets, processes (e.g. water treatment steps), sub-systems and system.

#### Planning and Preparation

This process includes the planning and preparation of asset operation, maintenance, modification, retrofitting and system

expanding in line with 5-year asset management planning. Planning is based on prioritization and adjusted to changing circumstances (surrounding), new information (incl. customer complaints and failures) and clustering. Central gate-keeping and coordination between gate operation, maintenance and project departments should safeguard operation (e.g. production) planning. Business cases are used for project monitoring and evaluation. Planning, goals, performance indicators and budgets are monitored through Service Level Agreements (SLA's). SLA's include information management requirements for the feedback loop.

Figure 4: age of drinking water mains

### Maintenance

Goal: optimizing maintenance activities as agreed in SLA. Focus on efficiency. Includes capacity and skill scheduling; clustering of activities; asset-linked registration, monitoring and evaluation of customer complaints, Mean Time To Repair (MTTR), Mean Time Between Failure (MTBF), maintenance effectiveness and costs. Clear and complete procedures and manuals for normal and emergency maintenance are developed and reviewed periodically. Risk centred inspection is introduced.

### Asset utilization

Goal: optimizing asset utilization as agreed in SLA. Includes scheduling of utilization (e.g. treatment, transport); performance monitoring and corrective actions; asset-linked registration and monitoring of input and output parameters, performance, utilization and costs. Clear and complete procedures and manuals for normal and emergency operation are developed and reviewed periodically.

Focus on efficiency and effectiveness. Project realisation is monitored and evaluated, through the use of business case formats, project-phasing (including documentation and cost control) and SLA's. Early equipment management (using knowledge of utilization and maintenance in design) is part of design process. Project delivering is according to business case requirements, operation and maintenance specifications and includes certifications, as-built documentation, object identification, operation and maintenance manuals.

### Logistics and Stock Management

Focus: efficient management of parts and materials in own store and through partnerships with suppliers, in such a way that service levels can be achieved. Stock is based on criticality and market availability analysis of parts and materials.

### Project realisation & delivery

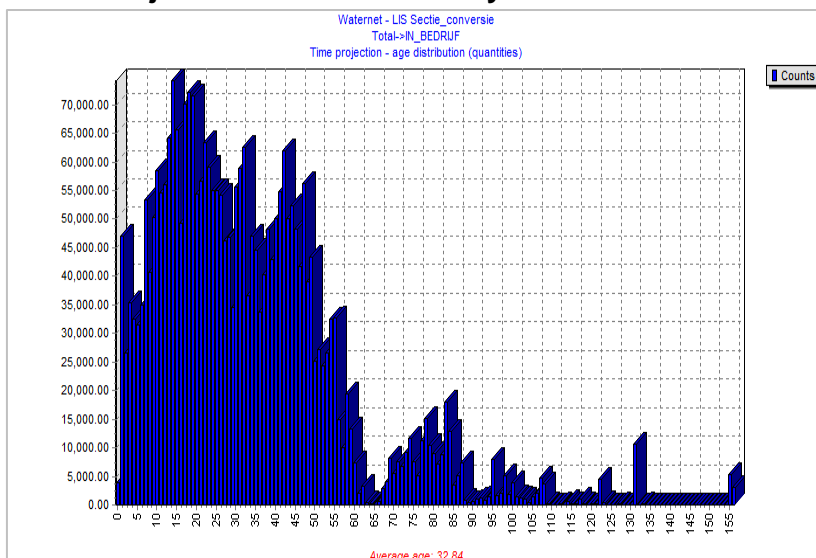
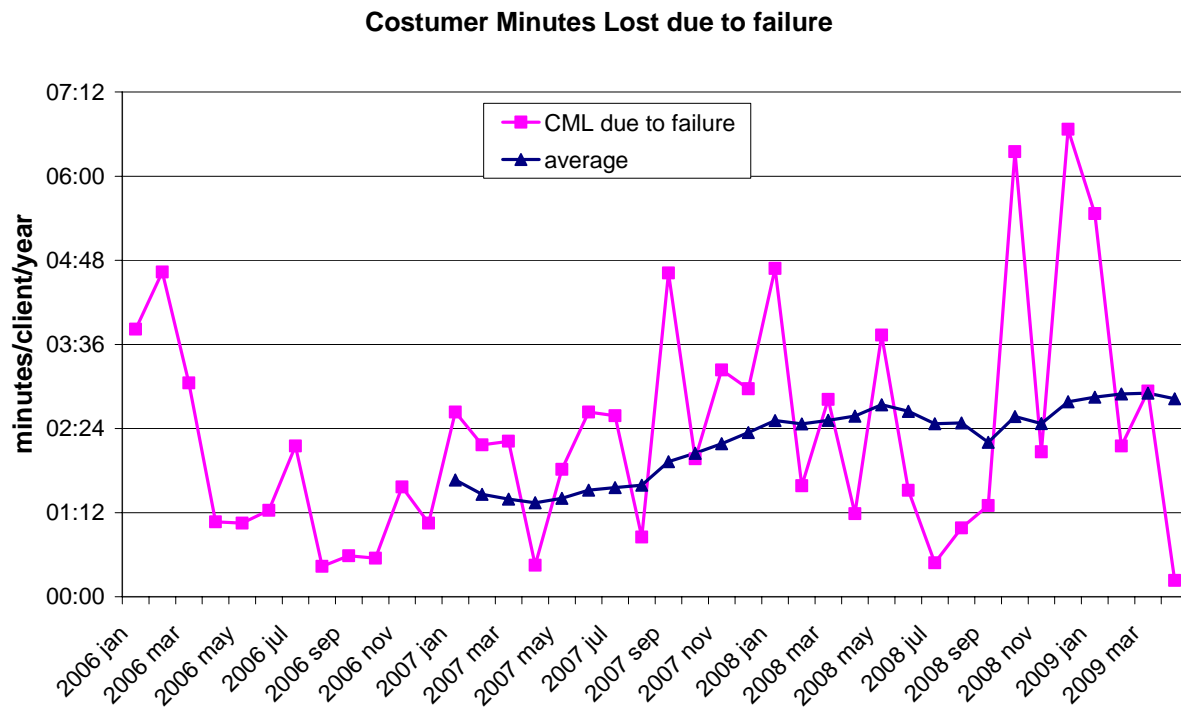


Figure 5: Customer Minutes Lost due to network failures for Drinking water costumers

knowledge to assets, standardizing and



**Review, monitoring and evaluation**

Goal: aiming at optimization and continuous improvement. Includes procedures for monitoring, evaluating and adjusting of plans (corrective action), through the explicit use of a PDCA cycle, based on hierarchical performance indicators linked to risk criteria and service levels. There is special attention for procedures and guidelines for: (1) performance and condition measurement and monitoring (including trend analysis), (2) handling and investigation of asset-related failures, incidents, non-conformances and corrective and preventive action, (3) information management. A Control Panel is used for monitoring Key Performance Indicators (linked to underlying indicators) for corrective actions.

**Information & knowledge management**

Systematic building-up, management and application of all technical, administrative and financial information and knowledge over the whole life cycle of the assets and using this information to optimize the life cycle management of these assets, including Early Equipment Management. Focus on uniform and logic asset (hierarchy) structure and coding, linking information and

structuring information. Phases for information and knowledge management are: (1) identify which information is needed for analysis, monitoring and evaluation (which information adds value), (2) create and collect data, (3) structure the data system taking into account data accessibility and (4) update and management of the system.

**Cost control**

Goal: control of costs related to asset maintenance, utilization and projects and clear insight in life cycle costs of assets. Asset-linked budgeting, registration and evaluation (including identification of cost-killers and possible quick-wins) is applied. Budgeting is based on the planning process and recorded in the SLA's. Budgets and costs are linked to the assets and activity types; specifying costs related to labour, materials and services.

**Purchase, outsourcing and contracting**

Goal: optimizing costs for purchasing, outsourcing and contracting. Includes a centralized purchasing department; evaluation of purchase and suppliers; use of an outsourcing matrix.

### Skill & capacity management

Focus: contracting, training, guiding and coaching personnel, with adequate attention to knowledge transfer, in line with required skills and capacities. Includes the development and validation of function profiles. Competence teams (across the departments) are formed to improve efficiency.

### General remark

In the above text the vision is described related to the asset management processes. However, Best Appropriate Practices (BAP) are only partly defined. The search for and development of BAP (e.g. business case formats, multi-criteria optimisation, models and prioritization tools) continues.

### Creation Strategy (1)

Three working groups were established. The first group focussed on strategic asset management. The second group defined and worked out different tools and guidelines related to asset life cycle management. The third group defined a maintenance vision and worked out the relation between strategic, tactic and operational asset management. These working groups have produced the below detailed results.

### Results 2008

#### Three asset management levels

##### Strategic level

- Focus: company, water cycle, long-term.
- Tasks and responsibilities: SEPTe, scenario & SWOT analysis, defining mission, vision, strategic goals and acceptable risk levels in line with stakeholder expectations, approval of general asset-related budget.

##### Tactical level

- Focus: infrastructure systems, medium-term.
- Tasks and responsibilities: Asset policy & Planning; translate core values and strategic objectives to performance indicators; risk and criticality analysis; define optimum improvement program and operation & maintenance strategies; develop asset management tools, (information) systems, methodologies and guidelines.

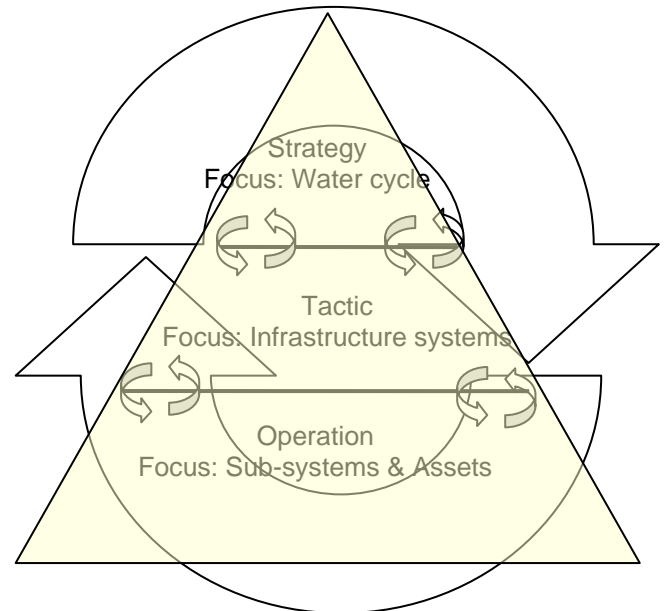
##### Operational level

- Focus: sub-systems and assets, short-term.
- Tasks and responsibilities: operational planning, operation, maintenance, project realisation and delivery; registration of asset-related data and information and performance monitoring.

### Tools and Guidelines

Different tools and guidelines were developed and introduced, e.g.: life cycle costing; life cycle (environmental) assessment; guidelines for early equipment management and project delivery; guidelines for the selection and use of environmental friendly materials; risk analysis methodologies; safety guidelines; integrate asset management in existing processes.

Figure 6: three asset management levels



### Maintenance vision

A maintenance vision was elaborated with the following underlying principles:

- use of Reliability Centred Maintenance (RCM); the risk categories are linked to strategic objectives; Failure Mode Effect and Criticality Analysis (FMECA) methodology will be applied;
- life cycle management; optimizing and fine-tuning between operation, maintenance, modification and retrofitting;
- registration, accessibility, transparency and completeness of asset-related information;

- priorities, products and services differ for drinking water, waste water and water management divisions, this will be shown in risk matrices and maintenance activities.

Waternet choose for an Asset Register and Maintenance Management System in order to:

- plan and monitor maintenance program;
- generate and administrate work orders;
- keep track of MTBF and MTTR of assets;
- monitor and analyse maintenance programs;
- register and monitor costs of maintenance activities;
- give input for early equipment management and criticality, reliability, availability, maintainability and economic analysis.

NB. Asset-linked registration is the starting-point.

### **Creation Strategy (2)**

The three working groups earlier mentioned have been replaced by one single working group at the beginning of 2009. This working group has the following tasks (Waternet, 2009):

- work out in more detail, validate and improve the introduced tools and guidelines;
- develop missing tools, systems and guidelines (e.g. risk matrices and FMECA);
- implement pilots applying tools and guidelines;
- implement of the Maintenance Management System;
- work out in detail the asset management processes and the roles of the different departments in these processes (see also figure 3).

Waternet aims at answering the 5 basic asset management questions (as specified in table 1), taking into account the dimension mentioned in PAS 55-2 (IAM & BSI, 2004; see table 2) and while looking for balance across all quality elements of the Total Enterprise Asset Management Quality Framework (see figure 7).

### **Concluding remarks**

Waternet is moving towards the implementation of asset management and

aims at implementing basic asset management halfway 2010 in at least one of the primary divisions (waste water, drinking water, water management) of the organisation and advanced asset management throughout the organisations a few years later. In order to achieve this, the asset management working group has to comply its tasks, the asset management steering committee has to provide adequate guidance and the board of directors of Waternet has to support the outcomes. In general commitment is needed and the search for BAP has to be continued.

*Table 1: the 5 basic asset management questions*

- |   |
|---|
| <ol style="list-style-type: none"> <li>1. <i>What is the current state of my assets?</i> <ul style="list-style-type: none"> <li>• <i>What do we own?</i></li> <li>• <i>Where is it?</i></li> <li>• <i>What condition is it in?</i></li> <li>• <i>What is the remaining useful life?</i></li> <li>• <i>What is the economic value?</i></li> </ul> </li> <li>2. <i>What is the required sustained level of service?</i></li> <li>3. <i>Which assets are critical to sustained performance?</i> <ul style="list-style-type: none"> <li>• <i>How does it fail? How can it fail?</i></li> <li>• <i>What is the likelihood of failure?</i></li> <li>• <i>What does it cost to repair?</i></li> <li>• <i>What are the consequences of failure?</i></li> </ul> </li> <li>4. <i>What are the best minimum life-cycle-cost continuous improvement program and operation &amp; maintenance strategies?</i> <ul style="list-style-type: none"> <li>• <i>What alternative treatment options exist?</i></li> <li>• <i>Which are most feasible?</i></li> </ul> </li> <li>5. <i>Given the above, what is my best long-term funding strategy?</i></li> </ol> |
|---|

*Source: AwwaRF and WERF (2008)*

Table 2: dimensions for successful implementation of asset management

1. *Holistic: integrating the management of all aspects of the assets;*
2. *Systematic: a methodical approach, promoting consistent, repeatable decisions and actions;*
3. *Systemic: considering the assets as a system and optimizing the system rather than optimizing individual assets;*
4. *Risk-based: focussing resources and expenditure, and setting priorities, appropriate to the identified risks and the associated cost/benefits;*
5. *Optimal: establishing the optimum compromise between competing factors such as performance, cost and risk, associated with the assets over their life cycles;*
6. *Sustainable: considering the potential adverse impact to the organization in the long term of short term decisions aimed at quick wins.*

Source: Institute of Asset management and British Standard Institute (2004)

**References**

1. Waternet. Care for water. 2008.
2. Waternet, Mainnovation and MRO Software. Eindrapport Meest Waardevolle Assetmanagement Organisatie. 2007.
3. Institute of Asset Management and British Standard Institute. PAS 55-2. Asset Management. 2004.
4. Heck, G.J. van. Asset Management Frameworks for (drinking water) infrastructures around the world. A (not exhaustive) overview of different initiatives and developments. Proceedings from NGI Conference. Rotterdam. 2008.
5. GHD. GAP-EX 1 Marketing Manual
6. AwwaRF and WERF. Sustainable Infrastructure Management Program Learning Environment” (SIMPLE). SIMPLE, version 1.1. 2008. ([http://km.ghd.com.au/SIMPLE\\_NET/](http://km.ghd.com.au/SIMPLE_NET/))
7. Waternet. Assetmanagement Projectplan 2009.



Source: AwwaRF and WERF (2008)

**Author’s biography**

Geert Jan (1964) is working in the Drinking Water division of Waternet since 2005. During the first two years he dedicated much of his time to asset management of the transport and distribution network. Since 2007 he plays a leading role in the development of an asset management framework, information management for the water distribution network and water supply reliability for the division of Drinking Water. He also participates in the development of company-wide asset management. Before 2005 he worked nearly 15 years in health, water and sanitation projects in Nicaragua. Geert Jan graduated as civil engineer in 1988. In Nicaragua he took out a MPH in Intercultural Public Health (2001) and in 2003 he finished a MSc in Sanitary Engineering. Recently he started a PhD research project on asset management tools and methods at the University of Technology in Delft.

Figure 7: Total Enterprise Asset Management Quality Framework