PROFESSIONAL PRACTICE GUIDELINES

GENERAL

LOCAL GOVERNMENT ASSET MANAGEMENT

VERSION 1.0
PUBLISHED JULY 29, 2021

ENGINEERS &
GEOSCIENTISTS
BRITISH COLUMBIA

FUNDING PROVIDED BY:

BC MINISTRY OF MUNICIPAL AFFAIRS

ENDORSED BY:

ASSET MANAGEMENT BC

FIRST PUBLISHED: VERSION 1.0, JULY 29, 2021

PREFACE

These *Professional Practice Guidelines – Local Government Asset Management* were developed by Engineers and Geoscientists British Columbia to guide professional practice related to Engineering/Geoscience Professionals working in and contributing to the practice of Asset Management in Local Governments in British Columbia, including contributions to the preparation of Asset Management Policies, Asset Management Strategies, and Asset Management Plans, as well as other inputs to the Asset Management planning process.

These guidelines were first published in 2021 to provide guidance and establish a standard for professional engineering and geoscience practice in the Local Government Asset Management field.

These guidelines describe the expectations and obligations of professional practice in relation to the specific professional activity of Asset Management to be followed at the time they were prepared. However, this is a living document that is to be revised and updated as required in the future, to reflect the developing state of practice.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

ABBREVIATION	TERM
AMBC	Asset Management BC
BC	British Columbia
CNAM	Canadian Network of Asset Managers
FCM	Federation of Canadian Municipalities
GHG	greenhouse gas
KPI	key performance indicators
MNAI	Municipal Natural Assets Initiative

DEFINED TERMS

The following definitions are specific to these guidelines. These words and terms are capitalized throughout the document.

TERM	DEFINITION
Act	*Professional Governance Act* [SBC 2018], Chapter 47.
Asset Management	The combination of planning, management, financial, economic, engineering, operations, and other practices applied to physical and natural assets with the objective of maximizing benefits, reducing risks, and providing the required Level of Service in a socially, environmentally, and economically sustainable manner.
Asset Management Plan	A plan developed for one or more asset classes to guide procuring, operating, managing, maintaining, and renewing assets within the class in the most cost-effective manner possible, while providing a specific Level of Service.
Asset Management Policy	A high-level document that describes how an organization intends to address Asset Management within the organization. Typically informs the creation of an Asset Management Strategy and an Asset Management Plan.
Asset Management Strategy	A strategy for the implementation and documentation of Asset Management Plans and Asset Management practices, processes, and procedures within an organization. Typically informed by the Asset Management Policy and used to inform the creation of Asset Management Plans.
Asset Register	A detailed list of all assets owned or operated by a Local Government.
Bylaws	The Bylaws of Engineers and Geoscientists BC made under the *Act*.
Condition Assessment	The process of continuous or periodic inspection, data collection, measurement, assessment, and interpretation of data to indicate or grade the condition of a specific asset. The Condition Assessment is used to determine remaining useful life and the need for preventive or remedial action for an asset.
Engineering/Geoscience Consultant	A firm that offers professional engineering and/or geoscience services and expertise to both public and private sector organizations. In the context of Local Government Asset Management, this describes firms hired by a Local Government to complete professional engineering, professional geoscience, or other projects, including those to benefit the Local Government's Asset Management program.
Engineering/Geoscience Professional(s)	Professional engineers, professional geoscientists, professional licensees engineering, professional licensees geoscience, and any other individuals registered or licensed by Engineers and Geoscientists BC as a "professional registrant" as defined in Part 1 of the Bylaws.
Engineers and Geoscientists BC	The Association of Professional Engineers and Geoscientists of the Province of British Columbia, also operating as Engineers and Geoscientists BC.

TERM	DEFINITION
Level(s) of Service	The defined service quality for a particular activity or service area against which service performance can be measured. Levels of Service usually relate to quality, quantity, reliability, responsiveness, and environmental acceptability. Levels of Service in Asset Management are frequently divided into technical Levels of Service and customer Levels of Service. Technical Levels of Service indicate asset and operational performance, whereas customer Levels of Service measure asset performance against customer and stakeholder requirements and values.
Life Cycle Management	The approach to managing an asset through planning, design, construction, operations, and disposal. Effective Life Cycle Management gives an overview of expected asset performance during the asset's lifespan, considering the expected Level of Service, and will allow an organization to estimate future operating, maintenance, and capital costs for an asset, asset class, or asset portfolio.
Local Government	A municipality, regional district, special purpose district, local board, or local agency in British Columbia. In these guidelines, the definition also applies to First Nations and Indigenous community governments in BC who follow Asset Management practices that are consistent with non-Indigenous local governments.
Registrant	Means the same as defined in Schedule 1, section 5 of the *Professional Governance Act*.
Risk Analysis	The process of comparing the likelihood and consequence of asset failure to a community or organization's risk tolerance, with the goal of identifying unacceptable risks and developing measures to mitigate those risks.

VERSION HISTORY

VERSION NUMBER	PUBLISHED DATE	DESCRIPTION OF CHANGES
1.0	July 29, 2021	Initial version.

1.0 INTRODUCTION

Engineers and Geoscientists British Columbia is the regulatory and licensing body for the engineering and geoscience professions in British Columbia (BC). To protect the public, Engineers and Geoscientists BC establishes, monitors, and enforces standards for the qualification and practice of its Registrants.

Engineers and Geoscientists BC provides various practice resources to its Registrants to assist them in meeting their professional and ethical obligations under the *Professional Governance Act (*the *Act*) and Engineers and Geoscientists BC Bylaws (Bylaws). Those practice resources include professional practice guidelines, which are produced under the authority of Section 7.3.1 of the Bylaws and are aligned with the Code of Ethics Principle 4.

Each professional practice guideline describes the expectations and obligations of professional practice that all Engineering/Geoscience Professionals are expected to have regard for in relation to specific professional activities. Engineers and Geoscientists BC publishes professional practice guidelines on specific professional activities where additional guidance is deemed necessary. Professional practice guidelines are written by subject matter experts and reviewed by stakeholders before publication.

Having regard for professional practice guidelines means that Engineering/Geoscience Professionals must follow established and documented procedures to stay informed of, be knowledgeable about, and meet the intent of any professional practice guidelines related to their area of practice. By carefully considering the objectives and intent of a professional practice guideline, an Engineering/Geoscience Professional can then use their professional judgment when applying the guidance to a specific situation. Any deviation from the guidelines must be documented and a rationale provided. Where the guidelines refer to professional obligations specified under the *Act*, the Bylaws, and other regulations/legislation, Engineering/Geoscience Professionals must understand that such obligations are mandatory.

These *Professional Practice Guidelines – Local Government Asset Management* provide guidance on professional practice for Engineering/Geoscience Professionals who participate in and provide inputs into the Asset Management planning process for Local Governments in BC, including municipalities, regional districts, special purpose districts, and local boards and agencies.

These guidelines were first published in 2021 to provide guidance for professional engineering and geoscience practice in the Local Government Asset Management field.

1.1 PURPOSE OF THESE GUIDELINES

This document provides guidance on professional practice to Engineering/Geoscience Professionals who provide a range of professional services to Local Governments in the practice of Asset Management. The purpose of these guidelines is to provide a common approach for carrying out a range of professional activities related to this work.

Following are the specific objectives of these guidelines:

1. Describe the expectations and obligations of professional practice that Engineering/Geoscience Professionals are expected to have regard for in relation to the specific professional activity outlined in these guidelines by:

- specifying tasks and/or services that Engineering/Geoscience Professionals should complete;
- referring to professional obligations under the *Act*, the Bylaws, and other regulations/legislation, including the primary obligation to protect the safety, health, and welfare of the public and the environment; and
- describing the established norms of practice in this area.

2. Describe the roles and responsibilities of the various participants, partners, and stakeholders involved in these professional activities. The document should assist in delineating the roles and responsibilities of the various participants, partners, and stakeholders, which may include Local Government elected officials, senior leadership, senior administration, and staff, as well as consultants to Local Governments.
3. Define the skill sets that are consistent with the training and experience required to carry out these professional activities.
4. Provide guidance on how to meet the quality management requirements under the *Act* and the Bylaws when carrying out the professional activities identified in these professional practice guidelines.

1.2 ROLE OF ENGINEERS AND GEOSCIENTISTS BC

These guidelines form part of Engineers and Geoscientists BC's ongoing commitment to maintaining the quality of professional services that Engineering/Geoscience Professionals provide to their clients and the public.

Engineers and Geoscientists BC has the statutory duty to serve and protect the public interest as it relates to the practice of professional engineering and professional geoscience, including regulating the conduct of Engineering/Geoscience Professionals. Engineers and Geoscientists BC is responsible for establishing, monitoring, and enforcing the standards of practice, conduct, and competence for Engineering/Geoscience Professionals. One way that Engineers and Geoscientists BC exercises these responsibilities is by publishing and enforcing the use of professional practice guidelines, as per Section 7.3.1 of the Bylaws.

Guidelines are meant to assist Engineering/Geoscience Professionals in meeting their professional obligations. As such, Engineering/Geoscience Professionals are required to be knowledgeable of, competent in, and meet the intent of professional practice guidelines that are relevant to their area of practice.

The writing, review, and publishing process for professional practice guidelines at Engineers and Geoscientists BC is comprehensive. These guidelines were prepared by subject matter experts and reviewed at various stages by a formal review group, and the final draft underwent a thorough consultation process with various advisory groups and divisions of Engineers and Geoscientists BC. These guidelines were then approved by Council and, prior to publication, underwent final editorial and legal reviews.

Engineers and Geoscientists BC supports the principle that appropriate financial, professional, and technical resources should be provided (i.e., by the client and/or the employer) to support Engineering/Geoscience Professionals who are responsible for carrying out professional activities, so they can comply with the professional practice expectations and obligations provided in these guidelines. These guidelines may be used to assist in the level of service and terms of reference of an agreement between an Engineering/Geoscience Professional and a client.

1.3 INTRODUCTION OF TERMS

See the Defined Terms section at the front of the document for a full list of definitions specific to these guidelines.

In addition, the following terminology is used to describe the types of assets addressed in these guidelines.

1.3.1 TYPES OF LOCAL GOVERNMENT ASSETS

These guidelines focus on Asset Management for physical assets that Local Governments are responsible for managing. Management of non-physical assets such as data and knowledge are not discussed in these guidelines.

In some cases, where there are specific considerations for Engineering/Geoscience Professionals, these guidelines differentiate between the following types of assets:

- **Built or grey infrastructure assets**
  - Include constructed environments and the equipment and resources needed to maintain them.
  - Designed and constructed by people from materials such as concrete, plastic, or metal to provide services such as water, sewer, and drainage systems; transportation networks; or sports and recreation facilities.
  - Examples include pipes, roads, buildings and facilities, and electronics.
- **Green or engineered green infrastructure assets**
  - Designed and constructed by people and use vegetation, soils, and other natural elements to perform services such as filtration, retention, infiltration, and reduction of water flows.
  - Examples include walking trails, green spaces, permeable pavement, street trees, green roofs, and bioswales.
- **Natural assets**
  - Natural resources or ecosystems such as wetlands, forests, grasslands, riparian areas (e.g., lakes, rivers, creeks), and aquifers.
  - Provide vital municipal services that supplement, mirror, or possibly enhance the services of built infrastructure, including filtering and purifying water; retaining or controlling stormwater; supporting air quality; mitigating urban heat enhancements; protecting against sea-level rise, storm surges, and coastal erosion; and absorbing atmospheric carbon, among other ecosystem services.
  - Should be considered part of a Local Government's infrastructure system.
  - Also provide multiple co-benefits to communities, including positive physical and mental health benefits; local economic development; recreation and tourism; and protection of biodiversity, food security, and cultural heritage.
  - Considerations around management and protection of natural assets must be understood in terms of how they function as an integrated system providing multiple services and benefits.

1.4 SCOPE AND APPLICABILITY OF THESE GUIDELINES

These guidelines provide guidance on professional practice for Engineering/Geoscience Professionals who participate in the Asset Management process, working for or with Local Governments in BC. These guidelines are not intended to provide technical or systematic instructions for how to carry out these activities; rather, these guidelines outline considerations to be aware of when carrying out these activities. Engineering/Geoscience Professionals must exercise professional judgment when providing

professional services; as such, application of these guidelines will vary depending on the circumstances.

These guidelines highlight the steps and tasks of the Asset Management process where professional engineering or professional geoscience judgment is required, and how Engineering/Geoscience Professionals can meet their obligations when completing those tasks. They also highlight areas where Engineering/Geoscience Professionals should cede responsibility to other professionals. The discussions of the roles and responsibilities of other non-engineering or non-geoscience functions in Asset Management are intended to help guide Engineering/Geoscience Professionals in how they can contribute to and support these functions.

An Engineering/Geoscience Professional's decision not to follow one or more aspects of these guidelines does not necessarily represent a failure to meet professional obligations. For information on how to appropriately depart from the practice guidance within these guidelines, refer to the *Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021a), Section 3.4.2.

While the guidance in this document is specific to Asset Management for Local Governments in BC, the principles outlined may help guide Engineering/Geoscience Professionals working on Asset Management processes with or for a wide range of other entities, including the provincial or federal government, Crown Corporations, and private entities.

While First Nations and Indigenous communities have been included in the definition of Local Governments for the purposes of these guidelines, we acknowledge that these communities may have very different approaches to Asset Management than those of non-Indigenous Local Governments. In addition to these guidelines, we recommend that Engineering/Geoscience Professionals who work with or for Indigenous communities in BC consult guidance on Asset Management written by Indigenous practitioners wherever possible, such as the *Asset Management Guide for BC First Nations* (Naut'sa mawt Tribal Council 2019).

1.5 ACKNOWLEDGEMENTS

This document was reviewed by a group of technical experts from a variety of disciplines typically involved in Asset Management, including engineering, operations and maintenance, planning, and finance, as well as by various committees and divisions of Engineers and Geoscientists BC. Authorship and review of these guidelines does not necessarily indicate the individuals and/or their employers endorse everything in these guidelines.

Asset Management BC reviewed these guidelines and provided their official endorsement.

Engineers and Geoscientists BC would like to thank Asset Management BC, the BC Ministry of Municipal Affairs and Housing, and the Municipal Natural Assets Initiative for their input and resources that contributed to these guidelines.

2.0 ROLES AND RESPONSIBILITIES

2.1 COMMON FORMS OF ORGANIZATION

Asset Management is a multi-faceted, multi-disciplinary practice. People in different functions in a Local Government work collaboratively to plan and budget for infrastructure needs required to serve their communities.

Local Governments in British Columbia (BC) vary in how they structure Asset Management, which affects their decisions about what part of the organization is designated as the lead responsible for Asset Management planning. Asset Management planning may be led by:

- a finance department;
- an engineering and/or public works department;
- a designated Asset Management group in senior administration or a corporate services department; or
- individual departments or divisions that manage their respective assets, such as a parks and recreation department.

Each approach generally recognizes that Asset Management is an inter-disciplinary process requiring collaboration across the organization. It is the lead group's responsibility to ensure that all key people in the organization have the opportunity to provide their input and judgment to inform sound planning and decision making overall. Together, they must collaborate to effectively balance the costs, risks, and Levels of Service delivered to the community.

Usually, this involves striking a multi-disciplinary Asset Management committee or team that comes together regularly to coordinate responsibilities, ensure implementation, and support continuous improvement of the Asset Management process. In very small Local Governments, that group may involve only two or three people—what is important is the principle of inclusivity and representation of all relevant roles that support service delivery.

There is also a trend towards striking joint climate and Asset Management groups because of the significant climate change impact of infrastructure decisions.

2.2 RESPONSIBILITIES

Asset Management is an integrated business process that enables informed decisions about infrastructure and efficient use of resources. It requires participation from all parts of a Local Government.

Engineering/Geoscience Professionals either play a major role in directly managing assets or a supporting role by collaborating with and providing technical advice to all the other roles that are needed for a Local Government to practice Asset Management effectively.

Table A - 1 in Appendix A provides examples of when Engineering/Geoscience Professionals and other roles typically provide either a lead or supporting role in aspects of the Asset Management process.

The four main types of roles within Local Governments that Engineering/Geoscience Professionals will interact with to help guide infrastructure decision making and the management of infrastructure assets include:

- local elected officials;
- senior leadership or administration;
- Local Government staff; and
- Asset Management consultants.

When interacting with these representatives of Local Government, Engineering/Geoscience Professionals must primarily consider their responsibilities to prioritize the safety of the public and the protection of the environment when undertaking any work in Asset Management.

This section describes the main Asset Management responsibilities of these four types of roles. In small Local Governments, their staff may undertake multiple roles and responsibilities in addition to any Asset Management role they may have.

The descriptions below are adapted from the Canadian Network of Asset Managers (CNAM) document titled *Asset Management Competency Framework for Canadian Communities* (CNAM 2020).

2.2.1 LOCAL ELECTED OFFICIALS

Local elected officials may be responsible for approving Asset Management Policies and Asset Management Strategies, and they are ultimately accountable for budget decisions related to infrastructure and services. Therefore, local elected officials should ensure that the analyses provided by the Local Government's executive and senior management support them in making informed, transparent, and evidence-based decisions. This allows local elected officials to fulfill their primary responsibility of ensuring good governance of the Local Government and for the community they serve.

Governance-related Asset Management responsibilities shared by local elected officials and senior Local Government leadership include:

- ensuring alignment of Asset Management activities with corporate strategic goals;
- ensuring inclusive and equitable cross-functional representation in Asset Management;
- ensuring clarity regarding accountability and responsibility for Asset Management;
- promoting competence, capacity, and consistency in Asset Management practices across the organization;
- promoting a culture of innovation and openness to change; and
- ensuring transparent decision-making and long-term orientation that considers environmental, social, and economic sustainability of service delivery.

Engineering/Geoscience Professionals are responsible for clearly communicating technical information, such as the costs and risks associated with infrastructure options, in audience-appropriate language, to support local elected officials in making informed decisions.

2.2.2 SENIOR ADMINISTRATIVE LEADERSHIP

It is the responsibility of the Local Government's executive management and senior management roles to:

- commit to and communicate the Asset Management Policy, Asset Management Strategy/Strategies, and Asset Management governance structure;
- ensure alignment of all aspects of Asset Management with organizational goals;
- participate in, review, and approve other strategic Asset Management systems or processes; and
- support the Asset Management team.

A Local Government's senior management team is also responsible for reinforcing and communicating a positive Asset Management culture across the organization and externally. That culture supports Asset Management practitioners in their efforts to build relationships across disciplines and departments and with external stakeholders, to integrate many perspectives, and to effectively balance competing interests. In doing so, senior management must also ensure integrity and fairness in adjudication and conflict resolution between departments, while fostering a culture of continuous improvement.

An Engineering/Geoscience Professional who is part of a Local Government's executive or senior administrative leadership would also be expected to fulfill these responsibilities.

2.2.3 LOCAL GOVERNMENT STAFF

A range of skill sets lead to effectiveness in Asset Management. The technical expertise and judgment that Engineering/Geoscience Professionals bring to the process is critical but is not sufficient on its own. This section describes the many Asset Management roles and responsibilities that Local Governments need in order to be effective.

2.2.3.1 Generalist Roles

Some Asset Management roles in a Local Government are referred to as generalist roles, and they may or may not be undertaken by Engineering/Geoscience Professionals. These roles focus on overseeing or managing the complete Asset Management process in a Local Government, either for the entire organization or for a specific department.

Some Local Governments have specific positions like asset manager, Asset Management advisor, Asset Management coordinator, or analyst, while others include these generalist responsibilities in other positions.

Responsibilities for generalist roles may include the following:

- Managing an Asset Management program in a Local Government, which requires
  - developing and supporting implementation of Asset Management principles, Asset Management Policies, and Asset Management Strategies,
  - developing, standardizing, and maintaining Asset Management systems and processes, and
  - managing an Asset Management team.
- Establishing, communicating, and championing a culture of Asset Management across the organization.
- Monitoring and reporting on Asset Management performance measures and analyzing Asset Management data and information.

Asset Management subject matter experts may be responsible for planning and delivering Asset Management projects and entrenching Asset Management practices in a department or across the organization, depending on the scope of their role.

2.2.3.2 Engineering/Geoscience Professionals

Engineering/Geoscience Professionals employed by Local Governments are responsible for leading or supporting the development of Asset Management Strategies and Asset Management Plans. Their effectiveness depends on the ability to successfully communicate complex or technical concepts to all audiences, including senior Local Government leadership and local elected officials. They also play a critical role in integrating Asset Management decision-making and analysis into engineering and geoscience practice.

Specifically, Engineering/Geoscience Professionals are responsible for the following:

- Infrastructure planning.
- Building knowledge of and communicating the current state of infrastructure, the risks to service delivery for the infrastructure, the Level of Service the current infrastructure provides, and the implications of engineering- or geoscience-related decisions on cost and the protection of the public and the environment. This knowledge is critical to inform both short- and long-term budgeting and financial planning, as well as land-use decisions.
- Identifying cost-effective service-delivery solutions, including how and where improvements can be made to meet people's expectations for service and service experience.

- Selecting, designing, and delivering infrastructure while considering value for money over the solution's life cycle, and cost considerations related to procurement of materials and services.
- Managing engineering-related Asset Management life-cycle activities, including project delivery.
- Focusing on systems and processes when problem solving. This includes assessing solutions by applying an understanding of the interconnections and interdependencies between assets and asset systems, including natural assets and ecosystem services provided by the environment.
- Looking for root causes, instabilities, and resiliency in asset systems, and analyzing how the relationships in these systems interact with and influence each other.

See Section 2.2.4 Asset Management Consultants for discussion of the roles of Engineering/Geoscience Consultants contracted by Local Governments to engage in Asset Management-related work.

2.2.3.3 Environmental Professionals

Environmental professionals, such as ecologists, hydrologists, environmental engineers, landscape architects, biologists, agrologists, and foresters, play critical roles in supporting the integration of natural Asset Management into the Asset Management process.

Environmental professionals are responsible for undertaking decision making and analyses in order to understand the role natural assets have in service delivery. This includes understanding the contribution and value of natural assets to the Local Government's infrastructure system as a whole, and the risks to the proper functioning condition of the system. Environmental professionals advise on the required regular monitoring, maintenance, restoration, or protection of natural assets that should be built into budgeting, long-term financial planning, land-use decisions, and related policies.

Engineering/Geoscience Professionals are expected to collaborate with environmental professionals on Asset Management, because environmental professionals bring complementary technical expertise to the process that enables a holistic and systems approach to infrastructure planning, management, and service delivery. Environmental professionals can assist when considering community risks of landslides, flooding, and wildfire as impacts to infrastructure and community resilience.

2.2.3.4 Operations and Maintenance Professionals

Operations and maintenance professionals are responsible for managing and contributing to the Asset Management life-cycle activities of the Local Government's physical infrastructure assets. They also support Asset Management decision-making and analysis by providing input on the development of Asset Management Strategies and Asset Management Plans, the Asset Management system, and Levels of Service.

2.2.3.5 Finance Professionals

Finance professionals in Local Governments, such as accountants, controllers, business analysts, financial analysts, and risk management and financial officers, are responsible for ensuring that the capital and operating requirements of infrastructure are financed appropriately over the infrastructure's full life cycle.

Finance professionals collaborate with the Asset Management team to develop Asset Management financial policies, and they undertake financial analysis that supports the development of Asset Management Strategies, Asset Management Plans, Asset Management systems, and Levels of Service. They also develop long-term financial plans for managing finance-related Asset Management life-cycle activities, and integrate Asset Management into finance practices, including budgeting, funding, and rate-setting.

While Engineering/Geoscience Professionals play a critical role in advising finance professionals on the full life-cycle costs of infrastructure and service delivery, finance professionals can also help

Engineering/Geoscience Professionals and planners ground infrastructure planning in the financial realities of Local Governments. This collaboration supports Local Governments in identifying service delivery solutions that are financially sustainable and within the means of the community.

2.2.3.6 Planning Professionals

Planning professionals are responsible for developing policies and local regulations governing land use and development. They play a critical role in supporting Asset Management decision-making and analysis by identifying services needed to support current and future generations.

Planning professionals undertake contextual analysis, such as demand and growth management and stakeholder engagement, that supports the development of Asset Management Strategies, Asset Management Plans, Asset Management systems, and Levels of Service. They also manage planning-related Asset Management life-cycle activities.

Planning professionals ensure Asset Management Policies, Asset Management Strategies, and Asset Management Plans are aligned and linked with higher-level organizational goals and strategies, such as a Local Government's official plan, climate action plan, resiliency strategy, environmental sustainability strategy, and other similar initiatives.

Planning professionals are also often trained as skilled facilitators and can be brought in to encourage collaboration and strategic thinking during the initiation and planning of an Asset Management program.

Engineering/Geoscience Professionals should collaborate with and provide technical advice and guidance to planning professionals, to help inform the full life-cycle costs and risk implications of planning decisions of any size. For example, major land-use decisions arising from official planning processes would predictably affect the type and cost of infrastructure required to deliver services; however, smaller decisions, such as the choice of assets on a main street rehabilitation project, may also have cost or technical implications that planning professionals should be aware of.

2.2.3.7 Human Resources Professionals

Human resources professionals and staff are responsible for ensuring the Local Government is meeting its human resource capacity and capability needs for Asset Management throughout the infrastructure life cycle. This group could also help secure knowledge assets by developing appropriate regulations and clauses related to employment, especially for unionized members.

2.2.3.8 Procurement and Supply Chain Professionals

Procurement and supply chain professionals are responsible for ensuring Local Governments meet their needs for obtaining infrastructure-related services, goods, and equipment from outside the organization. These professionals collaborate with the Asset Management team to integrate Asset Management into procurement and supply chain practices.

Engineering/Geoscience Professionals play a critical role in identifying and reviewing the technical requirements of infrastructure-related procurement processes and should ensure that principles of Asset Management are applied.

2.2.3.9 Information and Records Professionals

Documentation and formalization of data and information about assets underpins good practice in Asset Management. Professionals like data scientists or analysts, geographic information systems (GIS) specialists or analysts, business analysts, records management analysts or administrators, and similar roles in the organization are responsible for developing strategies and plans for asset information, data governance, data analysis, and information communication and visualization.

2.2.3.10 Information Technology/Information Systems Professionals

Information technology/information systems professionals support Asset Management teams with telecommunication services, information technology infrastructure, and Asset Management-related business systems. Roles may include asset system manager, database administrator, network analyst or technician, programmer analyst, business systems analyst or administrator, or similar roles in the organization.

Information technology/information systems professionals are responsible for developing strategies and plans for asset information, management systems, geographic information systems, and financial, analytical, and work management systems that support the management of asset life-cycle activities. They may also support asset monitoring, measurement, and analysis with Information technology/information systems.

2.2.4 ASSET MANAGEMENT CONSULTANTS

Local Governments may rely on the support of Asset Management consultants to deliver some aspect of their Asset Management process, such as developing Asset Management Policies, Asset Management Strategies, or Asset Management Plans; conducting Condition Assessments, Risk Analysis, or research; and/or managing stakeholder engagement related to service needs. Consultants may also help Local Governments develop their ability to deliver Asset Management with in-house resources, by creating processes for monitoring and continuous improvement.

Asset Management consultants working with Local Governments may include Engineering/Geoscience Consultants and firms with individuals from other professional disciplines, depending on the scope of work. It is the responsibility of Asset Management consultants to ensure that deliverables are based on good practices for Asset Management, including appropriate engagement, consultation, and information sharing with all relevant internal stakeholders, and are being developed using sustainable service delivery methods that balance cost, risk, and service.

Engineering/Geoscience Consultants contracted by Local Governments to engage in Asset Management-related work are expected to follow the processes outlined in Section 3.0 Guidelines for Professional Practice and to clearly outline their roles and responsibilities to their clients and team members.

See Section 2.2.3.2 Engineering/Geoscience Professionals for more information on the responsibilities of Engineering/Geoscience Professionals when working for Local Governments.

3.0 GUIDELINES FOR PROFESSIONAL PRACTICE

3.1 OVERVIEW

Engineering/Geoscience Professionals may either lead or hold supporting roles for Asset Management in Local Governments, and may be involved in the Asset Management process in different ways:

- in a technical capacity, providing professional judgment and recommendations that are incorporated into Asset Management Plans, Asset Management Policies, and Asset Management Strategies; or
- in a non-technical capacity, where their professional background helps inform decision making but their status as Engineering/Geoscience Professionals is not strictly required.

These guidelines apply to either scenario, and are intended to help Engineering/Geoscience Professionals meet their professional obligations in any role in the Asset Management process. This section emphasizes areas in which Engineering/Geoscience Professionals are expected to exercise professional judgment and due diligence, and the considerations they should take in completing their work in those areas.

The aim of the Asset Management process is to realize value from assets and achieve sustainable service delivery, while protecting public and environmental welfare, health, and safety. Engineering/Geoscience Professionals must consider consequences that flow directly and indirectly from their decisions and actions across the entire lifespan of an asset—these are important considerations since, in many cases, infrastructure can last for decades after being built, while requiring regular maintenance, renewal, risk management, and, eventually, decision making about how the infrastructure will be replaced.

These guidelines also outline the responsibility of Engineering/Geoscience Professionals to provide solutions to the public that adhere to the basic pillars of sustainability (environmental, social, and economic) and comply with relevant laws and enactments.

For example, considering consequences and sustainability could affect options for stormwater management: an Engineering/Geoscience Professional may use holistic decision making, to avoid unnecessary construction of new grey infrastructure assets where existing or rehabilitated grey infrastructure, green infrastructure, or natural assets could be used to perform the same functions. In a case like this, green infrastructure and natural assets could also provide additional co-benefits, like managing climate risks and supporting adaptation to a changing climate.

These guidelines use the principles from "Asset Management for Sustainable Service Delivery: A BC Framework" (Asset Management BC 2019) (Figure 1) as a structure to describe professional practice considerations for Engineering/Geoscience Professionals who participate in Asset Management. This framework provides a high-level, systematic approach that supports Local Governments in moving toward service, asset, and financial sustainability through an Asset Management process. A central principle of this framework is that Asset Management is a team effort, in that many stakeholders must work together to achieve successful Asset Management outcomes for organizations.

Figure 1: Illustration of an Integrated Process for Asset Management

Note: Figure reproduced from "Asset Management for Sustainable Service Delivery: A BC Framework" (Asset Management BC 2019).

Other frameworks exist that apply similar considerations, such as the ISO 55000 standard and the International Infrastructure Management Manual (IIMM); however, the Asset Management BC framework is locally relevant to projects in British Columbia (BC), and captures the typical components of Asset Management within a Local Government in this province.

Engineering/Geoscience Professionals can choose to apply the appropriate framework, based on their professional judgment and experience and the Local Governments' context. However, when using another framework, Engineering/Geoscience Professionals should be aware that to qualify for grants Local Governments may be required to align with the Asset Management BC framework.

While working within the Asset Management BC framework, Engineering/Geoscience Professionals should also apply the recognized principles of Asset Management, including:

- ensuring alignment between high-level organizational objectives and Asset Management processes;
- ensuring legal compliance;
- using risk-based, evidence-based, defensible decision making;
- using both systematic (methodical) and systemic (considering assets in a system context) approaches to Asset Management;
- considering sustainability (economic, social, and environmental); and
- ensuring integration with the entire organization.

Appendix A: Common Asset Management Roles and Responsibilities highlights where Engineering/ Geoscience Professionals interact with other

professions and what the role of the Engineering/Geoscience Professional is in each step of the framework. Engineering/Geoscience Professionals may act in the general lead role in Asset Management practices, and undertake specific work in the engineering area where professional experience and judgment is required.

3.2 ASSET MANAGEMENT ASSESSMENT

When working in the context of Local Government services, Engineering/Geoscience Professionals—either working directly for Local Governments or for Engineering/Geoscience Consultants that are supporting Local Governments—will usually be part of the team involved in assessing both Asset Management practices and the current state of assets.

3.2.1 ASSESS ASSET MANAGEMENT PRACTICES

Asset Management BC describes assessing Asset Management practices as "determining organizational capacity to undertake Asset Management as an ongoing corporate function." It notes that "this includes a high-level assessment of all the core elements: people, information, assets, and finances" and that "the assessment results serve as a foundation for developing and implementing the Asset Management process" (Asset Management BC 2021).

When reviewing these practices, Engineering/Geoscience Professionals must use their professional knowledge of physical assets (including natural assets) and Asset Management to support the comprehensive assessment of Asset Management practices. Typically, an Engineering/Geoscience Professional makes recommendations for the Local Government management staff and local elected officials to include in the assessment report on improving the processes, and provides asset-related data to support improving practices.

3.2.2 ASSESS THE CURRENT STATE OF ASSETS

Asset Management BC describes this task as "assessing the current state of assets including knowing the inventory, asset conditions, defined customer and technical levels of service, and risks within each asset group." It also notes that "this assessment is the foundation for the development of Asset Management Plans" (Asset Management BC 2021).

Given the technical nature of the assessment of asset condition and utilization, this task is usually led by the engineering or public works/operations team; as such, Local Government Engineering/Geoscience Professionals and Engineering/Geoscience Consultants frequently lead the development of Asset Management Plans. This differs from assessing the processes and capacity to undertake Asset Management and involves assessing the amount and quality of data and information.

Tasks and considerations for Engineering/Geoscience Professionals when leading or supporting the review of the state of assets include the following:

- Natural assets provide services that supplement or mirror the services of built infrastructure, including filtering and purifying water, retaining or controlling stormwater, supporting air quality, and absorbing atmospheric carbon. As such, it is important to inventory and assess the state of natural assets as well as engineered assets.
- Reviewing how infrastructure Asset Register data is being obtained, reviewing data collection standards and technologies, reviewing the data itself, and recommending improvements. These are done in order to optimize data collection, support better decision making, and improve confidence in data management processes and the information being provided for asset planning.
- Reviewing the completeness and relevance of information related to assets and Asset Management, to support effective decision making. Applying professional judgment to ensure the data is sufficient to support Asset Management

planning, and minimizing requirements to collect data that may not be useful.

- Understanding the technical skills and corporate environment of the Local Government, and providing recommendations to improve the methods used to collect Asset Register data and condition information, in a way that best matches the budget and capabilities of their team.
- Reviewing how the condition of assets is determined, and reviewing the development of standards of assessment (e.g., identifying whether they use known professional standards).
- Reviewing how asset risks are assessed, and recommending improvements to the Risk Analysis process.

3.3 ASSET MANAGEMENT PLANNING

This section describes the expectations of Engineering/Geoscience Professionals when they lead or support the development of Asset Management Policies, contribute to Asset Management Strategies, and prepare or update Asset Management Plans.

3.3.1 DEVELOP THE ASSET MANAGEMENT POLICY

Policy development for Asset Management is not generally considered the practice of professional engineering or geoscience; however, Engineering/ Geoscience Professionals who lead or participate in Asset Management Policy development must still meet their professional obligations under the *Act* and the Engineers and Geoscientists BC Code of Ethics.

Usually, Engineering/Geoscience Professionals involved in developing the Asset Management Policy act in the role of a generalist; as such, they do not have professional responsibilities other than applying their knowledge of Asset Management practices to support the development of policies (see Section 2.2.3.1 Generalist Roles).

However, Engineering/Geoscience Professionals are also responsible for ensuring considerations such as Life Cycle Management of infrastructure delivery activities, risk management, performance improvement, knowledge management, equity, financing, human resourcing, sustainability, and climate resilience are brought forward during the Asset Management Policy development process.

For more information about developing Asset Management Policies, refer to the Federation of Canadian Municipalities (FCM) document "How to Develop an Asset Management Policy, Strategy, and Governance Framework" (FCM 2018).

3.3.2 DEVELOP THE ASSET MANAGEMENT STRATEGY

The Asset Management Strategy (also referred to in the ISO 55000 – Asset Management standard as the "strategic asset management plan") details how the Asset Management Policy will be implemented to help achieve strategic organizational goals and objectives. Asset Management objectives may be defined in either the Asset Management Policy or the Asset Management Strategy.

The aim of the Asset Management Strategy is to align Asset Management objectives with organizational objectives. Furthermore, the Asset Management Strategy sets the tone and overall strategic direction to guide the development of the Asset Management Plan, which is the fundamental document supporting the development of the organization's long-term financial plan and the annual implementation program and budget.

The Asset Management Strategy can help drive progress in sustainability; examples include defining Asset Management objectives around facilitating sustainable modes of transportation, including alternatives to cars, or defining decision-making criteria that prioritizes engineered green infrastructure or natural assets when they can provide equivalent or better service than traditional built engineered infrastructure. By considering sustainability, Engineering/Geoscience Professionals have the opportunity to embrace new concepts, seek innovative design options to meet those objectives, and procure services with those objectives in mind.

Engineering/Geoscience Professionals support development of the Asset Management Strategy throughout the organization's overall asset planning and investment processes by:

- providing technical input and professional judgment that considers performance, risk, resourcing, sustainability, equity, and cost;
- articulating the role of natural assets in the Asset Strategy;
- clearly understanding the impacts of the Asset Management Strategy on their ability to fulfill their responsibilities related to Asset Management; and
- if leading in an Asset Management generalist role, developing the Asset Management Strategy for approval by senior administrative leadership or local elected officials in accordance with the Asset Management Policy.

As a key governance document, the Asset Management Strategy is normally developed in close consultation with senior administrative leadership of the Local Government, or with a specific inter-departmental governance body established for Asset Management (e.g., an Asset Management committee).

Engineering/Geoscience Professionals leading or supporting the development of the Asset Management Strategy should:

- understand the strategic direction set under the Asset Management Policy, and develop strategies accordingly;
- understand the technical skills and corporate environment of the Local Government, and provide recommendations for the Asset Management Strategy that best match the budget and capabilities of the team and meet the regulatory obligations of the Local Government;
- ensure the Asset Management Strategy is broad enough to cover all asset classes of interest to the Local Government and is reviewed when the organization's Asset Management Plans are updated (in some cases, the Asset Management Strategy may be developed for a specific asset class);
- review and help establish the critical success factors that define the success of the Asset Management Policy; and
- through robust consultation, develop an understanding of the needs of all of the stakeholders and partners that affect or could be affected by service delivery.

3.3.3 DEVELOP THE ASSET MANAGEMENT PLAN

During the development of an Asset Management Plan is when Engineering/Geoscience Professionals are most involved in an Asset Management project—whether they are employed by the Local Government or engaged as Engineering/Geoscience Consultants. This usually involves either preparing and/or updating the Asset Management Plan with input from others, or developing the underlying technical data, reports, and resources to support development of the Asset Management Plan.

The expectations and deliverables of Engineering/Geoscience Professionals for each section of an Asset Management Plan are described below.

3.3.3.1 State of the Infrastructure

This section of the Asset Management Plan provides the foundation for the entire plan. The usual roles of Engineering/Geoscience Professionals in this stage of Asset Management include:

- preparing the Asset Register;
- developing Condition Assessment criteria and undertaking Condition Assessment programs, including determining the remaining service life of the asset;
- working with finance professionals to establish valuations (e.g., replacement value for Asset Management planning);
- providing useful life estimates; and
- determining Levels of Service.

Asset Register

Preparing the Asset Register involves developing asset types, quantities, and attributes, including the age, useful life, and remaining useful life of the asset.

Engineering/Geoscience Professionals should apply their knowledge and experience about the type and scope of data that should be included in the Asset Register, taking the following into consideration:

- Including natural assets in an Asset Register:
  - Local Governments are often developing natural Asset Registers alongside their engineered green and grey infrastructure Asset Registers, to formally document and value the roles of natural assets in service delivery.
  - The reason for including natural assets and green infrastructure in an Asset Register is that they can provide equivalent or better services at lower cost than traditional grey infrastructure assets, and are critical in building resilience to climate impacts and managing climate risks. They also yield many co-benefits for communities and ecosystems related to urban heat mitigation, habitat, place-making, and recreation.
  - For more information on this emerging practice and ways in which Engineering/ Geoscience Professionals can integrate natural Asset Management into their own practices, see the Municipal Natural Assets Initiative (MNAI) document titled "Natural Asset Management Considerations for Engineering and Geoscience Professionals" (MNAI 2021).
- Determining appropriate levels of data to include in an Asset Register:
  - Avoid collecting data for an Asset Register that is too detailed to be useful and does not contribute to improving decision making and reporting. However, collecting opportunistic data with a specific usage in mind is acceptable.
  - The quality of data can be improved over time, provided collection methods are economical (e.g., collecting soil data when excavating for pipe-break repairs), and the reliability and accuracy of the data is noted in the Asset Management Plan.
  - Data should be gathered with consideration for both short-term and long-term time frames, to support analysis, identify trends, and assist with measuring outcomes to determine if Asset Management Policy objectives are being met.
- Collaborating with finance professionals to determine data relevance for an Asset Register:
  - Engineering/Geoscience Professionals should work with finance professionals to ensure data being collected for an Asset Register is appropriate for both asset and financial analyses and for reporting purposes.
  - Most data required for financial reporting is not sufficient for the purposes of proactive Asset Management. For example, in their financial reporting, a Local Government might only need to report on the depreciated cost of a facility. However, for Asset Management,

more detail about the operational components of the facility would likely be required, such as when the facility has to be maintained, and the replacement cost value of the facility to its users (e.g., a pump in a facility may be considered critical, even though it does not need to be reported individually for financial reporting purposes).

Condition Assessments and Remaining Service Life

Engineering/Geoscience Professionals should apply their experience and judgment when reviewing information being collected, to determine the condition to be recorded in the Asset Register. Where condition information is not available, Engineering/Geoscience Professionals must apply their experience and judgment, including knowledge of consulting research, benchmarking, or best practices from other jurisdictions, to provide a best estimate or to determine the necessary steps to gain an appropriate level of confidence in the condition and remaining service life of the asset.

Asset condition ratings may include separate ratings for demand/capacity and functionality, as well as physical condition and other factors such as user acceptability and aesthetics. Engineering/Geoscience Professionals should support these areas by undertaking master planning activities, including developing condition rating criteria for all factors. They should work with planning and finance professionals to complete master planning activities for an asset group or neighbourhood.

For natural assets, a Condition Assessment has unique considerations and approaches that necessitate treating it as a separate step in the natural Asset Register process. For more information on Condition Assessment and service life for natural assets, see the MNAI document titled “Natural Asset Considerations for Engineering and Geoscience Professionals” (MNAI 2021).

Valuations

Engineering/Geoscience Professionals employed by Local Government and/or Engineering/Geoscience Consultants may lead the process of valuation, to determine current replacement values using appropriate methodologies, or they may support other professionals in this work, such as technologists or quantity surveyors. This is a separate Asset Management exercise beyond the Local Government financial requirement to report on depreciation of tangible capital assets.

Useful Life Estimates

Engineering/Geoscience Professionals provide theoretical useful life estimates for new infrastructure, and estimate remaining useful life for existing infrastructure. This may involve using standard Condition Assessment methodologies, understanding asset deterioration models, and applying sound professional judgment and experience. For example, a pump station would include several asset categories, such as the structure, electrical subcomponents, and mechanical equipment like pumps; each component would have a different useful life. Manufacturers often supply expected useful life, but in other cases, Engineering/Geoscience Professionals must apply their knowledge and experience to determine useful life and to estimate the remaining useful life.

For a natural asset, the useful life can be correlated with its stability or resilience. A stable or resilient natural asset (or ecosystem) refers to a state of low variability (i.e., little deviation from its average state) despite shifting environmental conditions. A resilient ecosystem, while ever-changing, can last in perpetuity, barring a disruptive event that affects its composition. For more information on useful life for natural assets, see the MNAI document titled “Natural Asset Considerations for Engineering and Geoscience Professionals” (MNAI 2021).

Levels of Service

Level of Service (also called "service level") is the term for the quantity and quality of service for a given activity for which an asset is used. Levels of Service define the asset's performance targets in relation to criteria such as reliability, quantity, quality, responsiveness, safety, capacity, environmental impacts, comfort, social value/or impacts, cost/affordability, legislative compliance, and other criteria that are relevant to a Local Government's own vision.

Levels of Service are often documented as a commitment to carry out a given action or actions within a specified time frame in response to an event or asset condition data. The Levels of Service component of an Asset Management Plan describes what people or the environment experience from the Local Government's infrastructure.

Service providers need to understand the link between the type of service an asset is technically capable of delivering, and how the customer experiences the service. Thus, there are two types of Levels of Service:

1. Community (customer) Levels of Service: how a service is perceived by the user, with non-technical measures for service goals
2. Asset (technical) Levels of Service: specific and quantifiable measures for service targets

Engineering/Geoscience Professionals should consider industry best practices and apply professional judgment and experience to develop the customer and technical Levels of Service parameters, understand the relationship between both types of Levels of Service, and measure technical Levels of Service through relevant key performance indicators (KPI).

Importantly, Engineering/Geoscience Professionals should also stay up to date on how climate change may be impacting the technical Levels of Service that certain assets can provide to a Local Government. For example, intensity, frequency, and duration (IDF) curves for precipitation are updated regularly and could impact the technical Levels of Service for water and sewer infrastructure and natural assets. Current understanding of the impacts of climate change is constantly changing; therefore, the impact on Levels of Service should be re-evaluated periodically.

3.3.3.2 Demand Management

This section of the Asset Management Plan reviews information related to future demands for services being provided by existing assets, as well as future demands that may require enhancements to the current asset, construction of new assets, and/or decommissioning of assets that contribute to the services being provided.

Engineering/Geoscience Professionals usually lead the process of identifying appropriate responses to demand implications identified in the Levels of Service section of the Asset Management Plan. Their responsibilities may include the following:

- Undertaking infrastructure planning assignments (in collaboration with planning professionals, as needed) such as summarizing demand assumptions, projections, and recommendations to identify improvements that could be made to the asset classes defined as being of interest to the Local Government.
  - These reviews are typically initiated by changes to the official community plan or by updates to an Asset Management Plan.
  - In these reviews, Engineering/Geoscience Professionals should consider the contributions of developer-contributed assets, the timing of the assets' installation, and addition of demand capacity to the asset network.
- Identifying constraints and considerations for required capacity upgrades and incorporating those constraints into capital life-cycle plans.
  - This typically involves the application of engineering and geoscience knowledge and experience, and is usually completed by specialists in engineering and geoscience with expert-level knowledge.

- Considering the impact of climate change, natural assets, and engineered green infrastructure on Levels of Service for certain services, particularly in stormwater management.
  - For example, by restoring wetlands and riparian areas and stormwater ponds communities may be able to manage greater volumes of stormwater resulting from climate change, and at a lower cost than built infrastructure. In fact, in various regions across the globe, engineered green infrastructure assets such as bioretention systems, stormwater tree trenches, permeable pavements, blue-green roofs, engineered wetlands, and subsurface stormwater storage and infiltration systems are being widely used as cost-effective and high-performing engineered systems to support stormwater water volume and water-quality objectives.

3.3.3.3 Life Cycle Management

Life Cycle Management is when Asset Management practices are applied to the actual work of managing an organization's assets. In Life Cycle Management, the Asset Management system drives the day-to-day management and planning of assets throughout the infrastructure life cycle. By developing related competencies in their organizations, Local Governments can balance infrastructure Levels of Service, cost, and risk in their communities. This means they are effectively designing, commissioning, operating, and maintaining the physical and operational aspects of individual assets, and properly managing their rehabilitation, renewal, and/or decommissioning.

Life Cycle Management involves developing decision-making criteria to support decisions around renewing, replacing, reducing, or upgrading assets. Criteria include meeting sustainability requirements, particularly around climate change and reducing carbon emissions. These are important considerations, because asset acquisition and disposal work could increasingly be impacted by both the physical climate risks to which the asset could be exposed, and by transitional risks facing the asset, such as the influence of legal, market, reputation, or technology factors. Criteria can also be established to ensure natural assets are properly valued and utilized, especially since well-maintained natural assets may not have an end of life or require renewal, but may instead become more valuable over time.

Engineering/Geoscience Professionals are typically involved in Life Cycle Management during the acquisition, operations, maintenance, renewal, rehabilitation, and decommissioning stages of Asset Management, and apply their professional knowledge and experience to these areas.

In Life Cycle Management, Engineering/Geoscience Professionals may be responsible for:

- asset acquisition and disposal work, including delivering professional work related to planning, design, and construction;
- asset operations and maintenance work, including developing maintenance programs, performance measures, and standards;
- asset renewal and rehabilitation work;
- assessing life-cycle costs, which should account for the cost of greenhouse gas (GHG) emissions (for example, by accounting for projected increases in federal or provincial carbon tax, and/or any applicable internal carbon price set by the Local Government); and
- assisting Local Governments in understanding life-cycle costing, and providing solutions to support long-term financial planning, including evaluating and adjusting current practices and strategies such as operations and maintenance.

In addition to these areas, Engineering/Geoscience Professionals often apply their knowledge and experience to developing appropriate decision-making criteria to support the development of investment plans for Local Governments infrastructure.

3.3.3.4 Risk Management

Risk management involves a cycle of identifying and quantifying both the actual risks and the risk tolerance of a Local Government; implementing actions to address the risks; and assessing the effectiveness of those actions.

During risk management, Engineering/Geoscience Professionals should consider the risks of potential asset and service failures, as well as the risks of particular assets or technologies that meet service outcomes but do not follow best practices for achieving the desired Levels of Service (e.g., assets using technologies with high GHG emissions, like using internal combustion vehicles rather than electric vehicles). Engineering/Geoscience Professionals should use professional judgment to evaluate whether significant asset adaptations or decommissioning before the end of the asset's useful life is appropriate.

Risk frameworks are based on the multiplication of consequence and the probability of failure, and incorporating consistent types of risk (e.g., condition, growth, capacity, climate change, technological or regulatory change) that can be assessed across multiple asset classes.

Engineering/Geoscience Professionals must apply their professional expertise to all levels of Risk Analysis, with particular focus on risks that apply to individual assets. Professional engineering knowledge must be applied to make recommendations on managing and mitigating identified risks. During this process, Engineering/Geoscience Professionals may lead or work with other practitioners with expertise in risk management. They also collaborate with the organization's financial, operations and maintenance, planning, and other practitioners to identify risks that might affect service delivery and identify measures to mitigate potential future negative events, impacts, and outcomes.

Engineering/Geoscience Professionals should be aware that a failure to understand the current services provided by natural assets to Local Governments, and the financial and service delivery implications if those natural assets were to become degraded and cease to provide service, may be an important source of risk and possible liability to the Local Government.

3.3.3.5 Financial Strategies

The Asset Management Plan is the basis upon which the finance professionals develop the organization's long-term financial plan; in turn, the long-term financial plan is critical to implementing the Asset Management Plan. Furthermore, evidence of a strong financial plan allows Local Governments to demonstrate their concerted efforts to integrate Asset Management planning with long-term financial planning and budgeting, so they can make full use of all available infrastructure financing tools and ensure financial sustainability for their community.

This section of the Asset Management Plan typically identifies historic and future expenditures for both capital projects and for operations and maintenance. It also identifies any infrastructure funding gaps between current spending and required spending needed to maintain the assets at the desired levels of service in the future. This section also identifies strategies for eliminating or reducing any funding gap. By developing proactive, long-term financial plans (i.e., of at least 10 or 20 years) for capital, operations and maintenance, rehabilitation, and renewal spending for infrastructure, rather than relying on an annual budgeting process, organizations can avoid engaging in short-term, reactive decision making, thus providing greater certainty and stability in budgets and financial plans for asset spending. In fact, strategic financial projections and planning for assets may require consideration of longer horizons of 30, 50, or 100 years, particularly when planning for infrastructure with long life cycles.

Engineering/Geoscience Professionals employed by Local Government and Engineering/Geoscience Consultants apply their professional knowledge and experience to determine infrastructure replacement and rehabilitation needs for various funding scenarios. This professional judgment provides the support for

determining whether funding gaps exist, and identifying options for resolving those gaps. Options may include financial options, such as borrowing or adjusting tax rates, and physical options, such as reducing asset capacity, accepting a lower Level of Service, or accepting a higher risk of failure.

Overall, Engineering/Geoscience Professionals should apply their knowledge to support the Local Government in their efforts to achieve sustainable service delivery at an appropriate level of risk. Finding ways to balance financial management, risks, and Level of Service to meet the Local Government's goals and objectives can be challenging. Experience in Asset Management and understanding of technical outcomes related to financial scenarios are skills that Engineering/Geoscience Professionals can use to support the development of sound long-term infrastructure and financial plans.

Financial strategies and recommendations should find a balance between economical life-cycle costs, environmental protection, and acceptable levels of risk, while ensuring regulatory compliance. Engineering/Geoscience Professionals should work with finance professionals on all long-term financial planning and assist them in communicating full life-cycle costs, risks, and consequences to the local elected officials responsible for approving funding decisions based on the financial strategies in the Asset Management Plan. This helps ensure Engineering/Geoscience Professionals are meeting their obligations under the Code of Ethics to practice only in their field of professional competence (Principle 2) while also ensuring stakeholders understand the possible consequences of not following professional advice (Principle 10).

3.3.3.6 Continuous Improvement

Each time an Asset Management Plan is prepared, areas for improvement are identified that will be included in the next version of the Asset Management Plan. These might include improving business processes, developing Condition Assessment standards, gathering additional Condition Assessment information, undertaking master planning projects, or amending financial plans to support managing forecast demands.

Engineering/Geoscience Professionals employed by Local Government or Engineering/Geoscience Consultants may lead these projects as project managers, or support the projects by improving the technical analyses that inform decision making. Frequently, master planning for infrastructure is undertaken.

Continuous improvement of Asset Management Plans also benefits from an Engineering/Geoscience Professional's understanding of and possible involvement in research, pilot projects, testing innovative practices, monitoring, evaluation, and current best practices related to Asset Management.

3.4 ASSET MANAGEMENT IMPLEMENTATION

After completing Asset Management Policies, Strategies, and Plans, Local Governments must put these into practice, while also measuring and reporting the progress of Asset Management practices on an ongoing basis.

3.4.1 IMPLEMENT ASSET MANAGEMENT PRACTICES

Implementing Asset Management practices means undertaking the actions laid out in the Asset Management Policies, Strategies, and Plans. While the development of these guidance documents is important to set priorities for the Asset Management program, it is the implementation of the plans and the use of their

principles in the day-to-day operations of the assets that are most impactful to a Local Government's successful management of infrastructure.

Engineering/Geoscience Professionals, whether they are employed by or contracted by a Local Government to implement Asset Management practices, need to ensure they are adhering to the direction contained in the Local Government's Asset Management Policies, Strategies and Plans.

3.4.2 MEASURE AND REPORT ON ASSET MANAGEMENT

Annual and financial reports should include the Asset Management objectives and outcomes identified in the Asset Management Strategy and Asset Management Plans; some Local Governments now use an annual Asset Management report card to support budget recommendations.

Reporting demonstrates measurable progress in implementing the Asset Management Policies, Asset Management Strategies, and Asset Management Plans, and progress in achieving outcomes that contribute to sustainable service delivery. This work is usually completed by Local Government staff and is typically led by the area of responsibility for each Level of Service KPI. For example, technical KPIs are measured and reported by either the engineering or public works areas or by relevant departmental or divisional staff responsible for Asset Management operations in areas like parks and recreation or facilities.

Engineering/Geoscience Professionals may provide technical reviews and reports on these KPI measurements. Financial KPIs are usually measured and reported by finance professionals. Customer-level KPIs require a multidisciplinary approach and may be led by different areas of responsibility.

4.0 QUALITY MANAGEMENT IN PROFESSIONAL PRACTICE

4.1 ENGINEERS AND GEOSCIENTISTS BC QUALITY MANAGEMENT REQUIREMENTS

Engineering/Geoscience Professionals must adhere to applicable quality management requirements during all phases of the work, in accordance with the Engineers and Geoscientists BC Bylaws and quality management standards.

To meet the intent of the quality management requirements, Engineering/Geoscience Professionals must establish, maintain, and follow documented quality management policies and procedures for the following activities:

- Use of relevant professional practice guidelines
- Authentication of professional documents by application of the professional seal
- Direct supervision of delegated professional engineering or professional geoscience activities
- Retention of complete project documentation
- Regular, documented checks using a written quality control process
- Documented field reviews of engineering or geoscience designs and/or recommendations during implementation or construction (not typically applicable to Asset Management)
- Where applicable, documented independent review of structural designs prior to construction (not typically applicable to Asset Management)
- Where applicable, documented independent review of high-risk professional activities or work prior to implementation or construction

Engineering/Geoscience Professionals employed by a Registrant firm are required to follow the quality management policies and procedures implemented by the Registrant firm as per the Engineers and Geoscientists BC's permit to practice program.

4.1.1 USE OF PROFESSIONAL PRACTICE GUIDELINES

Engineering/Geoscience Professionals are required to comply with the intent of any applicable professional practice guidelines related to the engineering or geoscience work they undertake. As such, Engineering/Geoscience Professionals must implement and follow documented procedures to ensure they stay informed of, knowledgeable about, and meet the intent of professional practice guidelines that are relevant to their professional activities or services. These procedures should include periodic checks of the Engineers and Geoscientists BC website to ensure that the latest versions of available guidance are being used.

For more information, refer to the *Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021a), which also contains guidance for how an Engineering/Geoscience Professional can appropriately depart from the guidance provided in professional practice guidelines.

4.1.2 AUTHENTICATING DOCUMENTS

Engineering/Geoscience Professionals are required to authenticate (seal with signature and date) all documents that contain professional engineering or professional geoscience content, including electronic files that they prepare or deliver in their professional capacity to others who will rely on the information contained in them. This applies to documents that Engineering/Geoscience Professionals have personally prepared and those that others have prepared under their direct supervision. In addition, any document that is authenticated by an individual Engineering/ Geoscience Professional must also have a permit to practice number visibly applied to the document. A permit to practice number is a unique number that a Registrant firm receives when they obtain a permit to practice engineering or geoscience in BC.

Failure to appropriately authenticate and apply the permit to practice number to documents is a breach of the Bylaws.

There are many inputs to the Asset Management process that may require sealing when prepared by an Engineering/Geoscience Professional, particularly in situations where the failure of assets may affect the safety, health, and welfare of the public or the environment. These include:

- strategic risk assessments, including those for climate change or seismic risks;
- Condition Assessments for engineered assets, including structures (e.g., bridges, retaining walls), linear infrastructure (e.g., roads, pipes), and mechanical facilities (e.g., pump stations, pressure reducing valves); and
- cost estimates.

Inputs that may not require sealing, even when prepared by Engineering/Geoscience Professionals, include:

- Asset Management Policies;
- Asset Management Strategies;
- Asset Management Plans;
- Level of Service reports;
- maintenance strategies;
- state of infrastructure reporting;
- infrastructure report cards;
- Asset Management practice assessments;
- Asset Management improvement and implementation plans; and
- long-term financial plans and forecasts.

For more information, refer to the *Quality Management Guides – Guide to the Standard for the Authentication of Documents* (Engineers and Geoscientists BC 2021b).

4.1.3 DIRECT SUPERVISION

Engineering/Geoscience Professionals are required to directly supervise any engineering or geoscience work they delegate. When working under the direct supervision of an Engineering/Geoscience Professional, an individual may assist in performing engineering or geoscience work, but may not assume responsibility for it. Engineering/Geoscience Professionals who are professional licensees engineering or professional licensees geoscience may only directly supervise work within the scope of their licence.

When determining which aspects of the work may be appropriately delegated using the principle of direct supervision, the Engineering/Geoscience Professional having ultimate responsibility for that work should consider:

- the complexity of the project and the nature of the risks associated with the work;
- the training and experience of individuals to whom the work is delegated; and
- the amount of instruction, supervision, and review required.

Careful consideration must be given to delegating field reviews. Due to the complex nature of field reviews, Engineering/Geoscience Professionals with overall responsibility should exercise judgment when relying on delegated field observations, and should conduct a sufficient level of review to have confidence in the quality and accuracy of the field observations. When

delegating field review activities, Engineering/ Geoscience Professionals must document the field review instructions given to a subordinate. (See Section 4.1.6 Documented Field Reviews During Implementation or Construction.)

For more information, refer to the *Quality Management Guides – Guide to the Standard for Direct Supervision* (Engineers and Geoscientists BC 2021c).

4.1.4 RETENTION OF PROJECT DOCUMENTATION

Engineering/Geoscience Professionals are required to establish and maintain documented quality management processes to retain complete project documentation for a minimum of ten (10) years after the completion of a project or ten (10) years after an engineering or geoscience document is no longer in use.

These obligations apply to Engineering/Geoscience Professionals in all sectors. Project documentation in this context includes documentation related to any ongoing engineering or geoscience work, which may not have a discrete start and end, and may occur in any sector.

Many Engineering/Geoscience Professionals are employed by firms, including Local Governments, which ultimately own the project documentation. Engineering/Geoscience Professionals are considered compliant with this quality management requirement when reasonable steps are taken to confirm that (1) a complete set of project documentation is retained by the organizations that employ them, using means and methods consistent with the Engineers and Geoscientists BC Bylaws and quality management standards; and (2) they consistently adhere to the documented policies and procedures of their organizations while employed there.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Retention of Project Documentation* (Engineers and Geoscientists BC 2021d).

4.1.5 DOCUMENTED CHECKS OF ENGINEERING AND GEOSCIENCE WORK

Engineering/Geoscience Professionals are required to perform a documented quality checking process of engineering and geoscience work, appropriate to the risk associated with that work. All Engineering/ Geoscience Professionals must meet this quality management requirement.

The checking process should be comprehensive and address all stages of the execution of the engineering or geoscience work. This process would normally involve an internal check by another Engineering/ Geoscience Professional within the same organization. Where an appropriate internal checker is not available, an external checker (i.e., one outside the organization) must be engaged. In some instances, self-checking may be appropriate. Where internal, external, or self-checking has been carried out, the details of the check must be documented. The documented quality checking process must include checks of all professional deliverables before being finalized and delivered.

Engineering/Geoscience Professionals are responsible for ensuring that the checks being performed are appropriate to the level of risk associated with the item being checked. Considerations for the level of checking should include:

- the type of item being checked;
- the complexity of the subject matter and underlying conditions related to the item;
- the quality and reliability of associated background information, field data, and elements at risk; and
- the Engineering/Geoscience Professional's training and experience.

As determined by the Engineering/Geoscience Professional, the individual doing the checking must have current expertise in the discipline of the type of work being checked, be sufficiently experienced and have the required knowledge to identify the elements to be checked, be objective and diligent in recording observations, and understand the checking process and input requirements.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Checks of Engineering and Geoscience Work* (Engineers and Geoscientists BC 2021e).

4.1.6 DOCUMENTED FIELD REVIEWS DURING IMPLEMENTATION OR CONSTRUCTION

Field reviews are reviews conducted at the site of the construction or implementation of the engineering or geoscience work. They are carried out by an Engineering/Geoscience Professional or a subordinate acting under the Engineering/Geoscience Professional's direct supervision (see Section 4.1.3 Direct Supervision).

Field reviews enable the Engineering/Geoscience Professional to ascertain whether the construction or implementation of the work substantially complies in all material respects with the engineering or geoscience concepts or intent reflected in the engineering or geoscience documents prepared for the work.

Documented field review standards generally do not apply to Asset Management processes. Engineering/ Geoscience Professionals, particularly those working as Asset Management consultants, may prepare Asset Management Policies, Asset Management Strategies, Asset Management Plans, or other inputs to the Asset Management planning process. Engineering/Geoscience Professionals who prepare these documents do not have an obligation to ensure their implementation by the Local Government in a way that constitutes a field review. Once these documents are delivered to the Local Government, provided the requirements of the assignment have been met, it is outside of the Engineering/Geoscience Professional's control whether and how these are put into practice.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Field Reviews During Implementation or Construction* (Engineers and Geoscientists BC 2021f).

4.1.7 DOCUMENTED INDEPENDENT REVIEW OF HIGH-RISK PROFESSIONAL ACTIVITIES OR WORK

Engineering/Geoscience Professionals must perform a documented risk assessment prior to initiation of a professional activity or work, to determine if that activity or work is high risk and requires a documented independent review.

If the activities or work are deemed high risk, and an independent review is required, the results of the risk assessment must be used to (1) determine the appropriate frequency of the independent review(s); and (2) determine if it is appropriate for the independent reviewer to be employed by the same firm as the professional of record, or if the independent reviewer should be employed by a different firm.

The documented independent review of high-risk professional activities or work must be carried out by an Engineering/Geoscience Professional with appropriate experience in the type and scale of the activity or work being reviewed, who has not been involved in preparing the design.

The documented independent review must occur prior to implementation or construction; that is, before the professional activity or work is submitted to those who will be relying on it.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Independent Review of High-Risk Activities or Work* (Engineers and Geoscientists BC 2021g).

4.2 OTHER QUALITY MANAGEMENT REQUIREMENTS

Engineering/Geoscience Professionals must also be aware of any additional quality management requirements from other sources that are relevant to their work, which may include but are not limited to:

- legislation and regulations at the local, regional, provincial, and federal levels;
- policies of authorities having jurisdiction at the local, regional, provincial, and federal levels;
- agreements and service contracts between clients and Engineering/Geoscience Professionals or their firms; and/or
- standards for engineering or geoscience firms, particularly those that apply to quality management system certification, such as the ISO 9000 family.

Engineering/Geoscience Professionals should assess any areas of overlap between the Engineers and Geoscientists BC quality management requirements and the requirements of other applicable sources. If the requirements of different sources overlap, Engineering/Geoscience Professionals should attempt to meet the complete intent of all requirements.

Where there are conflicts between requirements, Engineering/Geoscience Professionals should negotiate changes or waivers to any contractual or organizational requirements which may conflict with requirements of legislation, regulation, or the Engineers and Geoscientists BC Code of Ethics. Generally, no contractual obligation or organizational policy that may apply to an Engineering/Geoscience Professional will provide justification or excuse for breach of any of the Engineering/Geoscience Professional's obligations under any legislation, regulation, or the Engineers and Geoscientists BC Code of Ethics. Where such conflicts arise and cannot be resolved, Engineering/Geoscience Professionals should consider seeking legal advice from their own legal advisers on their legal rights and obligations in the circumstances of the conflict, and they may also seek practice advice from Engineering and Geoscientists BC on any related ethical dilemma that they may face in the circumstances.

4.3 PRACTICE ADVICE

Engineers and Geoscientists BC provides their Registrants and others with assistance addressing inquiries related to professional practice and ethics.

Practice advisors at Engineers and Geoscientists BC can answer questions regarding the intent or application of the professional practice or quality management aspects of these guidelines.

To contact a practice advisor, email Engineers and Geoscientists BC at practiceadvisor@egbc.ca.

5.0 PROFESSIONAL REGISTRATION & EDUCATION, TRAINING, AND EXPERIENCE

5.1 PROFESSIONAL REGISTRATION

Engineering/Geoscience Professionals have met minimum education, experience, and character requirements for admission to their professions. However, the educational and experience requirements for professional registration do not necessarily constitute an appropriate combination of education and experience for Asset Management. Professional registration alone does not automatically qualify an Engineering/Geoscience Professional to take professional responsibility for all types and levels of professional services in this professional activity.

It is the responsibility of Engineering/Geoscience Professionals to determine whether they are qualified by training and/or experience to undertake and accept responsibility for carrying out inputs and activities for the Asset Management process (Code of Ethics Principle 2). Engineering/Geoscience Professionals must not practice in those fields where they are not qualified.

5.2 EDUCATION, TRAINING, AND EXPERIENCE

Participating in the Asset Management process as an Engineering/Geoscience Professional, as described in these guidelines, requires minimum levels of education, training, and experience in many overlapping areas of engineering and geoscience.

Engineering/Geoscience Professionals who take responsibility for Asset Management must adhere to the second principle of the Engineers and Geoscientists BC Code of Ethics, which is to “practice only in those fields where training and ability make the registrant professionally competent” and, therefore, must evaluate their own qualifications and must possess the appropriate education, training, and experience to provide the services.

The level of education, training, and experience required of Engineering/Geoscience Professionals should be adequate for the complexity of the process or input they are asked to prepare. Qualifications for Engineering/Geoscience Professionals who provide inputs into the Asset Management process will vary widely depending on the type of input they are asked to prepare.

Engineering/Geoscience Professionals involved in preparing Asset Management inputs often have education and experience from a diverse set of backgrounds that may include almost any engineering or geoscience discipline. No one field of academic

study can adequately prepare Engineering/Geoscience Professionals to participate in the high-level tasks in the Asset Management process, including implementing Asset Management programs and preparing Asset Management Policies, Asset Management Strategies, and Asset Management Plans. Instead Engineering/Geoscience Professionals must gain experience through on-the-job training, continuing education, mentorship, and participation in communities of practice. Continuing education can include taking formal courses; attending conferences, workshops, seminars, and technical talks; reading technical publications; and doing web research. Continuing education can help build initial skill sets in Asset Management, develop areas of specialty, and help Engineering/Geoscience Professionals remain current with evolving topics.

5.2.1 PROFESSIONAL CERTIFICATIONS IN ASSET MANAGEMENT

Several organizations offer training programs and/or professional certifications in Asset Management:

- Institute of Asset Management (IAM): training certificate and diploma programs
- NAMS Canada/Institute for Public Works Engineering Australasia (IPWEA): Professional Certificate in Asset Management Planning
- PEMAC Asset Management Association of Canada: various certificate programs
- World Partners in Asset Management: various certificate programs

These certification programs and other focused training can provide detailed instruction on Asset Management processes and help Engineering/Geoscience Professionals develop their network of Asset Management practitioners. However, currently, most Local Governments do not require certification of their professional staff and there is no national or universal standard.

5.2.2 ASSET MANAGEMENT COMPETENCIES AND LEVEL OF PROFICIENCY

Section 2.2.4 Asset Management Consultants of these guidelines describes the roles and responsibilities for Engineering/Geoscience Professionals.

Another useful document for understanding the competencies associated with engineering roles and responsibilities in Asset Management is the CNAM Asset Management Competency Framework for Canadian Municipalities (referred to as the "AM Competency Framework")(CNAM 2020). The AM Competency Framework outlines the skill sets and ability levels that Local Government employees involved in Asset Management should require from practitioners, to meet an organization's Asset Management goals.

See Appendix B: CNAM Asset Management Competency Framework for details.

6.0 REFERENCES AND RELATED DOCUMENTS

Documents and legislation cited in these guidelines appear in Section 6.1 Legislation and Section 6.2 References.

Related documents that may be of interest to users of these guidelines but are not formally cited elsewhere in this document, and codes and standards related to Asset Management appear in Section 6.3 Related Documents and Section 6.4 Codes and Standards.

6.1 LEGISLATION

Professional Governance Act [SBC 2018], Chapter 47.

6.2 REFERENCES

Asset Management BC. 2021. Asset Management for Sustainable Service Delivery. [web page]. [accessed: 03 Jun 2021]. https://www.assetmanagementbc.ca/framework/.

Asset Management BC. 2019. Asset Management for Sustainable Service Delivery: A BC Framework. [accessed 2020 May 20]. https://www.assetmanagementbc.ca/wp-content/uploads/Asset-Management-for-Sustainable-Service-Delivery-A-BC-Framework-.pdf.

Asset Management Guide Working Group. 2019 Asset Management Guide for BC First Nations. (accessed: 2020 Jul 15). Chemainus and Delta, BC: Naut'sa mawt Tribal Council. https://www.nautsamawt.org/assetmanagementguide.

Canadian Network of Asset Managers (CNAM). 2020. Asset Management Competency Framework for Canadian Communities. [accessed: 2020 May 20]. https://www.cnam.ca/wp-content/uploads/2020/02/CNAM_AM-Competency-Framework_v1.0_2020.pdf.

Engineers and Geoscientists BC. 2021a. Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines. Version 1.1. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 20]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021b. Quality Management Guides – Guide to the Standard for the Authentication of Documents. Version 3.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed:2021 May 10]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021c. Quality Management Guides – Guide to the Standard for Direct Supervision. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed:2021 May 10]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021d. Quality Management Guides – Guide to the Standard for Retention of Project Documentation. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 10]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021e. Quality Management Guides – Guide to the Standard for Documented Checks of Engineering and Geoscience Work. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 10]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021f. Quality Management Guides – Guide to the Standard for Documented Field Reviews During Implementation or Construction. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed:2021 May 10]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021h. Quality Management Guides – Guide to the Standard for Documented Independent Review of High-Risk Professional Activities or Work. Version 1.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed:2021 May 10]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Federation of Canadian Municipalities (FCM). 2018. How to Develop an Asset Management Policy, Strategy and Governance Framework: Set Up a Consistent Approach to Asset Management in Your Municipality. [accessed 2020 Jul 15]. Ottawa, ON: FCM. https://fcm.ca/sites/default/files/documents/resources/guide/how-to-develop-asset-management-policy-strategy-mamp.pdf.

Municipal Natural Assets Initiative (MNAI). 2021. Natural Assets Management Considerations for Engineering and Geoscience Professionals: Companion Guide to the Engineering and Geoscientists BC Professional Practice Guidelines – Local Government Asset Management. Vancouver, BC: MNAI. [accessed: 29 Jul 2021]. https://mnai.ca/resources-for-professions/.

6.3 RELATED DOCUMENTS

Asset Management BC. 2011. Guide for using the Asset Management BC Roadmap. [accessed: 2020 Oct 29]. https://www.assetmanagementbc.ca/wp-content/uploads/Guide_for_using_the_Roadmap20-AMBC-Sept_23_2011.pdf.

Asset Management BC. 2019. Climate Change and Asset Management: A Sustainable Service Delivery Primer. [accessed 2020 Oct 29]. https://www.assetmanagementbc.ca/wp-content/uploads/Climate-Change-and-Asset-Management.pdf.

Asset Management BC. 2019. Integrating Natural Assets into Asset Management: A Sustainable Service Delivery Primer. [accessed: 2020 Oct 29]. https://www.assetmanagementbc.ca/wp-content/uploads/Integrating-Natural-Assets-into-Asset-Management.pdf.

Asset Management BC. 2019. Land Use Planning and Asset Management: A Sustainable Service Delivery Primer. [accessed: 2020 Oct 29]. https://www.assetmanagementbc.ca/wp-content/uploads/Land-Use-Planning-and-Asset-Management.pdf.

Asset Management BC. 2019. The Role of Operations and Maintenance in Asset Management: A Sustainable Service Delivery Primer. [accessed: 2020 Oct 29]. https://www.assetmanagementbc.ca/wp-content/uploads/The-Role-of-Operations-Maintenance-in-Asset-Management.pdf.

Asset Management BC. 2015. Asset SMART 2.0: A Tool to Assess Your Community's Asset Management Practices. [accessed: 2021 May 27]. https://www.ubcm.ca/assets/Funding~Programs/Asset~Management/AssetSMART_2%20-_A_Local_Government_Self_Assessment_Tool--LGAMWG--September_2015.pdf.

Engineers and Geoscientists BC. 2016. Professional Practice Guidelines: Sustainability. Version 1.1. Burnaby, BC: Engineers and Geoscientists BC. [accessed 2021 Jan 04]. https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Federation of Canadian Municipalities (FCM). 2018. Asset Management Readiness Scale – Municipal Asset Management Program. Ottawa, ON: FCM. [accessed: 2021 May 27]. https://data.fcm.ca/documents/resources/mamp/asset-management-readiness-scale-mamp.pdf.

FCM. 2019. Guide for Integrating Climate Change Considerations into Municipal Asset Management. Ottawa, ON: FCM. [accessed: 2021 May 27]. https://fcm.ca/sites/default/files/documents/programs/mcip/guide-for-integrating-climate-change-considerations-into-municipal-am.pdf.

Institute of Public Works Engineering Australasia. 2015. International Infrastructure Management Manual.

Local Government & Municipal (LGAM) Knowledge Base. Asset Management. [accessed: 2020 Jul 15]. http://www.lgam.info/asset-management.

6.4 CODES AND STANDARDS

ISO 31000: 2018. Risk Management - Guidelines

ISO 55000: 2014. Asset Management – Overview, principles and terminology

ISO 55001: 2014. Asset Management – Management Systems – Requirements

ISO 55002: 2018. Asset Management – Management Systems – Guidelines for the application of ISO 55001

7.0 APPENDICES

APPENDIX A: COMMON ASSET MANAGEMENT ROLES AND RESPONSIBILITIES

This table illustrates typical roles and responsibilities for participants at each stage of the Asset Management process identified in the document titled "Asset Management for Sustainable Service Delivery – A BC Framework" (Asset Management BC 2019), from assessment to planning to implementation. This document focuses primarily on engineering-related participants; however, frequently other areas are involved (e.g., facilities, parks) that are not listed here. As such, readers should be aware there are other areas with assets that these processes can apply to.

Table A - 1: Participants, Roles, and Responsibilities for Asset Management

ASSET MANAGEMENT PHASE	ROLE IN ASSET MANAGEMENT PROCESS BY FUNCTIONAL AREA					
	ASSET MANAGEMENT LEAD/SPECIALIST	ENGINEERING	PUBLIC WORKS	FINANCE	PLANNING	ENGINEERING/ GEOSCIENCE CONSULTANTS
Assess Asset Management Practices (Section 3.2.1)	• Review Asset Management systems and practices • Review Asset Management Policies and Asset Management Strategies	• May lead or support the review of Asset Management practices	• May lead or support the review of Asset Management practices	• May lead or support the review of Asset Management practices	• Typically, support the review of Asset Management practices	• May be contracted to lead or support the review of Asset Management practices
Assess the Current State of Assets (Section 3.2.2)	• Lead and coordinate the review of the current state of assets	• Support the review of the current state of assets • Lead the asset life-cycle elements of the assessment	• Support the review of the current state of assets • Lead the operations and maintenance elements of the assessment	• Support the review of the current state of assets • Lead the financial elements of the assessment	• Support the review of the current state of assets • Review the future demand elements of the assessment	• Support the review of the current state of assets • Lead the asset life-cycle elements of the assessment
Develop the Asset Management Policy (Section 3.3.1)	• Lead the development of the Asset Management Policy	• Support the development of the Asset Management Policy	• Support the development of the Asset Management Policy	• Support the development of the Asset Management Policy	• Support the development of the Asset Management Policy	• Support the development of the Asset Management Policy

Table A - 1: Participants, Roles, and Responsibilities for Asset Management

ASSET MANAGEMENT PHASE	ROLE IN ASSET MANAGEMENT PROCESS BY FUNCTIONAL AREA					
	ASSET MANAGEMENT LEAD/SPECIALIST	ENGINEERING	PUBLIC WORKS	FINANCE	PLANNING	ENGINEERING/ GEOSCIENCE CONSULTANTS
Develop the Asset Management Strategy (Section 3.3.2)	• Lead the development of the Asset Management Strategy	• Support the development of the Asset Management Strategy	• Support the development of the Asset Management Strategy	• Support the development of the Asset Management Strategy	• Support the development of the Asset Management Strategy	• Support the development of the Asset Management Strategy
Develop the Asset Management Plan (Section 3.3.3)	• Lead the development of the state of the infrastructure	• Develop the requirements for and analyze data for the Asset Register • Develop Condition Assessment methodologies • Assess functional and demand capacity • Work with financial professionals to establish replacement value calculation methodology	• Support the development of the state of the infrastructure • Undertake Inspections to determine the condition of Assets • Provide information to update Asset Registers	• Work with engineering and public works staff to develop replacement values • Work with engineering and public works staff to update the Asset Register	• Work with engineering staff to develop growth projections • Work with engineering staff to determine community plan servicing requirements	• Undertake the preparation of the Asset Management Plan on behalf of Local Governments, when contracted to do so • Undertake technical studies requiring professional engineering, such as water modelling and sewer modelling
Determine Levels of Service (Section 3.3.3.1, subsection Levels of Service)	• Lead the development of the Levels of Service criteria	• Support development of the Levels of Service measures • Develop key performance indicators (KPI) for technical Levels of Service	• Support the development of the Levels of Service measures • Support engineering staff in developing KPI related to operations and maintenance	• Support the development of the Levels of Service measures related to cost of service	• Support development of the Levels of Service measures	• Support the development of the Levels of Service measures • Develop KPI for technical Levels of Service

Table A - 1: Participants, Roles, and Responsibilities for Asset Management

ASSET MANAGEMENT PHASE	ROLE IN ASSET MANAGEMENT PROCESS BY FUNCTIONAL AREA					
	ASSET MANAGEMENT LEAD/SPECIALIST	ENGINEERING	PUBLIC WORKS	FINANCE	PLANNING	ENGINEERING/ GEOSCIENCE CONSULTANTS
Demand Management (Section 3.3.3.2)	• Not applicable	• Develop demand and growth technical plans to support planning for Level of Service and infrastructure decisions	• Support Asset Management decision-making and analysis related to demand management	• Not applicable	• Integrate demand and growth management into Asset Management	• Develop demand and growth technical plans to support planning for Level of Service and infrastructure decisions
Life Cycle Management (Section 3.3.3.3)	• Not applicable	• Manage engineering-related Asset Management life-cycle activities, including project delivery • Focus on identification of service delivery solutions, planning, and selection, design, and delivery of infrastructure • Develop decision-making criteria for replacing, rehabilitating, or enhancing assets • Support operations and maintenance-related Asset Management life-cycle activities	• Manage operations and maintenance-related Asset Management life-cycle activities • Work with engineering staff to develop maintenance standards and criteria to maximize useful life of assets	• Manage finance-related Asset Management life-cycle activities	• Support Asset Management decision making and analysis • Manage planning-related Asset Management life-cycle activities • Integrate demand and growth management into Asset Management	• Support Local Government engineering staff in Asset Management life-cycle activities

APPENDIX B: CANADIAN NETWORK OF ASSET MANAGERS ASSET MANAGEMENT COMPETENCY FRAMEWORK

B1 OVERVIEW

The Canadian Network of Asset Managers (CNAM) document titled "Asset Management Competency Framework for Canadian Communities" (referred to as "the AM Competency Framework") (CNAM 2020) outlines the required skill sets and ability levels that Local Government employees involved in Asset Management should require from practitioners to meet an organization's Asset Management goals.

The document lists several functional areas and roles that are expected to contribute to Asset Management practices, one of which is engineering. It also describes twelve competencies, grouped under the six categories, within which an organization must build Asset Management proficiency and practices. For each of the twelve competencies, all functional areas, including engineering, are given an expected proficiency, either basic, intermediate, advanced, or expert. The expected proficiency is intended to describe the level of knowledge and experience expected from a practitioner in each of the functional areas. The combination of all functional areas performing at their expected proficiencies will support the Local Government in attaining competency in each category.

B2 ASSET MANAGEMENT COMPETENCY REQUIREMENTS

B2.1 COMPETENCIES REQUIRING INTERMEDIATE PROFICIENCY

According to the AM Competency Framework, those working in engineering roles in Asset Management should have at least intermediate proficiency in the following competencies:

- People and Leadership: Leading Others and Collaboration
- Policy and Governance: Contextual Analysis
- Data and Information: Information Management and Financial Analysis
- Asset Management Practice: Asset Management Expertise and Service Focus
- Life Cycle Delivery: Continuous Improvement

Having intermediate proficiency in these areas means that those in engineering roles are expected to understand the theories, concepts, context, and processes that guide these competencies, both generally and for their specific Local Government.

For these competencies, Engineering/Geoscience Professionals who are in a supporting role are expected to be knowledgeable participants and may be asked to provide their opinions and judgments. In cases where Engineering/Geoscience Professionals are asked to lead in these competencies, an advanced or expert level proficiency may be expected.

B2.2 COMPETENCIES REQUIRING ADVANCED PROFICIENCY

According to the AM Competency Framework, those working in engineering roles are expected to have advanced proficiency in the following competencies:

- Policy and Governance: Holistic Thinking
- Planning and Decision Making: Decision-Making and Risk Analysis

Having advanced proficiency in these areas means that those in engineering roles are expected to perform at a high level, including acting as a resource to others and applying creative and innovative approaches to issues and process improvements. These competencies draw on fundamental engineering and geoscience skills and problem-solving abilities, which is why those in engineering roles may be asked to lead the work completed in these competencies.

B2.3 COMPETENCIES REQUIRING EXPERT PROFICIENCY

According to the AM Competency Framework, those working in engineering roles are expected to have expert proficiency in the following competency:

- Life Cycle Delivery: Infrastructure Management

As an expert in this competency, those in engineering roles should possess extensive knowledge on infrastructure management approaches, bring strategic thinking and planning skills to bear on their work, and be working to continuously improve the processes they develop and apply. Being an expert and leader for this competency will require the application of engineering/geoscience skills and judgment; this will allow the Local Government to understand the risks and consequences of different approaches to managing their assets.

B3 SUMMARY

Meeting these expected proficiency levels will require differing amounts of background knowledge, training, work experience, mentorship, and continuing education. It is the shared responsibility of the Local Government and the practitioners working in each functional area to develop the skills that contribute to these proficiency levels.

It is notable that, as described in the AM Competency Framework, those in engineering roles are expected to have at least intermediate proficiency in all competencies. This points out the value that Engineering/Geoscience Professionals bring to the holistic processes that contribute to Asset Management: while they are not expected to be the lead of all contributing processes, they are expected to be engaged, knowledgeable participants at each step along the way.

Engineering/Geoscience Professionals participating in Asset Management must be well-rounded, with enough background knowledge of all competencies and an understanding of the roles of other practitioners to contribute to all core functions.

200 • 4010 REGENT STREET, BURNABY, BRITISH COLUMBIA, CANADA V5C 6N2
MAIN 604.430.8035 TOLL FREE 1.888.430.8035 EMAIL info@egbc.ca WEBSITE egbc.ca