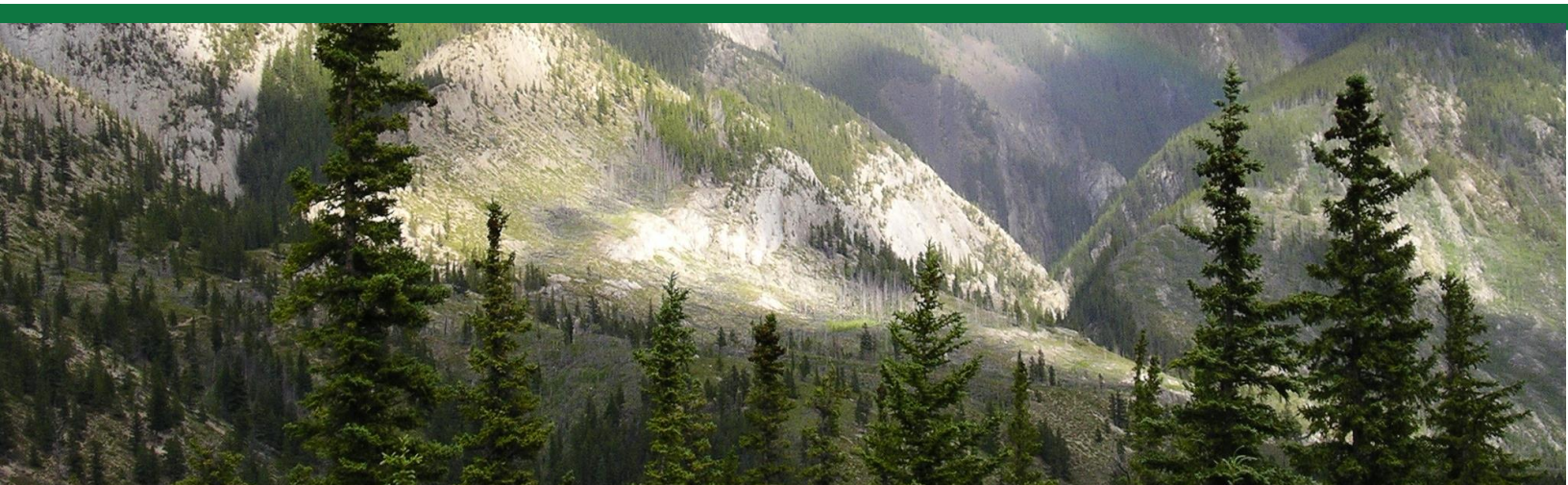
Environmental Professional (EP) Body of Knowledge



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Introduction

The Environmental Professional (EP) designation provides professionals who have significant experience in the Canadian environmental sector with formal recognition of their unique environmental competencies. Environmental Professionals are a group of diverse environmental and sustainability professionals across Canada. Among them are environmental scientists, technicians, engineers, biologists, auditors, managers, consultants, and executives – all of whom hold important, specialized knowledge in the environmental sector.

ECO Canada awards the EP designation based on:

1. **The applicant's competency level in their area(s) of specialization**
   As part of the EP designation process, ECO Canada will evaluate and validate an applicant's competency level compared to the National Occupational Standards for Environmental Employment. ECO Canada developed the National Occupational Standards for Environmental Employment through extensive consultation and validation with industry experts within Canada. These standards are a definitive guide of the skills and knowledge required for Environmental Professionals to do their jobs within their selected area(s) of specialization.

2. **The successful completion of the EP Ethics and General Knowledge Examination**
   Although Environmental Professionals may require knowledge specific to their area of environmental practice, all Environmental Professionals share a broad knowledge of the environment and environmental issues. The EP Ethics and General Knowledge Examination (EP Exam) evaluates individuals' knowledge in broad areas of the environment and the environmental issues in Canada, including six core knowledge areas: Social, Economic and Environmental Interactions, Environmental Regulatory Framework, Technical Guidelines, Impact Management, Results Management, and Relationship Management. Successful completion of the EP Exam ensures that EPs not only share a common foundational understanding of the environmental sector but also a strong ethical understanding of their obligations as a professional.

   The successful completion of the EP application includes a passing score for the EP Exam as well as fulfillment of application requirements including a recognized Canadian college diploma or university degree, or equivalent international credentials, and at least five years environmental work experience.

Canada's evolving environmental sector needs practitioners to be knowledgeable and ethical ambassadors that have the professional and technical skills necessary to thrive in today's workforce and to inspire public trust in the profession.

ECO Canada upholds high standards of its members to ensure that:

- The standards of admission and practice are met.
- Activities of members are regulated in terms of skilled practice and ethical conduct.
- Knowledge building is promoted within the profession through required professional development and professional practice (employment experience).

What does it mean to be an Environmental Professional in Canada? Environmental Professionals:

- Set a high standard and demonstrate dedication to the environmental sector
- Protect the environment and the public through engagement and involvement, the pursuit of education, and work experience
- Conduct work ethically and responsibly
- Become leaders by promoting sustainability, communicating effectively with the public, and influencing change on a larger scale

All EPs must practice in accordance with the EP Code of Ethics and provincial and federal law. EPs must restrict their practice to their area(s) of expertise and follow related established standards.

Overview of the Body of Knowledge

The Environmental Professional (EP) Body of Knowledge consists of four main sections (illustrated in **Figure 1**):

Section A: Ethics

The EP Guidelines for Ethical Practice and the EP Code of Ethics support the vision, values, rules of conduct, and standards of practice for EP members. The EP Code of Ethics provides a common set of values within the profession.

Section B: Core Enabling Competencies

The core enabling competencies describe the behaviours or soft skills that contribute to the successful performance of technical tasks; these competencies relate to how the job is accomplished and can be applied in many roles.

Section C: Core Knowledge Areas

Environmental Professionals must have knowledge in these core areas to thrive and contribute to the environmental industry in Canada.

Section D: Specialized Knowledge and Technical Competencies

The specialized knowledge and technical competencies describe the demonstrated ability of an Environmental Professional to perform a task or a series of tasks to the satisfaction of the employer or otherwise established norms.

Figure 1: Components of the EP Body of Knowledge

Although all sections of the EP Body of Knowledge can help applicants and the public understand the knowledge base expected of Environmental Professionals, the most important sections of the EP Body of Knowledge for all applicants are **Section A: Ethics** and **Section C: Core Knowledge Areas**.

Section A: Ethics

The **EP Code of Ethics** outlines the values and expected behaviours that guide Environmental Professionals in all activities related to their professional duties. By committing to these values and adhering to the expected behaviours, Environmental Professionals strengthen and inspire the public's confidence in the environmental profession.

The **EP Guidelines for Ethical Practice**, a companion document to the EP Code of Ethics, uses practical examples for Environmental Professionals to help them interpret and apply the EP Code of Ethics in their work.

In the context of a profession serving society and the environment, the EP Code of Ethics shapes individual practice. By adhering to the EP Code of Ethics, Environmental Professionals:

1. Share a common set of values within the profession and thereby offer a reliable professional product to the public. A professional practice carried out in both a competent and ethical manner is vital to maintaining a relationship of trust with clients and with the public in general.

2. Provide societal and environmental leadership. Trust is a fundamental element as EPs guide society to adopt environmental responsibilities for the advancement of ecological and human welfare. The public is looking to EPs for this leadership particularly because of the increasing rate of advancements in the environmental world.

The EP Code of Ethics includes five tenets. To remain in good standing, all certified and in-training members must perform under the following tenets:

1. Environmental Stewardship
2. Environmental Advocacy
3. Professional Responsibility
4. Ethical and Moral Standards
5. Confidentiality

EP designation staff, volunteers, and board and committee members must also abide by the EP Code of Ethics. This section describes each of these five central tenets of the EP Code of Ethics.

1.1 Environmental Stewardship

Environmental Professionals recognize the value of environmental efficiency and sustainability, determine the benefits and costs of additional environmental stewardship, and continue to implement sustainable solutions.

As part of their responsibilities, Environmental Professionals must also:

- Champion environmental stewardship
- Embrace EP roles and responsibilities
- Strive to leave a legacy
- Use scientific and Traditional Knowledge
- Support and promote ecological resilience

1.1.1 Champion Environmental Stewardship

Environmental Stewardship involves thorough efforts to protect the global environment and minimize the impact of human activity. Although all citizens are responsible for sustaining the viability of our environment, Environmental Professionals must champion environmental stewardship with an objective towards sustainability.

Society must reconcile these environmental stewardship needs with an EPs need for responsible sustainable development. EPs should take an active and cooperative role to help society meet present and upcoming environmental challenges. EPs must maintain their knowledge in areas that have a bearing on the quality and effect of their work.

When acting in a professional capacity, EPs are obligated to consider the implications of their work regarding environmental effect prevention and mitigation. Many aspects of a project can have direct or indirect environmental effects; these effects can be both positive and negative. All stages of a project have environmental consequences that must be considered early in the project; therefore, a systematic evaluation procedure is needed to effectively address such environmental issues. Developing effective prevention or mitigation strategies requires integrated project planning. EPs should ensure these integrated project planning and evaluation procedures are in place to affirm they protect, steward, and promote the environment when conducting their work.

1.1.2 Embrace Environmental Professional Roles and Responsibilities

Environmental work is best undertaken by a multi-disciplinary team. Due diligence requires that all reasonable steps be taken to ensure that the team comprises the necessary expertise and that this expertise is appropriately applied.

As part of Environmental Professionals service to society, they are accountable for their own professional practice, for the professional practice of those under their supervision, and generally for

the profession itself. This environmental and public interest bias must take precedence over self-interest. Protection of the environment and the public from unethical or incompetent practice is a top priority for Environmental Professionals. Clients and employers depend on Environmental Professionals for not only their environmental competence but also the confidence the public has in them. In addition, Environmental Professionals must also be credible in their character and in their integrity to serve society.

Environmental Professionals duty to public service extends beyond the EP Code of Ethics. EPs should continually strive to give back to their communities through service to public bodies that draw on professional expertise. EPs are also encouraged to participate in activities in their communities that require professional and ethical conduct but not necessarily the application of environmental knowledge.

1.1.3 Strive to Leave a Legacy

Environmental Professionals must uphold and enhance the honour, dignity, and reputation of their professions and serve environmental and public interests. EPs must strive to leave an environmental legacy while maintaining opportunities for future generations to drive responsible environmental management practices.

Environmental Professionals recognize environmental impairment as a risk to public welfare, and in response they must urge members of society to protect, preserve, and enhance the quality of the environment. The long-term objectives of Environmental Professionals and professionals employed in the environmental sector are to sustain the viability of our ecosystems and to safeguard the well-being of future generations so that they will not be compromised by our activities today.

EPs recognize that stewardship of the environment is a responsibility for all citizens; the public has a rightful role in setting goals for environmental management

Integrating environmental sustainability with social and economic considerations will require EPs to be innovative and creative in their planning and design. In the broader context, EPs are encouraged to look ahead and foresee how their role will shape the future. The future will not only be shaped through today’s innovations, but also by how innovations advance in the interest of the environment; public safety, health, and welfare; risk minimization and management; and social and cultural values.

1.1.4 Use Scientific and Traditional Knowledge

Environmental Professionals know that the projects they work on may involve scientific knowledge, which relies on laws that have been established through the application of the scientific method. Environmental Professionals also need to consider and apply Traditional Knowledge developed over centuries through the experiences of local communities around the world and adapted to local culture and environment.

The recognition of industry experts in this area is paramount. The EP must be vigilant in selecting a process or assembling a team with the appropriate knowledge for a proposed project. Environmental Professional must also recognize values applicable to the social and economic effects of projects. These values could include local and neighbourhood concerns, quality of life, specific-effect concerns (e.g., visual, sound, odour), along with traditional and cultural values which have all gained acceptance as pertinent and definable criteria that many jurisdictions are now interpreting and applying.

1.1.5 Support and Promote Ecological Resilience

Environmental Professionals must support and promote ecological resilience by incorporating information about natural variation, cumulative impacts, and climate change where appropriate or possible. An EP should evaluate and investigate any possible impacts that their work could have on nearby micro-ecosystems. These impacts can be individual or cumulative and they may have social and economic implications. Environmental Professionals should, wherever applicable, monitor the effects of a changing climate on standard design practices and adapt their decisions and project designs to accommodate these changes as they evolve.

Environmental Professionals must, at the minimum, comply with relevant legislation, approvals, and orders relating to the sustainable treatment of resources and disposal of the same resources and by-products. In addition, even where not required by legislation, approvals or orders, EPs should aim to increase the lifecycle of a resource to increase sustainability.

EPs understand that they are building resilience into an ecosystem by supporting the health and function of associated habitats, organisms, and ecosystem processes that are affected by their work. For ecological systems, an EP understands the importance of biodiversity and functional redundancy in helping ecosystems become more resilient to environmental changes. With this knowledge, an EP will use diverse strategies and methods to build resilient ecosystems for coping with and adapting to change.

1.2 Environmental Advocacy

Environmental Professionals empower communities around them. By empowering their communities, EPs enhance the dignity and reputation of both the profession and the designation, as well as respect the welfare, health, and safety of all persons and environment through competency, honesty, and transparency.

As part of their responsibilities for environmental advocacy, Environmental Professionals must:

- Exercise due diligence
- Inspire others and show value in making environmentally conscious decisions
- Facilitate and promote environmentally positive change
- Restrict professional practice to areas of competence and expertise

1.2.1 Exercise Due Diligence

EPs shall practice due diligence and apply reasonable care in all work. Environmental Professionals should:

- Stay apprised of the major environmental issues facing society so that they may inform the potential interaction of these issues with their professional activities.
- Recognize how their professional activities can affect the environment.
- Maintain a reasonable level of understanding and awareness of the environmental issues related to their field of expertise.
- Recognize the value of Environmental Management Systems (EMS) in identifying, controlling, and reducing negative impacts on the environment.
- Use other specialists in areas where the EP's knowledge alone is not adequate to address environmental issues.
- Apply professional and responsible judgment in their environmental considerations.
- Integrate environmental planning and management into all their activities.
- Consider the costs of environmental protection and promotion among the essential factors used to evaluate the economic viability of projects.
- Recognize the value of environmental sustainability, consider all benefits and costs of environmental stewardship, and endeavor to implement efficient and sustainable solutions.
- Openly engage and ask for input from stakeholders and strive to promptly respond to environmental concerns.
- Comply with regulatory requirements and endeavor to exceed or better them by striving to apply the best available cost-effective technologies and procedures.
- Disclose information necessary to protect public safety to the appropriate authorities.
- Work actively with others to improve environmental understanding and practices.

1.2.2 Inspire Others and Show Value in Making Environmentally Conscious Decisions

EPs must exemplify the benefits of engaging in environmentally positive behaviour. They must encourage clients, colleagues, employers, and the public to take action towards making ethical decisions at an individual, corporate, and public interest level.

EPs realize that no simple definition of "the environmental and public interest" exists and that environmental, technical, economic, and social issues related to sustainability and environmental projects are complex and interrelated. Trade-offs are frequently required. Substantial pressure can be applied on a project, based on a uni-dimensional agenda of a special interest group. Environmental Professionals make decisions in the best interest of the environment, even if these choices are not the most financially feasible or the easiest path forward.

The solution to complex long-term problems requires industry, governments, and academia to work together. EPs are encouraged to interact with others to translate concepts from theoretical research into applied practice.

1.2.3 Facilitate and Promote Environmentally Positive Change

EPs are encouraged to be actively involved with environmental issues. They should go beyond merely facilitating improvements; Environmental Professionals must promote environmentally positive change. By being actively involved and proactive, EPs can anticipate and prevent negative impacts on the environment, rather than being reactive and responding late.

Developing effective prevention or mitigation strategies requires integrated project planning. EPs are encouraged to verify that such evaluation procedures are in place and are followed. This commitment indicates that effective environmental protection strategies are an integral part of their activities. Environmental effect prevention and mitigation will always be a key consideration for Environmental Professionals in the execution of their work. Because of this consideration, many projects present an opportunity to think about planning and design alternatives that may benefit the environment. Environmental Professionals should advise their employers or clients of alternatives that could have a positive effect on the environment; employers and clients would then have the opportunity to manage from both a project and financial perspective, avoiding negative environmental impacts and maximizing positive impacts on society.

Environmental Professionals are uniquely poised between the two extremes of absolute preservation and unfettered development. Three strategies for creating positive change include:

1. For EPs to understand and say "no" when they know that the right decision is not being properly considered or executed -- speaking up in the interest of environment and not of ‘self’.
2. For EPs to be part of or involved with organizations that formulate environmental laws and see to their enforcement.
3. For the public to see EPs as stewards of the environment, professionals who have practical, knowledge-based solutions that serve the best interest of the environment and public.

1.2.4 Restrict Professional Practice to Areas of Competence and Expertise

Environmental Professionals must restrict their advice, opinions, and practice to their areas of competency and expertise. In situations where an environmental issue or an aspect of a project may be outside of the EPs speciality, they must consult an appropriate subject matter expert. The practice of environmental science integrates diverse disciplines and philosophies; therefore, many projects will require a team of specialists to address complex environmental issues. EPs should engage or recommend that their clients and employers engage other experts or specialists to best service the client’s or employer’s best interests. EPs shall only undertake work they are competent to perform based on their training and experience.

Before accepting assignments, EPs should ensure that their clients and employers understand the extent of their professional responsibilities. Defining the EP’s professional responsibilities and developing their scope of services involves listing both their tasks within the terms of engagement and the performance

expectations. All parties including the EP, the employer, and the client benefit from an accurate representation of skills, abilities, and expectations.

1.3 Professional Responsibility

Environmental Professionals must commit to ongoing learning and development. The environmental sector is growing and continuously changing and therefore the EP must adapt and grow along with it. EPs will adhere to the ethical guidelines, understand the rules of conduct, and uphold the standard of practice. They will also be accountable, understand their responsibility, work within the rules and regulations, and always work to the maximum of their expertise. EPs must remember that they need the publics trust for their decisions to be impactful, respected and sought out.

Environmental Professionals have a responsibility to:

- Promote the value of being an EP
- Maintain competencies and continuously improve
- Recognize when compliance is not enough
- Use the precautionary principle
- Hold others accountable and report unethical practices
- Conduct practice toward other professionals with courtesy
- Provide high quality services
- Abide by the law, regulatory guidelines, and policies
- Communicate respectfully
- Be mandate oriented – follow policy, behave ethically

1.3.1 Promote the Value of Being an Environmental Professional

At all times, EPs should be ambassadors of the EP designation and share the value of the profession with their peers, employers, and the public. Obtaining the EP designation validates knowledge obtained through both educational and employment paths, the skillsets obtained, and the ability to meet a professional standard. The EP designation certifies the experiences that the professional has gained in their environmental role(s) and attests to their dedication to the environmental sector.

When an EP is presenting, speaking at an event, or writing a proposal, affirming their qualifications by highlighting their EP status will help them gain credibility and grow the legitimacy of the EP community.

1.3.2 Maintain Competencies and Continuously Improve

Environmental Professionals must maintain competencies and continuously improve professional and ethical knowledge through education and skills enhancement. EPs must maintain a knowledgeable interest within their specialization(s) which have the potential to impact the public interest. Environmental, technical, and professional standards of conduct are set, revised, maintained, and enforced by EPs. Mutual accountability within the EP designation and amongst EPs must be stringent so that they are always seen to merit societal trust. If each member of a working group is highly

professional, it elevates the professionalism of the entire group. EPs must continue their professional development to maintain the standards expected of them.

Such standards may be provincial, national, or global, and address the following:

- **Code of Ethics.** EPs must hold the role of protecting the public from unethical or incompetent practice in the highest esteem.
- **Technical Requirements.** EPs must engage in skilled practice to ensure the protection of the environment and the public's well-being and safety
- **Continuing Competence.** EPs must continue to pursue personal and professional development and adherence to standards and guidelines in all areas of environmental practice
- **Discipline.** EPs who fail to comply with proper standards of environmental practice and ethical conduct may face discipline within their professional certification body and/or the law

1.3.3 Recognize When Compliance is Not Enough

If Environmental Professionals recognize when compliance is not enough or if compliance is not the best that they can do, then they must set a higher standard. The EP's primary responsibility is to protect the welfare of the environment and the public, whether the work is paid or is voluntary. This responsibility is not reduced or diminished when the EP provides service to the public through an employer; therefore, employed Environmental Professionals are still bound by these ethical responsibilities and obligations, even if or when they are influenced by others such as employers, clients, or the public. This dilemma may require EPs to confront company loyalty versus professional responsibility.

When an EP takes a professional stance, their career may be negatively affected. EPs must ensure that they take appropriate action or notify the proper authorities when they believe that public safety or the environment is endangered or when required by relevant legislation, approvals, or orders. EPs share corporate responsibility for the quality of products and services delivered.

When faced with these conflicting situations as either a consultant or employee, EPs must use judgement from their accumulated knowledge and experience. Recognizing ethical dilemmas and determining the actions to address them are important skills for EPs. ECO Canada and the EP Community can, if necessary, help the professional make ethically sound decisions through clarifications within the EP Code of Ethics and discussion.

EPs must understand that meeting the minimum standard is insufficient; EPs should always strive for higher standards. For EPs to have a real impact, their professional competence and project delivery should be rated as "excellent".

1.3.4 Use the Precautionary Principle

The Precautionary Principle states that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent

environmental degradation." (UNESCO, 2005) This strategy manages potential risks and impacts where scientific understanding is incomplete. In an environmental context, when an impact or irreversible damage to the environment exists, a lack of scientific knowledge should not be used to delay remedial actions.

EPs have an obligation to actively try to prevent harm even though there is not always certainty that an activity can lead to something negative or cause harm. In professional practice when there is not scientific proof of negative impacts upfront, an EP should use professional judgement based on their expertise to anticipate any harm that could occur. Environmental Professionals must understand and use the precautionary principle, meaning that they must minimize harm wherever and whenever possible. EPs must keep up with society's increased awareness of activities that can affect the environment. This awareness will inform an EPs contribution to designing and implementing solutions recognizing the possible significant effects that their professional activities have on the environment.

EPs are expected to respect the law in their personal conduct. They should not engage in activities outside of their professional practice that may compromise their professional or personal reputation or bring discredit to their profession. If an EP is presented with a situation that may compromise their reputation or the reputation of the profession, they should be prudent and take extra care, even while they await further evidence.

1.3.5 Hold Others Accountable and Report Unethical Practices

EPs should lead by example and exemplify competence and ethical conduct of business in their organizations. To many employers, this leadership is an asset and often a contributing factor towards offering employment to EPs.

When a disagreement occurs between two EPs, the individual who bears professional responsibility for the recommendation must ensure that their facts and recommendations are correct and that the information and assumptions are communicated simply and clearly. For contentious issues, this communication should be done both in writing *and* by phone or in person. If an EP chooses to overrule the other EPs recommendation, in full knowledge of its basis, then this EP consciously accepts responsibility.

When an EPs recommendation is questioned by someone, the EP must value their opinion and seek to understand. Although the other party may not have the environmental technical knowledge to appreciate both the rationale of the recommendation and the potential consequences of failure, their opinion should be addressed. The EP must explain, describe, and defend their recommendation and if necessary, seek support form their managers or their superiors to help resolve the conflict. In such instances, the EP should ensure that an appropriate decision is made.

As mentioned throughout the EP Code of Ethics, an EP has a duty of care to protect public welfare and report unethical practices if necessary.

1.3.6 Conduct Practice Towards Other Professionals with Courtesy

An EPs behaviour toward employers and clients sets an example and demonstrates the quality of their professional brand. Environmental Professionals must interact with other professionals with courtesy and good faith. For example, when an EP is administering a contract on behalf of a client or employer, they should act with fairness and justice to all parties including fellow professionals.

When providing services to a client, EPs should consider themselves as part of the client's organization or team. The foundation of an EP-client relationship involves the EPs duty of care for a client's interests, which should not supersede the EPs duties to protect public safety and other duties that may conflict with a client's interests. EPs should put their client's interests before their personal biases and act towards other professionals with respect and accountability.

The relationships of EPs with their business associates should be friendly and independent and free from obligating favours.

EPs are expected to have proper regard for all individuals. They must not violate the human rights of others and must not discriminate based on race, religion, sex, or disability.

EPs should take responsibility and precautions not to injure the professional reputation of another EP or person through troublesome or frivolous statements.

1.3.7 Provide High Quality Services

Environmental Professionals must provide high quality services in a timely manner. EPs have an obligation to their client that the project and the project deliverables are completed not only to the best of their ability, but also meet the contract requirements while keeping public interest in mind. Providing timely service does not mean doing a fast job, it means being efficient and effective in addressing concerns in timely manner. Providing efficient customer service is part of the EP designation gaining a positive reputation in the environmental sector.

In addition, Environmental Professionals have an obligation to their clients to provide timely notifications and advise their clients when they believe a project will not be successful or will not meet the original agreed upon timelines.

1.3.8 Abide by the Law, Regulatory Guidelines and Policies

Environmental Professionals must abide by the law, regulatory guidelines and policies and ensure that personal actions respect the environment and environmental laws. EPs shall determine which environmental laws, if any, apply to the activity they are undertaking early in the project’s timeline; this due diligence investigation will ensure compliance with applicable municipal, provincial, or federal environmental laws.

EPs should consider consulting with municipal, provincial, and federal authorities at the project scoping and planning stage. It is intended that this guidance will be applied regardless of the size of the activity or project. Some projects will require a full environmental impact assessment and other projects will require thought and planning to minimize environmental disruption even if disruption appears to be minor.

Environmental legislation can place responsibility for environmental impairment on an individual. In such cases, if the individual took all reasonable measures to prevent the offence, then they can demonstrate that they exercised their due diligence. The basis for judging these measures for an EP should be determined by evaluating their standard practice and their efforts to meet any legislation, approval, or order relating to the project in question.

Furthermore, in recent Canadian environmental legislation, an individual can be considered party to an offence if the individual was complicit in the commission of the offence. To ensure that their personal and professional actions comply with environmental laws, Environmental Professionals should abide by the following principles:

1. Environmental Professionals shall develop and maintain knowledge and understanding of legislation, regulations, approvals, codes, and guidelines; their purposes and limitations; and any changes to these requirements. EPs must also apply these requirements both on a procedural and substantive basis.

   Environmental Professionals must:
   - Ensure that proper documentation of adherence to environmental procedures, protocols, and regulations is maintained, and that relevant information is provided to regulatory agencies in a timely manner.
   - Have regard for both the reality and the trend of environmental legislation to assign personal responsibility for both action and omission. EPs shall reflect this reality in their professional duties accordingly as it relates to themselves, their employer, colleagues, and clients.
   - Exceed the standards and regulatory requirements to protect the health and well-being of the environment and the public. EPs are encouraged to collect evidence of cumulative, persistent, and synergistic environmental effects where they may not be fully considered in standards or regulations.

2. Environmental Professionals shall disclose, accurately represent, and provide information concerning environmental effects to regulatory authorities, including:
   - Informing public regulatory authorities on all environmental effects of any assignment they are involved in through the normal regulatory review and approval process.
   - Maintaining client and employer confidentiality unless otherwise required by relevant legislation, approvals, or orders. Where any confidential information is disclosed to

public authorities, EPs shall advise their employers and clients of such disclosure as soon as practicable.

Environmental Professionals shall ensure that appropriate action or notification of proper authorities occurs when they believe that public safety or the environment is endangered, or when required by relevant legislation, approvals, or orders.

1.3.9 Communicate Respectfully

Environmental Professionals will need to communicate with many different stakeholders and represent themselves, their organization, their client, the public and the EP profession. EPs must communicate respectfully to all parties. Respectful communication means having the ability to effectively convey their own views and fully listen to the views of others. When there is a disagreement or a difference of opinion, the objective should be on healthy discussions. An EP should be open to dialogue, to share their insights and collaborate using the strengths of different contributors to achieve the common goal.

An EP understands that the way they communicate with others is a reflection not only on themselves, but also on the EP designation and profession.

1.3.10 Be Mandate-Oriented – Follow Policy, Behave Ethically

The daily actions of Environmental Professionals affect the public's trust in the profession and the public's perception of an EPs ability to handle increasing public expectations, specialization and complexity, and multiple constituents or stakeholders. If EPs are aware of and consciously consider these issues, they can address them better.

Environmental Professionals must, therefore, manage expectations. EPs must inform clients of their professional responsibilities and the legal, ethical, and practical limitations of the service provided. EPs could provide this information through general documents (i.e., practice standards or guidelines), through targeted campaigns, or more specifically within service contracts and company information.

EPs are leaders in organizations and on projects. They must be vigilant in areas beyond their direct professional responsibility. EPs are obligated to report conditions or changing circumstances that present a material, immediate threat to safety, health, welfare, or the environment in either the workplace or on the project site. EPs must report these conditions first to those professionals who are responsible; if a satisfactory response is not forthcoming then the EP must report it to the appropriate corporate or regulatory authorities.

Note: This facet is aimed at informing responsible professionals about unknown or changing circumstances that require action or response. It does not empower those not involved directly in the decision to challenge, without all the facts, the environmental judgements, or recommendations of those who are responsible.

1.4 Ethical and Moral Standards

EPs are counted on for their expertise related to environmental issues and concerns. Because much of their work has a direct impact on public health and safety and the future of the environment, it is important that they are bound to an ethical code where objectivity can be ensured and where they conduct themselves with full integrity and serve in the interest of public health and safety and the environment. EPs need to act as advocates for those who cannot advocate for themselves.

Environmental Professionals must:

- Conduct all professional practice honestly and with integrity
- Present facts accurately and seek understanding
- Maintain integrity
- Retain objectivity and respect for other opinions
- Remain transparent and declare conflicts of interest
- Uphold ethical environmental requirements and practices
- Protect vulnerable sectors of the population

1.4.1 Conduct all Professional Practice Honestly and with Integrity

Environmental Professionals must conduct their professional practice honestly and with integrity, fairly, and in good faith with due care to the public and the environment. EPs should recognize how their activities and professional membership can influence society. They should recognize the value of early involvement and action versus reaction.

EPs are encouraged to share their expertise and knowledge on environmental issues with other members, governments, and the public. In working with other disciplines, EPs can help bring theoretical and technological research into applied practice.

EPs can encourage professionalism through mentoring and demonstrating their professional behaviour. In groups, EPs can encourage professionalism by being involved in environmental, technical, or professional areas and by promoting corporate professional responsibility.

Environmental Professionals should not attach their professional self to activism. EPs have a right to make political contributions, but they also have a duty under the EP Code of Ethics to avoid acting in a manner that impacts their professional stature. Their professional reputation may be damaged or exposed, or their intentions misunderstood.

1.4.2 Present Facts Accurately and Seek Understanding

Environmental Professionals must present facts honestly and accurately and speak directly and plainly to ensure that the recipients understand. EPs should clearly distinguish between facts, assumptions, and opinions in their professional work, in public discussion, or in published articles related to their

professional work. They should, when expressing opinions or taking part in public discussion on professional matters, clearly disclose on whose behalf they are giving opinions or statements.

EPs should express opinions on environmental matters that only present their knowledge, experience, and honest conviction. EPs should ensure, to the best of their ability, that any statements related to environmental matters accurately reflect their professional opinion.

Advertisements, proposals, presentations, and other solicitations for professional engagement should be factual, clear, and dignified, as well as complement the EP image and enhance the stature of the profession.

In contrast, some behaviors damage an EPs image and professional reputation. Some examples include:

- Exaggerating project involvement, experience, or level of expertise
- Negatively comparing or commenting on competing professionals
- Suggesting or implying solutions not duly founded in fact
- Making misleading claims, self-praising language, and sensationalism that diminish the dignity of the individual and, by association, the dignity of the entire profession

Environmental Professionals hold expertise pertaining to environmental practices in both competence and ethical matters. This expertise offers a reliable resource to industry and the public.

1.4.3 Maintain Integrity

Environmental Professionals should undertake assignments only when they are competent to complete the work. This rule does not prevent EPs from tackling new challenges and learning new skills, provided that the successful completion of the assignment is not jeopardized, and honesty is maintained with the client or employer. Similarly, EPs should not overlook the fact that today's environmental sector demands specialized knowledge.

Most importantly, EPs should regularly review their own and their organization's capabilities to provide specific services to the public. Many proven specialty companies are available to help when required; however, if specialized help is needed, EPs should evaluate the company's credentials. This due diligence is particularly important when a lack of capability could result in adverse consequences. When sub-consultant expertise is retained, it should be with the client's approval.

An EP shall not take credit for work done by others. An EP shall also take responsibility for their own work through authorship or acknowledgement. EPs should not allow their name to be associated with work that has been altered.

1.4.4 Maintain Objectivity and Respect for Other Opinions

Environmental Professionals should faithfully perform their duties and responsibilities to their clients and employers and always act with fairness and justice to all. EPs must maintain objectivity and have respect for the opinions of others, even if facing emotionally driven issues.

To maintain objectivity and respect for another's point of view, EPs must:

- Express the results of their work clearly and accurately
- Qualify the results, if necessary, when a matter is only partially resolved
- Avoid bias due to political, economic, or other non-technical factors

In both corporate and societal settings, EPs should focus their discussion on the facts of an issue and accurately represent their professional opinions. When presenting complex issues to a non-environmental or technical audience, EPs are encouraged to use plain language principles and simplify their discussion without losing the critical elements ensuring that their audience understands; this communication approach avoids misinterpretation or misunderstanding.

Although this subsection is not meant to dissuade an EP from stating their personal or political interests, they should consider that their personal views may differ from their professional practice and obligations. EPs must present and rely on facts when expressing professional opinions.

1.4.5 Remain Transparent and Declare Conflicts of Interest

Environmental Professionals must remain transparent and avoid and declare conflicts of interest. An EP will hold the interests of their clients or employers in high regard; however, some of an EP's duties take precedence over the interests of the professional's client or employer. These duties include:

- The duty to protect the safety of the environment and public.
- The duty to act fairly and justly to all parties when administering a contract on behalf of a client or employer.

As stated previously in this document, two of the primary objectives of the EP designation is to protect the public and to maintain professional integrity. These objectives are achieved through careful examination of each member in the Environmental Professional designation. For an EP to maintain professional integrity, they must be transparent in their intentions and actions. EPs should make provisions so that clients and employees under their responsibility have knowledge of and comply with the laws affecting their work.

An EP must disclose any influence, interest, or relationship that impairs or affects their professional judgement or objectivity. Failure to disclose any real, perceived, or potential conflict situation with an employer, a client or a stakeholder is a conflict of interest.

Under normal circumstances and before accepting assignments, EPs should inform their clients and their employers of any special interests, business connections, personal relationships, conflicts of interest, or other circumstances that could influence their professional services or judgement. They should never offer or accept any covert payment or benefits.

1.4.6 Uphold Ethical Environmental Requirements and Practices

Environmental Professionals must uphold ethical environmental requirements and practices. When an EP becomes aware of public concerns related to an assignment they are involved in, the nature of the concern should be investigated in a timely manner. Once they have determined the validity of the concern, the EP should promptly communicate the information through the normal lines of responsibility.

EPs are encouraged to seek a second opinion (professional or specialist) on the technical validity of their conclusions whenever possible and particularly when there appears to be a difference of opinion with the other responsible parties regarding environmental effects.

In disclosing information about environmental effects, EPs should communicate the information through normal lines of responsibility. Where, in the opinion of the EP, the withholding of confidential information poses a potential threat to the environment, they should make reasonable effort to contact responsible parties before disclosing the information to the proper regulatory authority. EPs must recognize, however, their individual responsibilities for reporting threats to the environment in accordance with legislation requirements.

There are many legal uncertainties with respect to the disclosure of confidential business information or intellectual property when an EP is involved in the design or supervision of a project that may pose a threat to the public. This situation may present a dilemma to the EP; the EP must remember that it is their responsibility to protect the well-being and safety of the public. This responsibility may conflict with their duty to a client or their employer to act as a loyal agent and not disclose, without consent, confidential information concerning the client’s or employer’s business affairs, technical methods, or processes. Since duty to the public is paramount, an EP in such conflict must advise the employer or client, preferably in writing, of a concern regarding the material threat to the public. If the concern is ignored or overruled and the client or employer continues to follow a course of action that is harmful, the EP should inform their employer or client that they are ethically bound to present the concern to the appropriate authorities and may perhaps even disassociate themselves from the project.

Environmental Professionals must not disclose their employer's or client's confidential information gained during the term of employment (except as required by law). If the EP feels that withholding confidential information jeopardizes public safety, then they should make every effort to contact all parties before they disclose this information to the proper authority.

1.4.7 Protect Vulnerable Sectors of the Population

Environmental Professionals must protect the vulnerable sectors of the population. They must recognize the importance of social and economic values in the environmental assessment process and consider local, neighbourhood, Traditional, and cultural criteria through stakeholder involvement.

Understanding the vulnerability of a group requires more than just analyzing the direct impacts the

stakeholders project may have on an economic, social, cultural, institutional, political, or psychological level. EPs should address the effects on the human rights and the environment of the group and assess any future considerations, which may include hazards, natural or otherwise, on a larger scale.

EPs are responsible in developing a protection plan if the projects they are working on will in any way affect a vulnerable group. In addition, an EP shall immediately advise their employer or client of any concerning potential adverse effects within a vulnerable group; these concerns can arise from the work an EP is directly involved in or from information they discover through the project(s) on a peripheral level. If they do not receive a prompt response from their employer, client or both their employer and client, then the EP must escalate the situation to appropriate representatives. For example, an EP may need to report on the potential conflict between Indigenous communities and the environmental management of their land.

1.5 Confidentiality

Environmental Professionals hold in strict confidence, except as required by law, all information they acquire during their professional relationships and do not use this information for personal gain.

EPs must both safeguard confidential information and understand and respect contractual obligations.

1.5.1 Safeguard Confidential Information

Environmental Professionals should keep all information acquired during their professional duties confidential including business affairs of present or past clients or employers. This obligation of confidentiality ends if the information legally enters the public domain. EPs must not use client or employer confidential information for personal gain. Confidential information is proprietary and only given to an EP to appraise a situation for a specific project.

Process information and all confidential information received during professional service is the exclusive property of its owner and only disclosed to others with the owner's approval. Care should be taken regarding trade practices that may be unique and practices that identify the owner's special attributes.

When applicable Environmental Professionals must:

- ***Disclose confidential information to legal authorities****.* Confidential information may be disclosed if the client or employer or both give permission or if disclosure is required by law. If disclosure of confidential information is required by law, it should be made only to the extent required by law. Present or past clients or employers should be advised of such disclosure as soon as possible. Under certain circumstances, an EP should understand that withholding information is contrary to the safety of the public. As a result, the EP should disclose to appropriate authorities only that information necessary to protect public safety.

- ***Maintain confidentiality when approached by two or more competing parties***. When a consulting EP is approached by a second client to work on a program where they have already worked for another client, or when an EP is approached separately by two parties competing on a proposed project, the EP must maintain confidentiality. Even to disclose to the second client that another client is actively considering a job or project would reveal competitive information about the original client. In such cases, the EP should use their professional judgement to decide if the second assignment can be fulfilled using their general professional knowledge, without being influenced by the first assignment. If there is a significant risk of influence by the first assignment or disclosure of proprietary information of the first client, the EP should decline the assignment without disclosing the interest of the first client.

- ***Ensure client consent before using and distributing material.*** The client maintains the exclusive rights and ownership of published content and designs. The EP must not duplicate published content or designs for others without the permission of the client.

- ***Request permission to apply confidential information in new works.*** If projects that EPs are working on or clients that they are working for require using confidential knowledge obtained through other projects, the EP can proceed only with the consent of all parties connected with the prior confidential information or projects.

Technical knowledge gained by an EP through work experience may be freely used in subsequent projects without consent from other parties.

1.5.2 Respect Contractual Obligations

An Environmental Professional must understand and respect contractual obligations. When an EP agrees to the terms and signs a contract, they are responsible for the agreed upon deliverables and timelines. Understanding the obligations and responsibilities of a contract will help EPs perform their duties, understand what to do when unexpected or legal issues arise, and if necessary, renegotiate the terms of the contract.

EPs should spend sufficient time on-the-job to ensure that their direction, reports, and estimates reflect actual site conditions and progress.

An EP can expect and should agree with their client that all the relevant information regarding the project will be provided either before the contract is signed or during the project.

A client may oversee the progress of a project and perhaps may even have a preference for a particular solution or a specific outcome; however, if a client tries to influence the results in a direction that doesn’t match scientific data or tries to influence the outcome of the project in a way that the EP doesn’t agree with then the EP should communicate the events that took place to both the client and

employer. The EP must communicate their ethical obligation to report illegal activities or practices even if under contract.

Environmental Professionals must also try to negotiate terms in their contracts that would be beneficial to public good.

Section B:
Core Enabling Competencies

Core enabling competencies, also referred to as transferable competencies, describe the behaviours or essential skills that contribute to the successful performance of technical tasks. Environmental Professionals can apply these skills in many roles because they relate to how the job is accomplished.

The National Occupational Standards (NOS) for Environmental Employment sort these transferable competencies into the following categories (i.e., clusters):

- Professional ethics and conduct
- Continuous learning and creativity
- Effective communication
- Collaboration
- Mentorship
- Leadership
- Critical thinking
- Project management
- Quality assurance and control
- Business acumen

2.1 Professional Ethics and Conduct

Environmental Professionals with the core competencies found in the professional ethics and conduct category will:

- Demonstrate professional and ethical conduct at work, including trust, integrity, confidentiality, and discretion
- Demonstrate objectivity, transparency and independence when gathering, interpreting, and reporting information
- Exemplify dependability by consistently following through on one's commitments
- Demonstrate self-reliance, motivation, commitment, and a strong work ethic in professional activities
- Exhibit flexibility, tenacity, and resourcefulness in dealing with unusual or unexpected circumstances
- Cooperate willingly with others in dealing with changing situations, conditions, and expectations
- Balance the need for 'attention to detail' with a focus on goals and objectives to achieve the desired outcomes
- Show respect for the values and opinions of others
- Take initiative and deals appropriately with new or changing situations and circumstances

- Have empathy and concern for others

2.2 Continuous Learning and Creativity

Environmental Professionals with the core competencies found in the continuous learning and creativity category will:

- Stay current on the theory and practice pertinent to one's roles and responsibilities
- Integrate relevant information from a variety of sources
- Participate in professional development activities to stay current in the field
- Recognize the limits of one's competence
- Generate creative approaches to solving problems, where appropriate
- Demonstrate an awareness of the implications of new information
- Evaluate solutions to problems to identify lessons learned
- Provide a realistic and objective assessment of own performance
- Make effective use of technology

2.3 Effective Communication

Environmental Professionals with the skills found in the effective communication category will:

- Write clear and well-organized documents that meet established protocols and are appropriate for the target audience
- Present information in a logical and structured fashion
- Communicate clearly and respectfully using verbal and nonverbal language appropriate to the cultural and social context
- Use effective interviewing techniques, including listening attentively, asking appropriate and respectful questions, and asking for clarification to elicit accurate and complete information
- Convey technical information accurately, clearly, and concisely, interpreting it appropriately and effectively for the target audience
- Use appropriate content and format of presentations to address the specific needs of the target audience
- Listen attentively to the inquiry, asking questions if necessary to identify the underlying concern
- Ensure that the information conveyed is understood and useful

2.4 Collaboration

Environmental Professionals with the core competencies found in the collaboration category will:

- Build professional networks inside and outside the organization to achieve desired results
- Develop strong relationships with team members enabling open communication and maximizing individual and team potential
- Collaborate effectively with others in teams to achieve desired results

- Work cooperatively with multiple stakeholders, showing willingness to consider alternative approaches or ideas
- Deal effectively with conflict, showing diplomacy, empathy, and consideration of different points of view
- Engage clients, staff, and stakeholders in the consultative process as appropriate

2.5 Mentorship

Environmental Professionals with the core competencies found in the mentorship category will:

- Act as a resource by sharing information with others
- Identify the strengths and areas of improvement for others
- Provide others with resources and opportunities to advance their professional development
- Help others to network effectively in the organization
- Facilitate personal development of others by listening, encouraging, supporting, and helping set goals
- Serve as a role model for others by consistently demonstrating integrity and professional values
- Hold others accountable for their professional obligations

2.6 Leadership

Environmental Professionals with the necessary leadership skills identified in this category will:

- Manage the work of others, including project teams, working groups and contractors
- Build commitment to team's vision, goals, roles, responsibilities, and processes
- Remove barriers to individual, team and project performance
- Identify the individual and team competencies that are required to accomplish objectives and deliverables
- Mentor others to improve their technical competence and help in their on-going professional development
- Create an environment that promotes innovation, creativity, and entrepreneurial thinking within the organization
- Navigate effectively through political and organizational complexities to avoid or overcome potential barriers to successful completion

2.7 Critical Thinking

Environmental Professionals with the critical thinking skills found in this category will:

- Carry out independent research to collect information pertinent to the area of inquiry
- Carry out work with due diligence and sound judgement
- Perform an objective and thorough analysis of information from multiple sources
- Distinguish between facts, inferences, biases, and assumptions to establish the quality of the information collected and the reliability of its source

- Apply suitable theoretical concepts when analyzing large volumes of information
- Apply structured reasoning to identify meaningful patterns in the information
- Extract key information for evaluation purposes
- Process information in a logical and timely manner
- Investigate conflicting information to determine which information to use
- Make decisions in a timely manner. Commits to a course of action after considering pertinent information, options, and implications
- Consider potential risks when making decisions
- Consider "a big picture" when making decisions

2.8 Project Management

Environmental Professionals with the project management skills identified in this category will:

- Use information communication technologies to manage work and increase its efficiency
- Manage multiple priorities by selecting and applying time management and project management tools and approaches
- Develop work plans that identify the work to be accomplished, the risks and contingencies that may arise, and the ways to address them
- Manage resources, including financial and material resources, needed to implement work plans and achieve desired results
- Engage in planning of contracting and procurement services for major projects
- Employ systematic approaches and tools to manage work activities and deliver results on time

2.9 Quality Assurance and Control

Environmental Professionals with the skills identified in quality assurance and control category will:

- Maintain an active awareness of the physical environment at work and safety hazards
- Conduct professional activities safely and in accordance with regulatory and local site health and safety requirements
- Apply the principles of quality assurance and scientific rigour in all professional activities
- Participate in continuous improvement activities through information sharing

2.10 Business Acumen

Environmental Professionals with the business acumen skills identified in this category will:

- Analyze relevant business trends, financial measures, economic factors, and new regulations to understand their impact on the organization
- Recognize business threats and opportunities that may affect the business and recommend actions to address them

- Identity clients stated and underlying needs, and professional activities that will best address these needs
- Translate the organization's vision and goals into relevant plans and actions, realigning work efforts with changes in organizational direction
- Drive the implementation of changes while monitoring their impact on organizational performance

Section C
Core Knowledge Areas

Environmental Professionals not only require technical knowledge specific to their area(s) of environmental practice, but also must share a broad knowledge of the environment and environmental issues. Section C, **Core Knowledge Areas** presents the knowledge areas integral to the success of the Environmental Professional.

The Environmental Professional's awareness and understanding of these core knowledge areas will enable them to:

- Appreciate, understand, and develop social, economic, and environmental interactions
- Gain an understanding of applicable legislative requirements
- Understand applicable technical requirements
- Assess and manage project impacts
- Manage and effectively communicate results
- Foster and manage professional relationships

This section includes relevant terms and definitions and an overview each core knowledge area. The concepts presented in each subsection build on the detail provided in previous sections. The core knowledge areas presented include:

1. **Social, Economic and Environmental Interactions.** This section emphasizes the interdependency between societies, the economy, and the environment – this concept is called sustainability. The Canadian context is presented as it relates to climate change adaptation and resilience, energy, and natural resources.
2. **Environmental Regulatory Framework**. This section discusses Canadian policy and guidance, legislative and case law, and federal, provincial, and municipal jurisdictions.
3. **Technical Guidelines**. This section presents technical guidelines for data collection, management and analysis, and the tools available for the environmental industry.
4. **Impact Management.** This section discusses the management of environmental, social, and economic impacts resulting from human development including cumulative impact assessment, environmental and impact assessment legislation and framework, and significance.
5. **Results Management**. This section refers to the interpretation, presentation and communication of environmental scientific data including identifying the audience and other communication considerations.

6. **Relationship Management.** From an environmental perspective, this section references the Duty to Consult, Section 35 of the Constitution Act, Indigenous People and Communities, and discusses the value of Traditional Knowledge, stakeholder identification and public consultation.

Table 1 defines the core terms used throughout this section.

Table 1: Core Terms for the Environmental Professional

CORE TERM	DEFINITION
CLIMATE ADAPTATION	Within the context of climate change, adaptation is the action of creating opportunities by adjusting policies and actions based on actual or expected changes in climate. Adaptation can be reactive, acting in response to climate impacts; or proactive, whereby measures are put in place before the impacts are observed.
CLIMATE RESILIENCE	The ability of the socio-economic system to anticipate, prepare for, recover, and adapt from significant impacts brought on by climate change. By identifying climate risks and vulnerabilities, adaptations may improve the sustainability of the system, enhancing resilience for future climate change impacts.
CORPORATE SOCIAL RESPONSIBILITY	The responsibility of an organization for the impacts of its decisions and activities on society and the environment through transparent and ethical behavior.
CUMULATIVE EFFECTS	Cumulative effects are changes to environmental, social, and economic values caused by the combined effect of past, present, and potential future human activities and natural processes.
ECOSYSTEM AND ECOSYSTEM COMPONENTS	An ecosystem is an interactive system of living organisms (biotic components are living components) in conjunction with non-living components (abiotic, such as minerals, soil, water, soil, and sunlight) of their environment.
ENVIRONMENTAL ASSESSMENT	A planning and decision-making tool that forecasts environmental effects of planned initiatives or projects before they are carried out. Environmental Assessment may also be referred to as Impact Assessment.
ENVIRONMENTAL AUDIT	An environmental audit is a detailed analysis of an organizations' products, activities, and processes to evaluate its performance from an environmental perspective.
ENVIRONMENTAL HEALTH AND SAFETY	A plan that ensures the environment is protected from the actions of an organization and people are protected from their work environment.
ENVIRONMENTAL IMPACT	An impact characterized by a change to the environment, or an ecosystem based on activities, products or services of people and businesses. Environmental impacts can result in either a detrimental or beneficial outcome. This term may also be referred to as an Environmental Effect.

Table 1: Core Terms for the Environmental Professional

CORE TERM	DEFINITION
ENVIRONMENTAL INSPECTION	All actions undertaken by or on behalf of an authority to check and promote compliance of installations with their permit conditions and, where necessary, to monitor their environmental impact.
ENVIRONMENTAL MANAGEMENT	Environmental management is the goal of achieving and demonstrating sound environmental performance by controlling the impacts, activities, products, and services on the environment. Through the integration of ecology, policy making, planning and social development, environmental management is an approach towards environmental sustainability.
ENVIRONMENTAL PROTECTION	A practice that involves the protection of the natural and social environments by individuals, organizations, and governments. Its goal is to conserve natural resources as well as the existing natural environment and provide social safeguards through construction and operation. If possible, this protection includes repairing damages done and reversing negative trends.
ENVIRONMENTAL RISK	Actual or potential threat of adverse effects on the environment because of human and non-human activities.
ENVIRONMENTAL SITE ASSESSMENT	A process that involves the study of a property to understand if any potential or actual contaminants are present, and if present, their location and concentration.
ENVIRONMENTAL STANDARDS	These standards are set by governments as administrative regulations that have been put in place for the treatment and maintenance of the environment.
LEGISLATION	A law that has been enacted by a governing body or the process of making it. Legislative items begin as a bill before they are administered as law.
MITIGATION MEASURES	Mitigation measures prevent, reduce, or control adverse environmental effects. Mitigation measures are chosen proportional to the potential harm. The Environmental Assessment/Impact Assessment determination considers both the positive and negative consequences before and after implementation of recommended mitigation measures. It also assesses the moral implications for both action and inaction.
NON-RENEWABLE ENERGY	Sources of finite energy that do not replenish readily and as a result cannot keep up at the rate of consumption.
POLLUTANT	A substance or energy that when introduced into the environment, produced undesired effects, or adversely affects the usefulness of a resource.
PRECAUTIONARY PRINCIPLE	A strategy that manages potential risks and impacts where scientific understanding is incomplete. In an environmental context, when an identified impact or irreversible damage to the environment exists, a lack of scientific knowledge should not be used to delay remedial effects.

Table 1: Core Terms for the Environmental Professional

CORE TERM	DEFINITION
REGULATION	A rule or directive made and maintained by an authority to enforce primary legislation. Typically drafted by subject-matter experts, regulations stipulate the delegated legislation.
RENEWABLE ENERGY	Energy sources that cannot be depleted and can replenish readily at the rate they are consumed.
SIGNIFICANCE	Significance is the importance, desirability, and acceptability of environmental effects or the degrees of importance for environmental factors.
STAKEHOLDER	Individuals or groups who may have a direct or indirect interest in the project.
STATUTE	A written law passed by a legislative body. They are publicly debated by the federal parliament or provincial legislatures and voted upon before becoming law. Statutes state the broad principles or rules that govern our lives.
SUSTAINABILITY	A goal that meets the needs of the present without compromising the ability of future generation to meet their own needs. Sustainability considers the natural environment, the social environment, and economic factors.
TRADITIONAL KNOWLEDGE	Collective knowledge that is holistic, dynamic, and intergenerational know-how, linked to experience on traditional lands. This knowledge is often oral, and experiential and may not consist of a written text.

3.1 Social, Economic and Environmental Interactions

The study of the environment on its own is relatively new, with terms like “environmental studies” and “environmental science” being absent from our language until the 1970s. The book Silent Spring, by Rachel Carson, published in 1962, documented the adverse environmental effects caused by the indiscriminate use of pesticides. Carson’s book is often cited as a key event in the raising of environmental concerns within the public eye.

Today, we understand that there is an interdependency between society, the economy, and the environment; this concept is often referred to as sustainability. These interdependent relationships exist across both time and space – past, present, and future are all connected. This concept of interdependence can be described as the Seventh Generation Principle in which “the decisions we make today should result in a sustainable world seven generations into the future” (ICTINC, 2020). The Seventh Generation Principle is generally referenced regarding decisions being made about energy, water, and natural resources.

Environmental Professionals must appreciate and understand social, economic, and environmental interactions and their interdependencies. This interdependency emphasizes sustainability in the Canadian context as it relates to climate change adaptation and resilience, energy, and natural resources.

3.1.1 Adaptation and Resiliency

Climate change is an example of the interdependency between society, the economy, and the environment. Greenhouse gas, although generated in natural processes, has seen exponential increases in emissions because of society's dependence on industrial processes, fossil fuels and other economic drivers. The increased greenhouse gas and resulting climatic effects are having societal impacts worldwide. For example, climate change has the potential to impact water supplies, agricultural production, human health, and our energy infrastructure (Government of Canada, 2018). In Canada, these impacts have manifested as rising temperatures, eroding coastlines, severe droughts, floods, and wildfires (Government of Canada, 2018). Canada further recognizes that climate change poses significant risks to the health and well-being of the economy and communities, and the natural environment (Government of Canada, 2018).

3.1.1.1 Climate Change Resilience and Adaptation

Climate change is a natural process, but the rate that human activity has accelerated this change in climate is cause for concern. The World Health Organization has identified climate change as the greatest threat to global health in the 21st century (Government of Canada, 2018). Some climate change is inevitable, even after significant greenhouse gas reduction measures have been implemented; therefore, humans need to determine appropriate adaptation measures moving forward. Climate change impacts are forecasted to affect Canadian communities at the economic, social, and environmental scale (Canada, 2015). To reduce negative impacts, Canadians will have to adapt to maintain and enhance existing and new infrastructure.

Climate change adaptation creates opportunities to mitigate risk to vulnerable infrastructure and complex systems by adjusting policies and actions based on observed or expected changes in the climate. Adaptation can be reactive, acting in response to climate impacts, or proactive, whereby measures are introduced before the impacts are observed (Canada, 2015). Anticipatory adaptions and proactive actions, rather than a reactionary approach, are favored because of lower long-term costs and greater effectiveness.

The ability to prepare, recover and adapt from significant impacts brought on by climate change is better understood as climate resilience (C2ES, 2019). Climate resilience is a measured ability to absorb the impacts caused by climate change (C2ES, 2019). It focuses on addressing vulnerable communities, states and countries that are susceptible to the effects of climate change.

Adaptation is a long-term challenge that aims to help protect Canadians from climate change risk, builds resilience, reduces costs, and enables a society to thrive in a changing climate (Government of Canada,

2016). Federal, provincial, and territorial governments have identified actions targeted to build resilience to climate change in the following areas (Government of Canada, 2016):

- Translating scientific information and Traditional Knowledge into action
- Building climate resilience through infrastructure
- Protecting and improving human health and well-being
- Supporting particularly vulnerable regions
- Reducing climate-related hazards and disaster risks

3.1.2 Energy

In Canada, the energy sector accounts for over 10% of nominal gross domestic product (GDP) bringing in $14.1 billion of revenue in 2017 (Natural Resources Canada, 2020). Canada is the sixth largest energy producer in the world; it has one of the most diverse supplies of energy including oil and gas, hydroelectricity, solar, wind and other renewables. Canada has the third largest supply of oil and uranium reserves globally and provides 7% of the world's renewable energy through hydroelectricity (Natural Resources Canada, 2020). Although the United States accounts for 89% of Canada's energy exports, Canada is the fourth largest net energy exporter, exporting its energy products to 148 countries.

Environmental Professionals should be aware of the types of non-renewable and renewable energy sources, their histories, regulatory requirements and their associated impacts and benefits to society and the environment. These energy sources are highlighted in the following sections.

3.1.2.1 Non-Renewable Energy – Types

Petroleum has been Canada's major energy source since its commercial exploitation in the 1850s (Cope, 2015). Found in the Earth's crust, petroleum is a hydrocarbon that is composed of complex hydrogen and carbon compounds. Coal can be distinguished as solid fossilized hydrocarbons that have a high carbon content, while petroleum can take on a more viscous form (referred to as bitumen) or in a liquid and gaseous forms such as crude oil and natural gas (Cope, 2015).

The oil and gas industries in Canada operate through stringent regulations from federal, provincial, and territorial regulations. These regulations allow the activities of these industries to be monitored. The industries must provide data to ensure regulatory conditions are met and operations are able to improve (CAPP, 2019). In June 2019 Bill C-69 was passed, which allowed the overhaul of the National Energy Board Act (NEBA) and the Canadian Environmental Assessment Agency (CEAA). This legislation, "The Modernization of the National Energy Board and Canadian Environmental Assessment Agency," changed how major infrastructure projects are reviewed and approved in Canada. As a result, a new agency, the Canada Energy Regulator (CER), now reviews major energy projects.

Several provinces have their own regulations that must be followed when considering energy projects. In Alberta, the Alberta Energy Regulator (AER) accounts for application and exploration, construction and development, abandonment, reclamation, and remediation (CAPP, 2019). This agency was established in 2013 to ensure that public safety, environmental management, and landowner rights are aligned with the energy industry's efficiency and competitiveness (CAPP, 2019). British Columbia is another province that has their own regulatory measures through the B.C. Oil and Gas Commission (BCOGC). This agency reviews applications for drilling, hydraulic fracturing, and water management along with other developments (CAPP, 2019).

Crude Oil

One hundred and sixty-five billion barrels of the 170 billion barrels of Canadian oil are found in Alberta's oil sands with other substantial deposits found on Canada's Atlantic coast (CAPP, 2019). Shale oil is extracted by a combination of drilling and multi-stage hydraulic fracturing; crude oil is specifically attained by means of exploration, drilling, field processing, storing, and transporting (Natural Resources Canada, 2020). To support the crude oil industry, Canada has an extensive pipeline network, spanning 840,000 km, supplying an estimated 3.8 million barrels of crude oil per day to domestic and US refineries (Natural Resources Canada, 2020).

Natural Gas

Canada's reserves of natural gas are located primarily in Alberta (69%) and British Columbia (29%). Canada's supply of natural gas is projected to meet its domestic needs as well as the needs for projected future exports for the next 300 years (CAPP, 2019). The natural gas industry can be separated into upstream, midstream, and downstream industries. Upstream gas industries explore, drill, and produce raw natural gas. The midstream natural gas industry operates plants that remove impurities, provides natural gas storage facilities, and gather pipelines. The downstream natural gas industry receives natural gas from pipelines and distributes it to consumers through networks of pipelines (Natural Resources Canada, 2020).

Coal

Coal is notably Canada's most abundant fossil fuel, primarily supporting steel production and power generation. Canada produces 6.6 billion tonnes of coal annually; over 90% of Canada's coal reserves are in the western provinces, with small deposits found in Nova Scotia (CAPP, 2019). An organically based material, coal is formed through decaying plant material compressed over millions of years (Natural Resources Canada, 2020). In 2016, coal made up 26.5% of the world's energy supply, and in 2018 coal production saw an estimated 7.8 billion tons globally (Natural Resources Canada, 2020). Nine percent (9%) of Canada's electricity generation comes from coal. Canada is aiming to reduce this dependency and eliminate coal-fired electricity by 2030 curbing greenhouse gas (GHG) emissions and maintaining its use only for metallurgical processes (Natural Resources Canada, 2020).

Nuclear

Since the early 1960s, nuclear power has provided Canada with commercial electricity. Having four power stations across the country, three in Ontario and one in New Brunswick, nuclear energy generates 15% of the nation's electricity (CAPP, 2019). In 2018, Canada exported 78% of its uranium production throughout the world (Natural Resources Canada, 2020). The mining, refining and fuel fabrication for nuclear power is located in Ontario and Saskatchewan. Although not a renewable energy source, nuclear power does not emit any greenhouse gases. Nuclear power is under Canada's nuclear non-proliferation policy and can only be used for peaceful purposes (Natural Resources Canada, 2020). Disposal of nuclear waste is, however, challenging and is a project undertaken at a national scale.

3.1.2.2 Non-Renewable Energy – Environmental Impacts

The need for renewable energy comes in-part from the finite nature of non-renewable resources, as well as a need for more sustainable forms of energy development. Burning coal and natural gas (fossil fuel) and using diesel and heavy fuels (petroleum-based fuels) has contributed greatly to Canada's air pollution and global greenhouse gas levels. Additional environmental impacts from using non-renewable sources of energy and the burning of fossil fuels include:

- Acid rain and smog from sulphur oxides, nitrogen oxides, particulate matter, and mercury pollutants
- Harm to water quality, biodiversity, and species' habitants from oil spills
- Perpetuating climate change by emitting large amounts of greenhouse gases (Government of Canada, 2019)

Some specific environmental impacts associated with non-renewable energy are included in the following subsections.

Greenhous Gas Emissions

Greenhouse gas (GHG) emissions are those composed of carbon dioxide, methane, nitrous oxide, and ozone. Greenhouse gases are produced when hydrocarbons are burned (Canadian Association of Petroleum Producers, 2019). In Canada, more than 81% of greenhouse gas emissions are aligned with energy consumption and production (Natural Resources Canada, 2020). Human activities and greenhouse gases are leading causes of climate change (Government of Canada, 2020). Greenhouse gases stay in the atmosphere from a few years to thousands of years. Governments around the world are finding ways to reduce emissions to meet targets set by international agreement (United Nations Climate Change, 2020).

Potential Water Contamination from Tailings Ponds

Tailings ponds are a result of separating bitumen (raw crude oil from sands) from a mixture of sand, clay and bitumen that make up the oil deposits (Natural Resources Defence Council, 2017). Tailings ponds are known to have significant environmental impacts, and in Canada, are reported to exceed 1.18 trillion liters (Natural Resources Defence Council, 2017). Tailings ponds have the potential to contaminate regional water resources, with societal and ecological impacts recorded (Natural Resources Defence

Council, 2017). Tailing ponds typically contain lead, mercury, arsenic, and benzene; if contaminated water resources are not properly mitigated, it may lead to permanent brain damage in children and are well-known for sources of cancer (Natural Resources Defence Council, 2017).

Construction Impacts and Spills from Pipelines

Various types and degrees of environmental impacts are associated with pipelines. Some of these environmental impacts include air quality deterioration from construction periods, soils being eroded and contaminated, vegetation being disturbed, and wildlife being displaced (Williams, 2012). Pipelines can accidentally leak as well, causing several environmental and human health related impacts. Crude oil can combust or catch on fire, may contain any combination of toxic chemicals, and its physical properties impact wildlife such as birds, affecting their ability to float, fly or stay warm (Williams, 2012). In areas where pipelines are not viable, rail transport is an alternative. The environmental impacts from rail transport can come from derailment, resulting in serious fires, air pollution, environmental destruction, and the displacement of populations (Green, 2013).

Impacts from Fracking

Fracking is a process of extracting oil or natural gas by horizontal drilling and hydraulic fracturing to obtain the product that is trapped in non-porous rock formations, such as shale (CAPP, 2020). Horizontal drilling and hydraulic fracturing require injecting liquid and additives at a high pressure to create small fractures allowing hydrocarbons to be released into wells for extraction (CAPP, 2014). Although this is an innovative technique, many environmental impacts are associated with this process ranging from climate change, soil erosion, species invasion, deforestation as well as water pollution (Meng, 2017).

Nuclear Waste Management Environmental Impacts

Nuclear power produces waste with various levels of radioactivity, categorized as low (rags, protective clothing, and contaminated soil), intermediate (used reactor components) and high-level waste (used nuclear fuel) (NWMO, 2020). The higher the level of radioactivity, the longer-lived the radionuclides involved, and the more a permanent solution is required to safely manage the waste. In Canada, the Nuclear Waste Management Organization (NWMO), established in 2002 by the Nuclear Fuel Waste Act (NFWA), wants to design and construct a deep geological repository (i.e., a very stable deep underground mine, purpose-built to store nuclear waste safely over a millions-of-years timeframe). The comprehensive process to select a site with informed and willing hosts for this project is a complex and difficult challenge involving science, new technology, society, economics, and environmental implications. Readers are encouraged to review the NWMO website for more information.

3.1.2.3 Renewable Energy – Types

Renewable energy refers to natural processes where energy is replenished at a rate faster than it is consumed. Renewable energy typically relies on atmospheric processes, and since atmospheric process of temperature, wind, precipitation, and cloud cover may vary, energy sources may not always be consistent in how they are able to renew themselves (Chapman & Pawlowska-Mainville, 2019).

Renewable energy provides for 17% of Canada's total primary energy supply with wind and solar energy quickly growing as sources of electricity in Canada (Natural Resources Canada, 2020).

Canada's Energy Regulator (CER) is the regulatory body responsible for ensuring energy moves safely across the country. It reviews energy development projects and enforces some of the strictest safety and environmental standards in the world (Canada Energy Regulator, 2020). Canada's Energy Regulator regulates the export of electricity from Canada, including energy produced from renewables, including those described in the following subsections. Renewable energy is regulated by Canada's Energy Regulator and environmentally focused federal and provincial legislation. Legislation that applies to renewable energy production ranges from the *Canada Energy Regulator Act* to the *Canadian Environmental Protection Act*, *Impact Assessment Act*, and *Species at Risk Act*, to name a few.

Wind

Based on government initiatives, wind as a renewable resource has expanded in recent years and is projected to see continued growth. Large propeller-based turbines are strategically placed onto "wind farms" in a manner that allows for optimal wind patterns. Quality areas for wind turbines tend to be along coastlines, and although Canada does not exercise wind farms along remote offshore locations, it has seen success in the southern Prairies and along the Gulf of the St. Lawrence (Natural Resources Canda, 2017). As of 2018, the Canadian Wind Energy Association indicated that 6% of Canada's electricity demand was met through 12,900 MW produced by wind power (CAPP, 2019).

Geothermal

Geothermal energy is heat that is captured from under the Earth's surface. Canada's highest geothermal temperatures are found in British Columbia, Northwest Territories, Yukon, and Alberta (CAPP, 2019). Although geothermal energy can also be captured from the heat absorbed by the oceans and the atmosphere, underground steam is what allows for the production of geothermal electricity (Natural Resources Canda, 2017). Temperature differences between the outside air and ground or groundwater is the source of oceanic and atmospheric geothermal energy (Natural Resources Canda, 2017).

Solar

Solar technologies generate electricity, and they heat homes and water through the sun's energy. Most of Canada's solar energy capacity is in Ontario. The two more common solar technologies are solar panels and solar photovoltaic systems. Solar panels allow for the heating of water and ventilation in buildings, and photovoltaic technology allows for electricity production through the conversion of sunlight with solar cells (Natural Resources Canda, 2017). Although the energy generated varies based on weather, season, and technology, in 2015, the Canada Energy Regulator indicated that 1.5% of Canada's energy capacity came from 2,100 MW of solar energy (CAPP, 2019).

Hydroelectricity

Canada's largest source of all electricity generation, not only renewable generation, is from hydroelectricity. It provides more than 60% of the country's total electricity through a capacity of 85,000

MW (CAPP, 2019). Hydro-Québec is Canada's largest electric utility and the country's second largest corporation with more than 95% of the province's electricity production coming from renewable hydroelectricity. Established in 1944, Hydro-Québec came into its prowess in the 1960s and by the 1970s and 1980s had contracted to buy power from the Churchill Falls project in Labrador at 1969 prices until 2041 (Bolduc, 2015).

Hydroelectricity is produced when the kinetic energy of moving water rotates a turbine connected to a generator, creating usable electrical energy (Natural Resources Canda, 2017). Québec has many hydroelectric generating stations because of its geography and vast hydraulic resources in its lakes and rivers. British Columbia, Newfoundland and Labrador, Manitoba, and Ontario also have a number of hydroelectric generations stations producing large quantities of hydroelectricity (Natural Resources Canda, 2017).

Marine

The Bay of Fundy on Canada's east coast has the highest tides in the world, with the capability to harness more than 2,500 MW of energy from a potential 8,000 MW kinetic source (Government of Canada, 2017). Fundy Ocean Research Centre for Energy (FORCE) was established in 2009 by the province of Nova Scotia and five tidal energy developers, with the goal to permit, construct and operate a tidal turbine test and demonstration facility. This test facility would enable monitoring and research, along with the installation and operation of tidal in-stream energy conversion devices (Government of Canada, 2017). Through Nova Scotia's Marine Renewable Energy Strategy, further research, development and regulation will help create a new dependable source of power, a global demand for new expertise, and new economic opportunities for Nova Scotia (Nova Scotia , 2019).

3.1.2.4 Renewable Energy – Environmental Impacts

Renewable energy sources, such as wind and solar energy generally disturb large areas of land during construction. Onshore wind energy, with turbines spread over hundreds of square kilometres requires the construction of turbine foundations, access roads, and underground or overhead "collection systems" (cables) for gathering the electricity at substations necessary to connect to the grid. The earthworks for these types of power systems can impact ecology in wetlands or at water crossings, for example, and the primary mitigation is through avoidance (i.e., addressed through careful siting during preliminary design and Environmental Assessment), and through control of construction practices (e.g., use of silt fence to prevent erosion and sedimentation).

Wind

During the planning stages of wind generation projects, people are typically concerned about the possible effects to human health; however, there is little factual evidence of health effects resulting from wind energy generation. The socioeconomic impacts of wind turbines that are commonly cited include the perceived reduction in land values, or the loss of enjoyment of property. With the growth of this sector, several wind farms are expected to be constructed globally in the near future. According to the National Wind Coordinating Committee (NWCC), collisions with wind turbines and the air pressure

change associated with spinning turbines has resulted in harm to bats, birds, and marine birds. (Tajne, 2015).

Geothermal

Geothermal sites may contain poisonous gases that can escape once the Earth's surface has been drilled into, and for this reason extensive research is often recommended before drilling can commence (Tajne, 2015). Another significant environmental impact of geothermal energy generation is that the energy stations can cause earthquakes. In extreme cases, geothermal energy stations may create conditions with earthquake generating potential (Tajne, 2015). More common impacts, however, may include land disruption, noise and sight pollution, water discharge, foul odours, and soil subsidence (Lund, 2020).

Solar

A typical solar farm requires land to be cleared and thousands of foundations for the solar arrays to be constructed. Clearing the land may result in soil compaction, erosion, and alteration of drainage channels, as well as impacts to the land from material extraction, exploration, and disposal (Tajne, 2015). Solar energy can be associated with water use and habitat loss along with harmful materials that are used in the manufacturing of solar panels (Tajne, 2015).

Hydroelectricity

The environmental impacts of hydroelectricity have been well established for decades. Rivers have been heavily affected by the construction of dams to harness hydropower; damming rivers alters ecosystems and negatively impacts populations and wildlife. Flooding has been the most significant impact brought on by hydroelectricity; agricultural land, forests, and wildlife are destroyed when water stored in a dam is suddenly released downstream (Tajne, 2015). After land is flooded, decaying vegetation transforms trapped inorganic mercury into organic mercury (also called methylmercury). Methylmercury is a neurotoxic substance that accumulates in the tissue of animals and pollutes water. Managing this pollutant is an important issue for developers of hydroelectric power (Hydro Quebec, 2017).

Marine

Tidal energy, associated with marine renewable energy, is a result of water surge during times of high and low tide. When this water surge occurs, the associated land is completely disrupted. Other potential impacts resulting from generating marine renewable energy include:

- Plant and animal life damage resulting from water level changes
- An organism's ability to survive because of a change in salinity
- Fish being blocked in or left out of tidal lagoons because of dams
- Marine animals getting caught in the turbine blades of barrages (National Geographic, 2020)

3.1.3 Natural Resources and Associated Environmental Impacts

Canada has an abundance of natural resources from coast to coast to coast. When considering natural resources as a source of economic prosperity, it is important to apply a lens of sustainability and emphasize continued economic stability. Regarding sustainability, natural resources as a source of

economic viability depends on several factors including the size of physical resource reserves and the price of resource.

The natural resource sectors in Canada include:

- Forestry
- Agriculture
- Mining
- Fishing

Extraction, use, and sale of these abundant natural resources is not without socio-economic and environmental implications, as presented in the following subsections.

3.1.3.1 Forestry

Forests are a primary natural resource for Canadians and provide a wide range of economic, social, and environmental benefits. In 2013, the forest sector contributed 1.25% to Canada's gross domestic product, equating to $19.8 billion (Natural Resources Canada, 2020). The three primary forest industry subsectors are (Natural Resources Canada, 2020):

- Solid wood product manufacturing
- Pulp and paper product manufacturing
- Forestry and logging

The forestry sector is innovative. It provides new products, materials, and services to society, including biofuels, new buildings materials and bio-based pharmaceuticals (Natural Resources Canada, 2020). The forestry sector is based on regrowth and therefore must implement sustainable practices to protect and conserve the natural resource. Forest conservation includes activities, tools, and approaches that nourish forest health and biodiversity (Government of Canada, 2020). Forest protection comes from creating parks and other spaces where industrial activity is prohibited in order to sustain healthy ecosystems (Government of Canada, 2020).

Forests are crucial to the balance of the Earth's carbon dioxide supply and exchange, in addition to providing habitat for many species and medicinal ingredients (Government of Canada, 2015). Clear cutting lands for agriculture or development, particularly if the vegetative root base is disturbed or destroyed, can result in erosion and sedimentation, habitat loss, and reduced air quality (increased dust) impacts. Recognizing the forestry industry's importance to the Canadian economy and the need to combat its effects on the environment, the Canadian government has implemented forestry management laws and developed science-based sustainable forest management practices to conserve and protect this valued resource (Natural Resources Canada, 2019).

3.1.3.2 Agriculture

More than half of the highest quality farmland in Canada can be found in Ontario, with over 51,950 farms making up for one fourth of all farm revenue in Canada (Ontario, 2019). Agriculture is dependent on the climate and weather; crops can fail without the appropriate rainfall or temperatures. However,

agriculture has also impacted climate and in turn has also influenced the management of croplands and pastures. Many physical, chemical, and biological interactions take place between the atmosphere and the Earth's surface including agriculturally induced conditions that may result in air temperature and precipitation shifts (Government of Canada, 2020).

Aside from emissions resulting from fossil fuels and fertilizer production, 10% of Canada's greenhouse gas emissions, particularly carbon dioxide, methane, and nitrous oxide, are a result of crop and livestock production (Government of Canada, 2020). In 2009, Canada produced 690 million tons of carbon dioxide from energy use, with agriculture accounting for 8%, primarily through methane and nitrous oxide output (Government of Canada, 2020). In 2009, through improved practices, farmlands were able to remove approximately 12 million tons of carbon dioxide from the air (Government of Canada, 2020). These practices include storing carbon from organic matter, perennial vegetation, and trees on agricultural lands (Government of Canada, 2020).

3.1.3.3 Mining

Within the mining sector, Canada is a recognized world leader in potash production, while also ranking fifth in producing cadmium, cobalt, diamonds, and uranium (Government of Canada, 2019). The direct contribution of the mining industry to Canada's gross domestic product in 2018 was $72.4 billion, while providing employment opportunities for 626,000 people (Government of Canada, 2019). Minerals are produced by every province and territory; however, in 2018, 75% of Canada's total value of mineral production came from Ontario, Québec, British Columbia and Saskatchewan (Government of Canada, 2019).

One of the environmental impacts contributed by mining comes from waste rock and mine tailings being released into water and soil. Often aquatic ecosystems and water quality suffer significant damage from acidic draining and metals leaching from mine workings and mine waste (Government of Canada, 2018). Mining can also destroy glaciers, exercise deforestation, forcibly displace people, divide impoverish communities and endanger human health (Hill, 2014). Along with these impacts, the processes that take place in a mining operation contribute significantly to carbon emissions that in turn, impact human health and biodiversity.

3.1.3.4 Fishing

Fishing is a growing sector in Canada with approximately 72,000 Canadians making their livelihood from fish-related activities (Canada, 2017). In 2016, Canada exported $6.6 billion in fish and seafood products (Canada, 2017) In 2015, the Canadian aquaculture industry generated close to $3 billion in total economic activity, with $1 billion being contributed from aquaculture alone (Canada, 2017). Canada's aquaculture is split between the Pacific and Atlantic coasts with British Columbia making up 49% of production, Newfoundland, and Prince Edward Island with 15% each, New Brunswick with 11% and Nova Scotia with 5% (Canada, 2013).

Entire ecosystems can be impacted from overfishing. Overfishing results in a change of the size of fish, how they reproduce, and their maturity rates. Documented impacts of the fishing industry include the

destruction of ecosystem features from using trawl nets and fishing vessels (Higgins, 2011). The cod fishery sustained the economy of the island of Newfoundland for hundreds of years. Newfoundland's fishery, developed from inshore to offshore, increasingly attracted international fleets. It provides an example of the perils of non-sustainable industrial behavior. Following unprecedented increases in catch in the latter decades (wherein regulations failed to keep up with technological advances in equipment), the Government of Canada imposed a moratorium on cod fishing in 1992, putting 300,000 people out of work (Hertitage Newfoundland & Labrador, 2009).

3.1.4 Principles of Sustainability

The concept of sustainability includes environmental, social, and economic development tenets. In 1983, the United Nations selected Norwegian Prime Minister Gro Harlem Brundtland to head the *World Commission on Environment and Development* (University of Alberta, Office of Sustainability, n.d.). Four years following the "Brundtland Commission", the final report, "Our Common Future" famously defined sustainable development as:

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

In the document, *Sustainability: Definition and Five Core Principles - A New Framework*, Michael Ben-Eli presents the principles of sustainability in a general manner but can be aligned to receive specific operational meaning depending on the application. The principles are expressed to five fundamental domains:

1. The Material Domain makes up the basis for regulating the flow of materials and energy that underlie existence.
2. The Economic Domain provides a guiding framework for defining, creating, and managing wealth.
3. The Domain of Life allows the basis for appropriate behavior in the biosphere with respect to other life forms.
4. The Social Domain is the basis for social interactions.
5. The Spiritual Domain identifies the required attitudinal orientation and allows the basis of a universal code of ethics (Ben-Eli, 2015).

Sustainability is a process of dynamic equilibrium, where a population and the carrying capacity of its respective environment are able to express their full potential without creating irreversible impacts on the carrying capacity to the environment they depend on (Ben-Eli, 2015).

The three pillars of sustainability, illustrated in **Figure 2** below, include the environment, the economy and society.

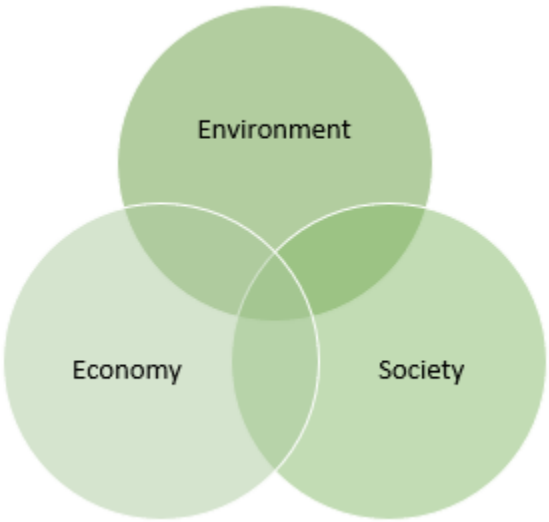

Figure 2: Pillars of Sustainability

Further description of these pillars of sustainability include:

- Environmental sustainability is achieved where ecological integrity is maintained. To achieve this, all of earth's environmental systems must be kept in balance, and the natural resources within them consumed at a replenishable rate.
- Social sustainability is achieved when all people have attained universal human rights and basic necessities, with access to enough resources to maintain healthy and secure families and communities.
- Economic sustainability is achieved when communities across the globe can maintain their independence and access the resources that they require to meet their needs (University of Alberta, Office of Sustainability, n.d.).

3.1.4.1 Tools for Sustainability Assessment

Leadership in Energy and Environmental Design (LEED) is an internationally recognized green building certification system that provides a sustainability framework for design, construction, operations, and maintenance of new and existing buildings. LEED provides third-party verification that a building or community has been designed and built using strategies aimed at improving sustainable performance using a points-based system. Points are awarded for incorporating nearby natural resources and ecosystems into design, using earth-friendly products, enhancing energy performance and indoor air quality, and addressing regional or geographical concerns (Rodriguez, 2019).

The Institute of Sustainable Infrastructure has developed a similar point-based rating system for evaluating sustainability as it relates to infrastructure projects. The rating system is called Envision; it measures the sustainability of infrastructure projects from design though construction and maintenance (Institute for Sustainable Infrastructure, n.d.). Envision can be used to meet sustainability goals, make

decisions regarding the investment of resources, and include community priorities in the implementation of infrastructure projects (Institute for Sustainable Infrastructure, n.d.).

3.1.5 Impact of Current Business Practices on the Environment

The principles of sustainability consider environmental, social, and economic development Economic development should be considered together with considerations for the continued health of the environment and society. Environmental Professionals should be aware of forms of corporate social responsibility and its benefits considering social and environmental factors within an economic framework.

3.1.5.1 Corporate Social Responsibility

Corporate social responsibility is defined as a company's efforts to improve society in some way; these efforts may include donating money to non-profits for implementing environmentally friendly policies in the workplace (Double the Donation, n.d.). Corporate social responsibility is not a mandated requirement in Canada and is instead considered something extra that companies do to enhance local and global communities. This responsibility is intended to "give back to the community", provide positive social value and encourage companies to become involved in philanthropic causes (Double the Donation, n.d.). Employees, society, businesses, and non-profits can all benefit from this initiative. Types of corporate social responsibility include (Double the Donation, n.d.):

- Corporate philanthropy
- Corporate volunteerism
- Ethical labour practices
- Economic responsibility
- Environmental leadership

Companies can demonstrate environmental leadership by reducing carbon emissions, recycling their products, showing leadership in environmental impact assessments of their projects, and giving back to environmental causes. Similarly, environmental, social, and corporate governance is a common understanding globally, where a company's long-term financial success is aligned with its success within social responsibility, environmental stewardship, and corporate ethics (Kell, 2014).

3.2.5.2 Economics

Canada is a country rich in natural resources. The use and processing of these natural resources helps sustain and regulate the national economy. Given the nature of our natural resource-based economy, it is easy to see how, without regulations, legislation, and governing bodies, these resources could be exploited rather than developed. For example, gold is sold by the ounce and gravel is sold by the ton; therefore, revenues will increase with more extraction and processing. Canadians and our economy are however completely reliant on the environment and therefore the economic benefits of resource development must include assessment of the associated environmental costs.

The industrial revolution (1840 to 1860) brought about new technologies with immense power, and new manufacturing processes were developed in a time when the world was assumed to have infinite resources (Edinburgh Sensors, 2019). Industrialization continues to this day and further technological advancements endure in developed countries around the world. The paradox is that, although the perceived impact of technology on the environment has been negative (mining, for example, is never referred to as being "good for the environment", despite the fact that mining can be done in such a way as to minimize its damage), the concept exists that environmental technology could save our planet from the harm that has been done (Edinburgh Sensors, 2019). Advances in technology include renewable energy, smart technology, electric vehicles, the newer sciences of "direct air capture", and environmental technology designed to remove carbon from the atmosphere (Edinburgh Sensors, 2019).

Environmental/ecological economics is a field of study designed specifically to study of the complexities of the relationships and interactions between economies and the ecosystems that support them.

3.1.5.3 Business Practice and Environment Interrelationships

Businesses have begun to consider the environmental impacts of their operations not only because of regulations, but also because it makes good business sense. Although corporate social responsibility is intended to "give back to the community", it also builds positive corporate brands (Double the Donation, n.d.). For example, a clothing company that plants ten trees for every item purchased to revitalize the environment while also building a corporate brand.

Additional benefits of corporate social responsibility include employees' preference for working at a company with a good public image and consumers preference for supporting companies that are socially and environmentally responsible (Double the Donation, n.d.). Companies can gain support generate business and build a solid reputation as an environmental leader when they demonstrate that they care about improving and preserving the environment (Double the Donation, n.d.).

3.2 Environmental Regulatory Framework

Canada's environmental regulatory framework is as diverse as the country it serves. Federal, provincial, and municipal environmental acts, regulations, by-laws, and best management practices all serve to manage human-environment interactions, while also balancing the needs of the social, economic, and natural environments. Within Canada the Federal-Provincial environmental regulatory framework is unique; it is designed to best serve the region for which the laws and regulations apply. As authority over the environment is shared between federal and provincial governments, the Supreme Court has ruled that these governments can adopt coordination mechanisms, particularly as they relate to environmental assessment (Brideau & Brosseau, 2019).

The environmental regulatory framework is a core knowledge area for Environmental Professionals. This section of the EP Body of Knowledge discusses Canadian policy and guidance, legislative and case law, federal, provincial, and municipal jurisdiction, and how Environmental Professionals use them in their professional capacity. It is important to mention that when applying multiple laws and regulations,

environmental or otherwise, certain laws will take precedence over others. The distribution of regulatory powers is constantly evolving; therefore, it is recommended that environmental laws be assessed for each individual application and legal clarification be sought where precedence is required and unclear.

3.2.1 Policy and Guidance

Policies are not law, but they may form the basis for statutes and regulations, such as Ontario's Provincial Policy Statement (2020). Ontario's Provincial Policy Statement is developed under the *Planning Act* and sets the policy foundation for regulating the development and use of land in Ontario (Ministry of Municipal Affairs and Housing, 2020). The policies contained within the Provincial Policy Statement provide a framework that forms the basis for attaining key management objectives.

Various governing agencies publish policies and guidance that provide direction on how laws and regulations are or may be implemented. For example, Environment and Climate Change Canada has published policies on their webpage supporting the interpretation and implementation of the *Canadian Environmental Protection Act, 1999* (Government of Canada, 2018). These policies include:

- Toxic Substances Management Policy
- Compliance and Enforcement Policy
- Pollution Prevention Planning

3.2.2 Canadian Law

The Constitution, 1982, is the highest law in Canada, which defines and limits legislative authority (who makes the law), executive authority (who enforces the laws), judicial power (who interprets the law) and the rights and freedoms of Canadian citizens (University of Toronto Faculty of Law). In addition, the Constitution, 1982, contains several documents including the *Canadian Charter of Rights and Freedoms*. The *Canadian Charter of Rights and Freedoms* defines Canadian's rights and freedoms as they relate to speech, religion, democratic rights, mobility rights, equality rights, language rights and legal rights (University of Toronto Faculty of Law). The law-making powers defined in the Constitution, 1982, shared between the federal and provincial governments, are clearly stated Sections 91 and 92 of the Constitution.

3.2.2.1 Legislation

Legislation is a written law that provides the rules of conduct. Elected representatives from any level of government can make legislation. Legislation can be used to introduce a new law, or to change or clarify existing laws. The three primary types of legislation in Canada include statutes, regulations, and by-laws. Each of these types of legislation are enacted differently, as described below (University of Toronto Faculty of Law):

- **Statutes:** are publicly debated by the federal parliament or provincial legislatures and voted upon before coming into force. Statutes state the broad principles or rules that govern our lives.

- **Regulations and Bylaws:** regulations (created by federal or provincial bodies) and bylaws (created by municipal bodies) are the details that operationalize and allow for implementation of the statute.

3.2.2.2 Legislative Changes

Legislative changes are common within the Canadian context and often occur as result of the elected government determining a change is warranted. In Canada, legislation and legislative changes must be proposed to Parliament in the form of a Bill, which provides the basis to amend or repeal existing law or put a new one in place. For example, the federal government recently repealed the *Canadian Environmental Assessment Act, 2012*, and replaced it with the *Impact Assessment Act, 2019*. The Canadian Environmental Assessment Agency published the figure, shown as **Figure 3**, to describe the process of legislative change. The graphic is a good example of the federal legislative framework as it applies within the environmental context. (Government of Canada, 2018).

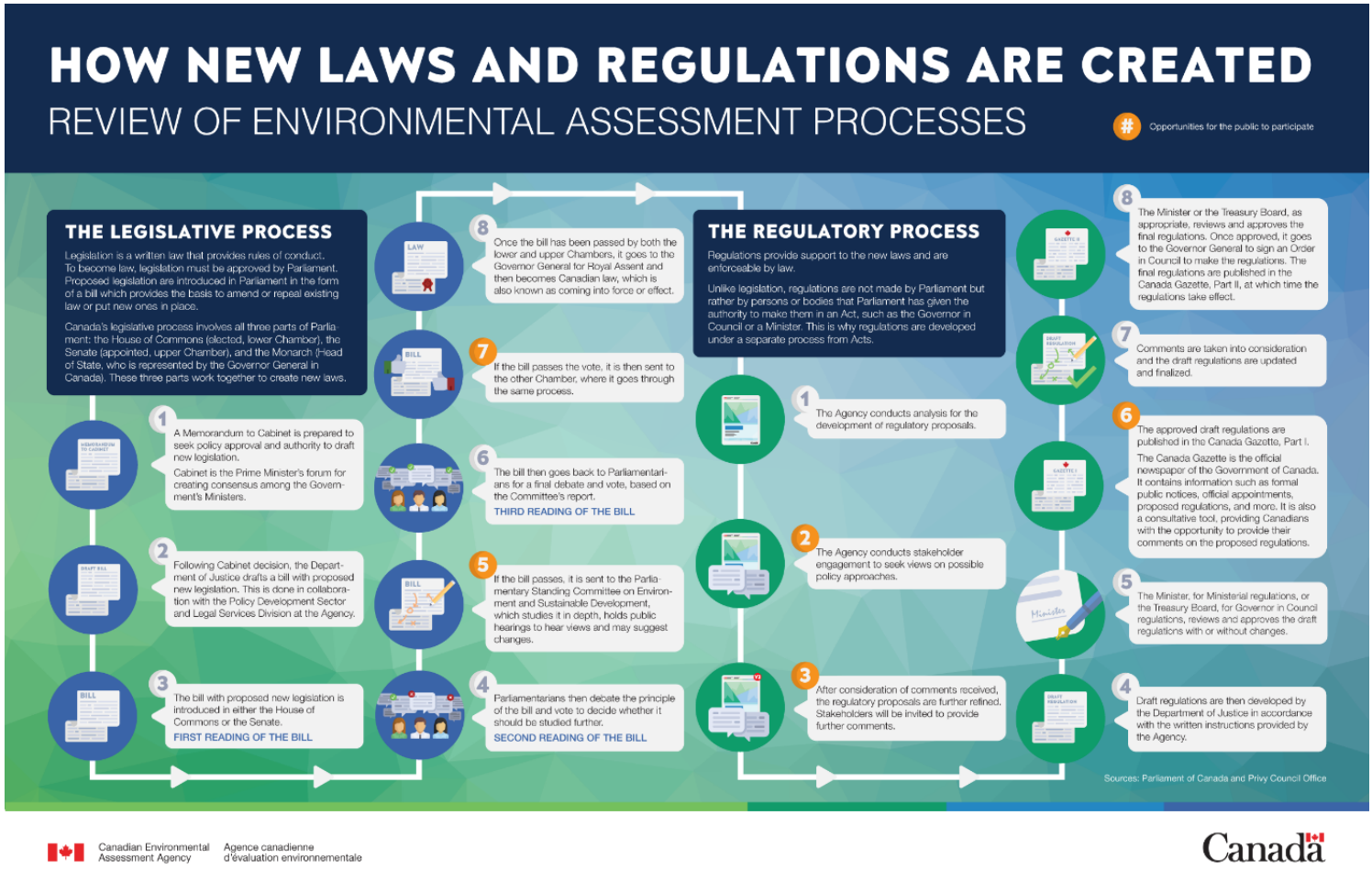

Figure 3: How New Laws and Regulations are Created

3.2.2.3 Regulatory and By-Law Changes

Regulations provide support to laws in Canada and are enforceable by law. Regulations are not made by Parliament; they are developed by persons or bodies that Parliament has granted authority such as the Governor in Council, or a Minister (Government of Canada, 2018).

It is important that Environmental Professionals maintain a current understanding of legislative and regulatory processes and updates. For example, the federal and provincial species-at-risk lists are periodically updated with new species added and thus protected. Being familiar with these species lists and updated schedules would prove valuable to the Environmental Professional in all phases of a project's life cycle.

3.2.2.4 Case Law

The law in Canada is made up of two primary parts: Legislation, as discussed in the previous subsections, and case law. Case law is made up of the written decisions of judges in court cases and tribunals, stemming from all levels of court in Canada (University of Toronto Faculty of Law). Generally, judges must follow the previous rulings of other judges in higher courts (i.e., precedents) in their province or territory and the Supreme Court of Canada (University of Toronto Faculty of Law). Decisions from the same level of court or other provinces or jurisdictions may help judges in making those decisions.

Within the Canadian context, several notable examples of case law exist as they relate to environmental duty. They include:

<u>Case: Resolute FP Canada Inc. v. Ontario (Attorney General)</u>

In a complicated case, spanning decades, the Supreme Court has determined that companies are responsible for the cost of complying with environmental orders, not the government (Resolute FP Canada Inc. v. Ontario(Attorney General), 2019)**.** In brief, a pulp and paper mill in Dryden, Ontario produced chemicals to bleach the paper in the 1960s. The process used mercury and, at the end of the process, the waste was dumped into nearby rivers where it flowed downstream. Downstream communities of Grassy Narrows and Islington First Nations had residents suffer serious, long-term health effects. In 1977, these two First Nations bands sued for damage from the mercury contamination.

In 2009, Bowater, the company that owned the waste disposal site that was now separate from the mill, filed for bankruptcy. As part of this process, a court allowed it to abandon the site in 2011. But the Ontario Ministry of the Environment said Bowater and Weyerhaeuser (the previous owner) still had responsibilities. It ordered them to repair the waste disposal site, continue monitoring and testing, and take steps to prevent and deal with leaks. This case dealt with a company that was going bankrupt; companies can still be responsible for following environmental rules even when they go bankrupt.

<u>Case: Orphan Well Association v. Grant Thornton Ltd.</u>

The Supreme Court has ruled that, after going bankrupt, an oil and gas company must fulfill provincial environmental obligations before paying anyone it owes money to (Orphan Well Association v. Grant Thornton Ltd., 2019)**.** Redwater was an Alberta oil and gas company that owned over a hundred wells,

pipelines, and facilities. The company went bankrupt in 2015 under the federal *Bankruptcy and Insolvency Act*. The Constitution gives provinces the power to make laws in specific areas, such as natural resources and property rights, which allowed Alberta to pass laws allowing oil and gas companies to operate with appropriate permits and authorizations.

When Redwater went bankrupt, most of its wells were dry. Dismantling the sites and restoring the land would have cost much more (millions) than the company was worth. To avoid paying the restoration costs, the trustee (Grant Thornton) decided to disown the useless wells and sites, claiming this action was allowed under the *Bankruptcy and Insolvency Act*. Federal and provincial laws governing abandonment and bankruptcy payments seemed to contradict each other and overlap when applied.

The two primary legal issues were whether the *Bankruptcy and Insolvency Act* supported the trustee to walk away from sites it did not take responsibility for; and whether the provincial orders to remove structures from the land were provable claims. If the claims were provable, then the payment order set up in the *Bankruptcy and Insolvency Act* would apply and the company's remaining money could be used to pay for taking the sites down.

The trial judge and the majority at the Court of Appeal said that the Redwater trustee could walk away from the disowned sites and that the abandonment costs were provable claims. However, the majority at the Supreme Court said that the trustee could not walk away from the disowned sites. The Supreme Court stated that the *Bankruptcy and Insolvency Act* was meant to protect trustees from having to pay for a bankrupt estate's environmental claims with their *own* money, not that the estate could avoid its environmental obligations. The majority also cited the costs as *duties* (to the public and nearby landowners) not *debts*.

3.2.2.5 Legal Terminology

The regulatory framework is applicable, in some capacity, to all projects. Interpretation of legal terminology and definitions is provided within the relevant act or regulation. For example, the *Canadian Environmental Protection Act* provides interpretation for the terminology used within the act as it relates to federal lands, aboriginal governance, air pollution, hazardous substances, and environmental emergencies. Similarly, the *Fisheries Act* provides interpretation for fish, fishery, and Canadian fisheries waters.

In addition to the interpretation and definitions provided within environmental acts and regulations, Environmental Professionals should understand the differences and application of the terms may, shall, must and should as they relate to implementation of environmental law, authorizations, and best management practices. The definitions and guidance on these terms include:

- **May:** used to express possibility.
- **Shall:** must; is or are obliged to. When used as an auxiliary verb, shall, according to Webster's Online Dictionary, "denotes a requirement that is mandatory whenever the criterion for

conformance with the specification requires that there be no deviation" (2). This word implies obligation and is traditionally used by laws and regulations.

- **Should:** In contrast to shall, should "denotes a guideline or recommendation whenever noncompliance with the specification is permissible." When used as an auxiliary verb, it expresses "a conditional or contingent act or state … or moral obligation".

In property transactions (purchase and sale) the doctrine of *caveat emptor*, meaning "let the buyer beware", is generally applicable, absent fraud. As such, investigations into the environmental condition of property are recommended to be undertaken by a purchaser to avoid them becoming responsible for clean-up (costs, liability) for a site that they did not contaminate. The real property branch of environmental law is complex and varies by province, but the associated business of conducting environmental site assessments and remediation in association with property sales and for dispute resolution is a significant employer of Environmental Professionals.

Environmental justice stresses the need for public policy to be based on respect and justice for all people, void of any sort of discrimination or bias (Green Action, 2020). It is the fair treatment and involvement of people with respect to the development, implementation and enforcement of environmental laws, regulations, and policies (Department of Energy, 2020). Environmental justice is understood to ensure all people and communities gain equitable and equal access to environmental benefits. An example of environmental justice is provided in Section 3.4.1.1 of the EP Body of Knowledge, 'Public Safety – Protecting People and the Environment' as it relates to the Sydney Tar Ponds example of impact management.

3.2.3 Federal, Provincial, and Municipal Jurisdictions

The regulatory framework within Canada enables law, regulations, by-laws, and governmental and regulatory authorities to enact safeguards aimed to minimize risk to the health of Canadians and their environment. The sections presented here will provide an overview to Environmental Professionals of the key pieces of legislation aimed to protect Canadians and their environment and includes information on:

- Basic federal and provincial regulations
- Policy and procedural differences
- Levels of governance
- Types of policy

3.2.3.1 Basic Federal and Provincial Regulations

Federal and provincial legislation exists to protect Canadians and their environment. In fact, the *Canadian Environmental Protection Act* (CEPA), 1999 is described as "An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development." (Environment and Natural Resources, 2019). *Canadian Environmental Protection Act*, 1999 is one of Canada's key pieces of environmental health and safety legislation. It sets out key principles related to the administrative duties of government, including:

- Sustainable development dependent on a sustainable, clean, healthy environment and a strong, healthy economy.
- Pollution prevention described as "the use of processes, practices, materials, products, substances or energy that avoid or minimize the creation of pollutants and waste and reduce the overall risk to the environment or human health”.
- Virtual elimination of substance release related to persistent, bio accumulative, toxic, and primarily the result of human activities.
- Ecosystem approach considers the environmental, social, and economic elements that affect the environment.
- Precautionary principle "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."
- Intergovernmental cooperation directs the federal government to endeavor to act in cooperation with governments in Canada to ensure that federal actions are complementary to and avoid duplication with other governments.
- National standards reinforce the role of national leadership to achieve ecosystem health and sustainable development by providing for the creation of science-based, national environmental standards.
- Polluter Pays Principal notes that that users and producers of pollutants and wastes should bear the responsibility for their actions.
- Science-based decision-making emphasizes the vital role of science and Indigenous Traditional Knowledge (where available) in decision-making.

Provincial Environmental Health and Safety (EHS) legislation refers to the provincial laws and regulations that have been designed in cooperation with the federal government and in support of *Canadian Environmental Protection Act*, 1999. Provincial laws and regulations aim to protect Canadians from the impacts associated with industry and may provide scientifically based thresholds for pollutants. Provincial legislation covers:

- Release of substances
- Waste disposal
- Waste management and management of contaminated materials
- Air quality, noise, and vibration management
- Contaminated sites
- Dangerous goods and pesticides
- Environmental assessment processes and mechanisms

3.2.3.2 Policy and Procedural Differences

Given the differing Constitutional powers provided to federal, provincial, and municipal governments, and the diverse needs of Canadians based on region, there is an array of policy and procedural practices

in place. Although federal legislation is applied from coast to coast to coast in Canada, each province and territory is responsible for local issues.

Although the intent of environmental protection statutes and regulations are generally consistent between provinces, the implementation and enforcement of them vary. Differences may include, but are not limited to, regulated timelines, acceptable contaminant concentration limits, acceptable noise limits, consultation procedures, government review and response times, documentation, approval processes, monitoring frequency and duration and rehabilitation or restoration requirements.

3.2.3.3 Levels of Governance

In Canada, the Constitution gives the federal government the power to pass bills into laws, as they relate to areas of federal interest including fisheries, federal public property, shipping, interprovincial trade and commerce, and criminal law (Franson & Hughes , 2013). Additional environmental review and authorization power is provided to federal departments and the subject matter experts that comprise them. Federal legislation enacted under the Constitution includes:

- ***Canadian Environmental Protection Act, 1999.*** The purpose of this act is to contribute to sustainable development through pollution prevention.
- ***Canadian Impact Assessment Act, 2019.*** This act respects the federal process for impact assessments and in turn results in the prevention of significant adverse environmental effects.
- ***Species at Risk Act, 2002.*** This act enforces the protection of wildlife species at risk in Canada.
- ***Pest Control Products Act, 1985.*** This act regulates products used for the control of pests and the organic functions of animals and plants.
- ***Canada Shipping Act.*** This act is in line with shipping and navigation. It was established to amend the Shipping Conference Exemption Act, 1987 and other Acts.
- ***Arctic Waters Pollution Prevention Act*.** This act prevents the pollution of areas of the arctic waters next to the mainland and islands of the Canadian arctic.
- ***Fisheries Act.*** This act provides a framework for the proper management and control of fisheries and the conservation and protection of fish and fish habitat, including by preventing pollution.
- ***Transportation of Dangerous Goods Act.*** This act promotes public safety in the transportation of dangerous goods.

The provinces regulate local matters, including property rights. The provinces also have jurisdiction over agriculture, forestry, mining, and hydroelectric development. Provincial legislation includes legislation on water pollution, air pollution, and protection from the effects of contaminated land, management of hazardous substances, regulation of waste management, and wildlife and conservation management including species at risk protection. Although the provinces have had powers delegated to them, Canada's three northern territories do not have any jurisdiction in their own right, pursuant to the *Constitution Act, 1867*. That being said, Parliament has delegated much of the legislative jurisdiction to the territorial legislatures (Brideau & Brosseau, 2019).

Provincial governments grant authority to municipal governments. Municipalities are responsible for matters relevant at a local scale, such as property taxes, property standards, zoning, development, identification of greenspaces and local development planning, including local by-laws.

3.2.3.4 Types of Policy

Figure 4 illustrates the types of policy applicable in Canada using the Province of Ontario as an example. This figure shows the broader context of international and federal policy and legislation, narrowing to the more localized context of provincial and municipal interest.

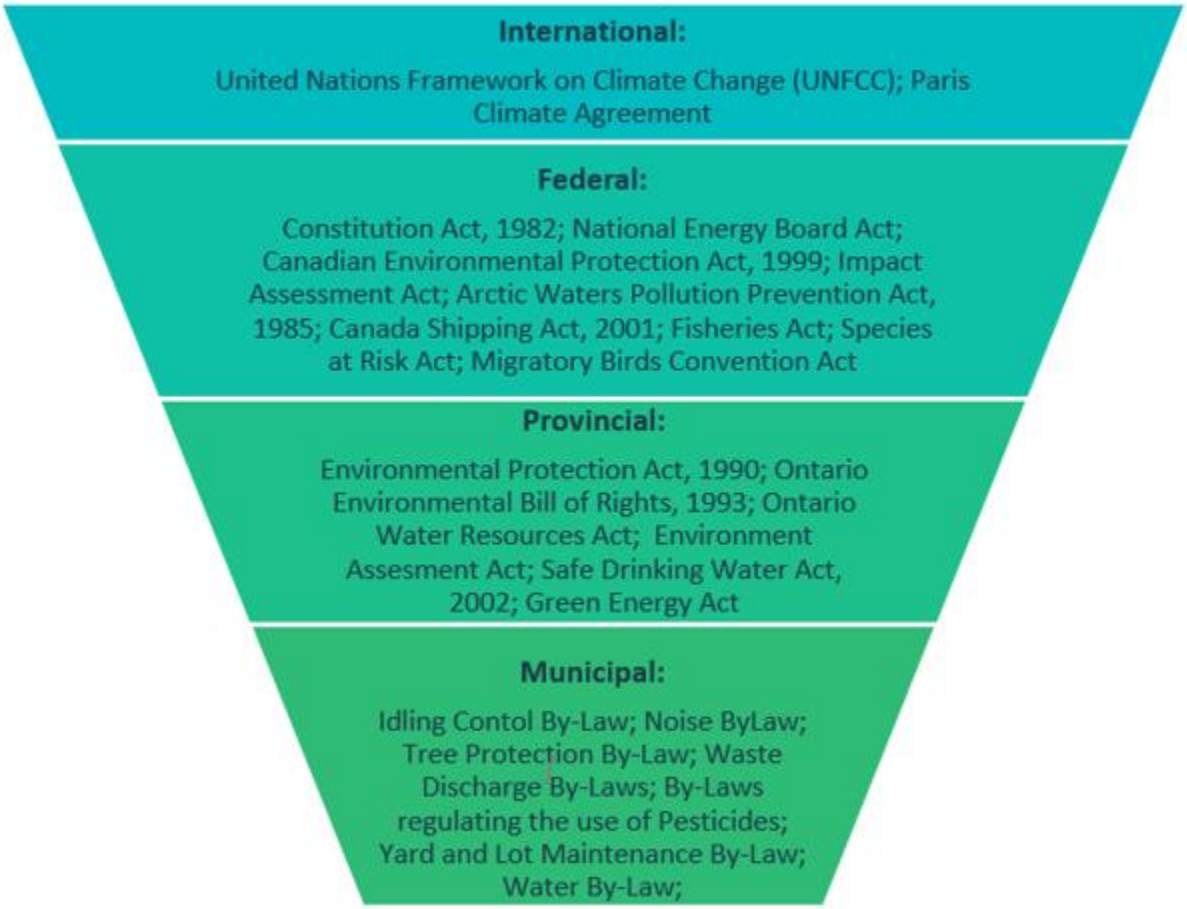

Figure 4: Types of Policy Applicable in Canada

3.2.4 Joint Review Panel

Proposed projects can avoid duplication during an environmental assessment by establishing a joint panel review between federal, provincial and another jurisdiction. Through negotiation with the federal government and respective jurisdictions, a joint panel review would outline the process and terms of reference (Impact Assessment Agency of Canada, 2019). The main steps include:

1. Proponent submits project description.

2. The Agency accepts the project description.
3. Proponent is notified of consideration if an environmental assessment is required and if a comment period on the designated project and its potential effects on the environment is required.
4. The Agency determines if an environmental assessment is required.
5. The public is notified that an environmental assessment required.
6. Comment period on draft environmental impact statement guidelines is prepared.
7. The Agency issues the final environmental impact statement guidelines.
8. Participant funding application period and decision by the President of the Agency on funding requests.
9. Comment period on draft review panel terms of reference and joint review panel agreement, if applicable.
10. Proponent completes environmental studies and submits environmental impact statement to the government.
11. The Agency conducts a completeness review of the environmental impact statement.
12. The Agency appoints joint review panel.
13. Proponent revises environmental impact statement information and submits it to the review panel.
14. Joint review panel determines if environmental impact statement is sufficient, or if additional information is required.
15. Joint review panel holds public hearings.
16. Joint review panel prepares and submits report to the Minister, and the province or other jurisdiction, for joint review panels.
17. The Governor in Council determines if significant adverse environmental effects are justified.
18. Minister issues the environmental assessment decision statement with enforceable conditions.
19. Federal authorities exercise powers or perform duties if regulatory decision making is required.
20. The proponent implements mitigation measures and follow-up program.

3.2.5 Environmental Emergencies and Environmental Response Plans

The Federal Environmental Emergencies Program was created in 1973 following a large oil spill in Nova Scotia (Government of Canada, 2018). This program is delivered by Environment and Climate Change Canada departmental experts including meteorologists, biologists, water scientists, environmental engineers, and enforcement officials. An environmental emergency is defined as an uncontrolled or unexpected incident involving the actual or likely release of a polluting substance into the environment (Government of Canada, 2018).

Federal regulatory emergency response responsibilities are defined in the *Canadian Environmental Protection Act, 1999*, the *Fisheries Act*, *1985,* the *Emergency Management Act, 2007*, the *Migratory Birds Convention Act, 1994* and the *Species at Risk Act, 2002*. Provincially, emergency response regulations are generally related to any spill or contaminant release that may threaten the environmental quality of water, land, or air. Provincial regulations governing environmental protection

and spill response will dictate when to report a spill and the appropriate actions required for remediation.

When response time is paramount in some environmental emergencies, the review process normally required by permits and their conditions may not apply. For example, important, but time-consuming consultations with the public and Indigenous groups, as well as standard regulatory review and permitting procedures may not apply following an environmental emergency. Emergency response teams within the private sector or at various levels of government guide decision making for safety and environmental response in the event of an emergency.

Facilities or worksites that manufacture, store, transport, recycle or handle dangerous goods, hazardous wastes, or hazardous chemicals are required under law to prepare an emergency response (contingency) plan. The emergency response plan responds to various emergencies involving the accidental release of detrimental substances into the environment. Environmental emergency response plans should identify all potential hazards; develop systems for preventing accidents at the various project stages; identify and provide appropriate mechanisms for reducing risk, loss and damage resulting from such incidents; and provide an incident management structure to guide response activities (Government of British Columbia, 2020).

Provision for vulnerable groups must be made in emergency response plans. In Canada, the construction and manufacturing industries are subject to environmental assessment, regulation, monitoring, and reporting. The Government of Canada recently developed Gender-Based Analysis+ (GBA+). The GBT+ is an analytical framework that uses multiple identifying factors, like race, ethnicity, religion, age, and mental or physical disability in decision making processes. Decision makers should consider implementing the GBA+ Framework in their project planning and implementation, including impact / environmental assessment phases where emergency response plans may be detailed.

The best way to identify vulnerable groups is by consultation and engagement with stakeholders, subject matter experts, the public and Indigenous groups. A current list of vulnerable groups should be maintained and included in regular review under an Environmental Management System. The potential scale of requirements of vulnerable groups can be estimated before an emergency and should form part of an emergency response plan in terms of resources and equipment.

Vulnerable groups may include geographically isolated communities (i.e., remote First Nations), long-term care homes, school children and daycare centres, and hospitals. How these groups are considered and included in the emergency response plan will be dependent on the nature of the industry.

3.3 Technical Guidelines

The core knowledge area of applicable technical guidelines for Environmental Professionals includes data collection, management, and analysis and the analytical tools available for use in the

environmental industry. In this section of the EP Body of Knowledge, Environmental Professionals can gain an appreciation and understanding of applicable technical requirements for their work.

The technical guidelines include:

- Principles of experimental design
- Data sampling and collecting
- Data analysis and interpretation
- Data collection and management tools
- Systems thinking in environmental practice

3.3.1 Principles of Experimental Design

There are three primary principles of experimental design that must be followed to maximize the chances that results are conclusive and not just attributable to chance (PennState, 2020). These principles of experimental design include: (PennState, 2020):

1. Replication: Enough samples are collected to ensure that randomization creates groups that resemble each other closely and to increase the chances of detecting differences among the treatments to determine if or when differences exist.
2. Randomization: Samples should be randomly divided into groups to avoid unintentional selection bias in the groups.
3. Local Control: The need to control for effects due to factors other than the ones of primary interest.

In addition to the primary principles of experimental design, EPs must also understand informal and formal experimental designs. Informal experimental designs generally use a less sophisticated form of analysis based on differences in magnitudes; whereas formal experimental designs offer relatively more control and use precise statistical procedures for analysis (Wisdomjobs, 2020). Various methods and statistical approaches are available for both informal and formal experimental designs including, but not limited to, before-and-after experiments (both with and without control), after-only control, completely randomized, randomized block, Latin square and factorial designs (Wisdomjobs, 2020).

3.3.2 Data Sampling and Collecting

Data sampling is the basis for many environmental disciplines and is integral to developing an understanding of existing baseline conditions. Data is most often collected using direct observation and experimentation collection methods, though surveys may also be used. In this context, “surveys” are defined as data collection by means of soliciting information from people (UTDallas, 2020), which is admittedly not the common usage of this term by Environmental Professionals. For example, a Pre-Construction Survey of cultural heritage resources is not a “survey” in this sense but is a direct observation of those resources. The observation is documented with photographic evidence of the resources’ condition, before, during and following construction; provides a record of comparison; and provides an opportunity to identify potential project-related impacts.

Taking samples, or "sampling", is central to any scientific study of the environment. The most popular sampling techniques include: (MSG, 2020):

1. Population Sampling Techniques
   (i) Random Sampling: a sample in which every member of a population has an equal chance of being selected. This method is not applicable to the results of processes, given the population set should be static. The results of random sampling are amongst the best if adequate sample size is selected.

   (ii) Stratified Random Sampling: the population is broken down into strata which contain their own data elements; within the strata, each data element has an equal chance of being selected. This technique requires a static population and therefore cannot be used for a process because a process is dynamic.

2. Process Sampling Techniques
   (i) Systematic Sampling: the first element in the sample is chosen at random, with the following elements chosen in a systematic way. For example, the first element will be chosen at random followed by every fifth element which will be included in the sample. This technique is one of the most popular methods for process sampling.

   (ii) Rational Subgrouping: refers to a sampling technique that produces data for control charts. Samples are drawn from subgroups at regular intervals. The person designing the data collection needs to decide the sample size and the interval, given samples are drawn from subgroups at regular intervals.

When collecting data, the type of data required first needs to be determined (UMass, 2020). To make this determination, Environmental Professionals consider the types of variables, the scale of the data and the type of data required for analysis (UMass, 2020). The definitions of these terms include:

- **Types of variables** refers to independent and dependent variables. Independent variable refers to the variable being controlled, manipulated, or changed, and the dependent variable refers to the observed result.
- **Scale of the data** refers to the scale of measurement or observation and can be qualitative or quantitative. The scale of the variable is described as a function of both the intrinsic nature of the variable and the researcher's choice of how to quantify the variable.
- **The "type" of data required for analysis** refers to the form of the dependent or response variable.

In environmental studies, there are seven primary types of data (UMass, 2020) as listed in **Table 2**.

Table 2: Seven primary types of data (UMass, 2020)

TERM	DEFINITION
BINARY DATA	Data where the observations can only take one of two values, such as present/absent, alive/dead or male/female.
CIRCULAR DATA	Circular data refers to observations where the beginning and end of the sequence is the same, such as the day of a year. An example of circular data is the environmental sustainability of a circular economy.
CONTINUOUS DATA	The most common type of environmental data, which is measured on a continuum scale, such as temperature, distance, and mass.
COUNT DATA	Data in which the observations can only have positive integer value and have no upper bounds, such as number of territories or number of detections in a specific habitat type. An example of count data could be the number of infected trees or species within a town.
PROPORTION DATA	Data that have known observations in one category, as well as the others such that percentages and ratios can be determined. Examples within the environmental context include percent mortality, percent infected and sex ratio.
TIME SERIES	A time series refers to data collected at successive times, often spaced at intervals including population size and annual temperatures. Time series examples include river discharge measured over time, and temperature data measured at fixed intervals.
TIME TO DEATH	Time to death references the time of failure of a component being observed. Examples include plant and animal longevity and infrastructure failure.

3.3.3 Data Analysis and Interpretation

Data analysis and interpretation requires, at a minimum, a basic understanding of the variables, the scale of the data and the type of data. Once data has been collected and synthesized it is often presented in graphic form such as graphs and charts, and in written form such as educational material and reports (Environmental Science, 2020). Digital mapping and presenting spatial data using geographic information system (GIS) tools is becoming increasingly popular. The synthesized data is often used, absorbed, and compiled with other data sets from different environmental disciplines to form a whole picture of a given situation (Environmental Science, 2020).

The Environmental Professional must be aware of:

- Data quality interpretation
- Quality assurance
- Measurement error
- Non-detects measurement

3.3.3.1 Data Quality Interpretation

Data quality is crucial to making informed decisions. Data quality can be understood as the state of data, which can be aligned with its ability or inability to solve a task (Mikhailouskaya, 2020). Data in this right could be good or bad, and often carries the following attributes:

- Consistency
- Accuracy
- Completeness
- Auditability
- Orderliness
- Uniqueness
- Timeliness

Poor quality data can result in consequences; therefore, steps can be taken to improve the quality of data. These best practices include making data quality a priority, automating data entry, preventing duplicates, and taking care of both master and metadata (Mikhailouskaya, 2020).

3.3.3.2 Quality Assurance

To ensure a process, item, or service meets the users needs (i.e., data quality and type), a system of management activities is performed. These activities are better known as quality assurance (Government of Canada, 2017). Through quality assurance, the system creates management controls that go over planning, implementing, and reviewing data collection activities. An example of this process is the Integrated Atmospheric Deposition Network (IADN) which has implemented a quality assurance strategy to monitor the trends and loading of toxic chemicals in the Great Lakes. By implementing this quality assurance strategy, the monitoring data produced by the Network is credible, defensible and of known accuracy and precision (Government of Canada, 2017).

3.3.3.3 Measurement Error

Measurement error is defined as the difference between the true value of the data and the measured value collected. Accuracy can be understood as how close a measurement is to the correct value of that said measurement. Precision is how close the agreement is between a repeated measurement within a measurement system. In this regard, measures can be accurate and precise, accurate and not precise, precise but not accurate, or neither accurate nor precise (Lumen Learning, 2020). A data measurement error may arise and be classified as a) gross error, b) systematic error or c) random error, as illustrated in **Figure 5** that follows.

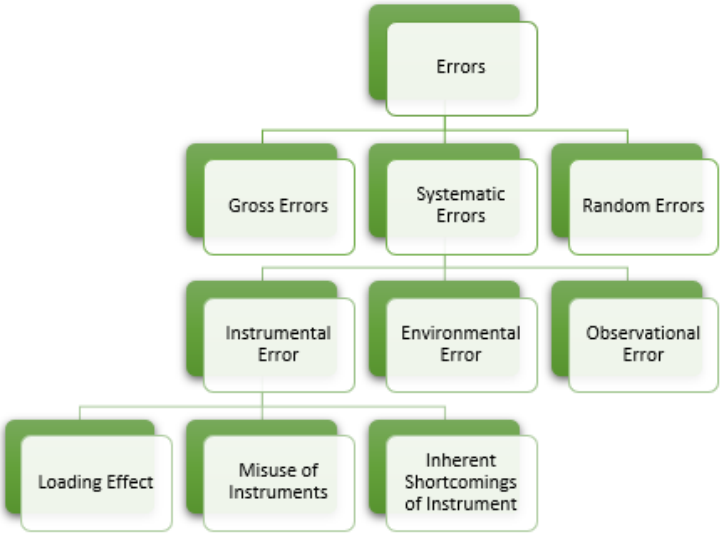

Figure 5: Types of Error in Data Measurement

3.3.3.4 Non-Detects Measurement

Environmental data sets for chemical parameters often include samples with concentrations below the analytical limit of detection; these samples are referred to as non-detects (Science Direct, 2019). Non-detects can introduce complications into data analysis because they are not numbers and cannot be counted, averaged, contoured, etc. However, samples presenting as non-detects can provide useful information that should not be discarded or ignored. When contouring a contaminant plume, for example, the non-detects provide an outer bound for a low concentration contour (Science Direct, 2019).

3.3.4 Data Collection and Management Tools

Data collection tools refer to the devices and instruments that are used to collect data, such as pen and paper or digitally assisted collection systems (e.g., tablets, iPads, and software) (Formplus, 2020). In today's digital world, many tools are available for data collection and management. Examples of these tools to collect environmental data include water level meters, interface probes, vapor meters, and dissolved oxygen meters. Data collection applications can provide custom mobile data collection forms for variables including soil, air, and water quality, wildlife monitoring, invasive species tracking, and tree surveys (Formplus, 2020).

Remote Sensing is the science of capturing information about the Earth's surface using reflected or emitted energy collected by sensors mounted on satellites, aircrafts, or drones (Natural Resources Canada, 2020). RADARSAT, a Canadian remote sensing Earth observation satellite program overseen by the Canadian Space Agency, is used to deliver government services to Canadians in three main areas: maritime surveillance, disaster management and ecosystem monitoring (Natural Resources Canada, 2019). Remote sensing provides powerful tools for observing everything from sea ice to land cover, to vegetation type, over broad areas.

Although remote sensing and digital tools are wonderful data collection and management aids, field work and physical sampling processes are still required for many environmental fields. Sampling of tissue for contaminant levels in fish might be required, for example, to assess ecosystem health at an existing or prospective mine site. Sampling of soil, rock, or groundwater might be required to assess sites for potential waste disposal or to track contaminant plumes.

3.3.5 Systems Thinking in Environmental Practice

Systems thinking is a relatively new approach to analysis that focusses on how the different parts of a system interrelate and how systems work within the context of other, larger systems. This holistic approach to analysis contrasts with the traditional approach, which studies systems by breaking them down into their separate elements. Faced with complex problems of climate change, rapid population growth, pollution, deforestation and biodiversity loss, systems thinking represents one of society's best opportunities for making real progress (Seibert, 2018).

In the environmental field, systems thinking requires people to consider that a system is a dynamic and complex whole, situated within an environment, and that objects within a system are interdependent. Practically speaking, systems thinking asks us to expand our problem-solving frameworks and more carefully consider how we will define problems, plan studies, collect and manage data, and analyze and communicate findings. Environmental Professionals studying potential impacts of a mine development, for example, must recognize that ecological systems (for example a forest containing a certain tree-based crop) and human systems (an economy based around harvesting of a crop, which might be affected by the new jobs created at the mine) are interrelated.

An example of systems thinking is the PPDAC Model; the PPDAC short form stands for the cyclical steps of Problem, Plan, Data, Analysis, and Conclusions. The PPDAC Model is a methodological framework for applying the scientific method to an analytical or research question (Smith, Goodchild, & Longley, 2007). It emphasizes the need for Environmental Professionals to consider how the data will be analyzed before it is collected.

3.4 Impact Management

Impact management is a core area of knowledge for Environmental Professionals because it comprises of the fundamental principles for the environment profession. This section of the EP Body of Knowledge discusses the management of environmental, social, and economic impacts resulting from human development. Topics include concepts of cumulative impact assessment, environmental assessment and impact assessment legislation and framework, and significance.

The Environmental Professional must be aware of and knowledgeable about:

- Environmental health and safety
- Environmental impact assessment

- Reclamation and restoration
- Environmental site assessment and remediation
- Historical resources
- Environmental management
- Environmental auditing

3.4.1 Environmental Health and Safety

Environmental Health and Safety (EHS) is about ensuring that steps are taken to protect the environment from the actions of an organization, while also ensuring that people are protected from their environment (Environmental Science, 2020). EHS refers to the prevention and reduction of accidents, emergencies, and health issues at work, along with any environmental damage that could result from various work practices. These EHS tasks are generally the responsibility of specific environmental health and safety departments within an organization.

3.4.1.1 Public Safety – Protecting People and the Environment

Understanding the interdependency between societies, the economy, and the environment is the reason that human health and public safety are intricately tied to the state of our environment. When economic gains are favored above the environment and society, public safety is negatively impacted. Several examples of social injustice resulting from a lack of environmental oversight illustrate the detriment to public safety when the quality of our environment is jeopardized. The Sydney Tar Ponds story is one these examples.

Starting around 1900 and for nearly 100 years, the Sydney Steel Corporation (later known as Sysco) was an important industry in Cape Breton and used locally mined coal and iron-ore (Jala, 2019). The steel making industry provided jobs for the people of Cape Breton and Sydney, but it left a legacy of environmental degradation. Today, the story of the “Sydney Tar Ponds” provides an example of one of Canada’s most polluted sites and the great efforts required to clean it up. The lack of environmental oversight led to significant degradation and effects on public health and safety. (CBC News, 2010).

In 1980, the Department of Fisheries and Oceans discovered high levels of polychlorinated biphenyls (PCBs), mercury, lead, and polynuclear aromatic hydrocarbons (PAHs) in the lobster of Sydney Harbour. These contaminants were attributed to the coke ovens of the steel mill; waste from the coke ovens was deposited as sludge into the infamous “tar ponds”. Run-off from the tar ponds flowed by way of a brook into the harbor. The lobster fishery was shut down; the pollution problems became well-documented and were proven to have affected the public in surrounding neighborhoods.

The story of the cleanup is long and complicated and cost hundreds of millions of dollars. The cleanup involved the input of all levels of government and significant efforts by citizen’s groups and environmental organizations (notably the Sierra Club Canada). The process culminated in 2014 with the opening of Open-Hearth Park. The Park was built atop the tar ponds after they had been solidified and stabilized by the addition of Portland cement powder, capped, and otherwise isolated from the

surrounding environment. Contributors to the eventual success of the remediation were the formation of a special agency of the government of Nova Scotia, a Community Liaison Committee, the Joint Action Group (a diverse advisory group) and more than 100,000 hours of volunteer time (Sydney Tar Ponds Agency, 2020).

Environmental justice stresses the need for public policy to be based on respect and justice for all people, void of any sort of discrimination or bias (Green Action, 2020). Environmental justice is the fair treatment and involvement of people with respect to the development, implementation and enforcement of environmental laws, regulations, and policies (Department of Energy, 2020). Environmental justice is understood to ensure all people and communities gain equitable and equal access to environmental benefits.

3.4.1.2 Occupational Health and Safety – Protecting Individuals from the Working Environment

Occupational health and safety legislation are designed to keep individuals safe from hazards presented by a working environment. In Canada, there are 14 occupational health and safety jurisdictions representing federal provincial and territorial areas. Federal legislation applies to employees of the federal government including Crown agencies and corporations across Canada. Approximately 6% of the Canadian workforce falls under the Occupational Health and Safety jurisdiction of the federal government; this jurisdiction includes organizations that operate provincial or international borders, such as canals, exploration and development of petroleum, highway transport, First Nations activities, pipelines, and shipping services to name a few (CCOHS, 2020). The federal health and safety legislation are commonly referred to as the Canada Labour Code. Under occupational health and safety regulations, agencies are aligned with the requirements of where the individual completes the work. For context, if a contractor is working on a federal project, and the work done is primarily within municipal or provincial lands and not on federal lands, said contractor would be regulated provincially.

Depending on the province or territory, a worker's compensation board or commission takes on the responsibility of occupational health and safety. When a person is placed in a complex jurisdictional position, a "jurisdictional review" will be exercised to best understand which regulations would be applicable.

Provincial and territorial authority applies to most Canadians, dependent on the work locations, with some exceptions. Each province or territory has its own set of occupational health and safety legislation that applies to most workplaces in the region. These Acts generally do not apply to workplaces in private homes, nor do they apply to farming operations unless specific regulations apply. In each case, it is recommended that legislation be consulted to determine regional nuances.

Within the Occupational, Health and Safety program, organizations may have different scopes and needs; however, there are some major components that are necessary (CCOHS, 2020). These necessary components include:

- Individual responsibility
- Joint occupational health and safety committee

- Health and safety rules
- Correct work procedures
- Employee orientation
- Training
- Workplace inspections
- Reporting and investigating accidents/incidents
- Emergency procedures
- Medical and first aid
- Health and safety promotion
- Workplace specific items

Control of exposure to hazardous substances is a major emphasis of Occupational Health and Safety Regulations. People are much more likely to be exposed to these substances while on the job than at home. The regulations generally require that project owners identify certain hazardous substances to all workers, such that plans can be put in place for the workers' protection. Asbestos is arguably the most important and most regulated of the hazardous substances, especially when considering the number of people killed through exposure to it.

Asbestos is a mineral that was used in building construction for its thermal properties, high tensile strength, low electrical conductivity, and its ability to withstand chemical breakdown. Mined in the Eastern Townships of Québec, this mineral was as added to a myriad of building materials including pipe and tile, drywall joint compound, duct wrap, and caulking to name a few. It eventually became clear that an individual's exposure to this mineral resulted in dangerous health complications, including cancers like mesothelioma. Workplace exposure originally took place in mines and factories but moved into the construction and building maintenance industry, affecting workers disturbing and breathing in the friable (easy to make airborne) material. Today, because asbestos is the top workplace killer in Canada, the control of workplace exposure is a major focus of provincial, territorial, and federal health and safety regulations (Young, 2014). In 2018, the Government of Canada made it illegal to import, manufacture, sell, trade, or use products made with asbestos to protect individuals from this workplace environmental risk (Environment and Climate Change Canada, 2018).

3.4.1.3 Environmental, Health and Safety Management

Environment, Health, and Safety (EHS) Management is a discipline that studies and exercises environmental protection and safety at work through practicality as a means of achieving legislative requirements related to Occupational Health and Safety (National Research Council of the National Academies, 2011). An organization's EHS department typically oversees a range of hazards that includes ergonomic hazards, exposure to carcinogens, falls from height, and heavy machinery. Environmental Health and Safety Management strategies present practical approaches that aim to:

1. Protect employees, their health, and the natural environment
2. Comply with legal requirements and regulatory standards

3. Increase productivity, profit, and morale

EHS Management responsibilities cover the environment, health, and safety of people at work. From an environmental perspective, EHS Management creates a structured approach to abiding by environmental regulations, such as managing waste or air emissions, and may even incorporate policies and procedures aimed to decrease an organizations carbon footprint. From a health perspective, EHS Management strategies aim to develop safe, high quality, and environmentally friendly processes, working practices and systemic activities to prevent or reduce the risk of harm to people. And finally, from a safety perspective, EHS Management strategies include creating policies and procedures that help identify workplace hazards and reduce accidents and exposures to harmful situations and substances in the workplace. EHS programs with respect to health. (National Research Council of the National Academies, 2011).

The intentions of an EHS Management policy are to (National Research Council of the National Academies, 2011):

- Avoid or mitigate both economic and human losses from accidents, adverse occupational exposures, and environmental events
- Build EHS considerations into all parts of the operations, as well as laboratory discovery and development environments
- Achieve and uphold compliance with laws and regulations
- Ensure EHS performance improves continuously

The EHS policy and policy statement should be reviewed, revalidated, and revised by top management (i.e., Vice President and President) as often as necessary (National Research Council of the National Academies, 2011). It should be made available, accessible, and communicated to all employees and relevant interested parties, as appropriate.

3.4.1.4 Guidelines and Standards

As an Environmental Professional, it is important to be aware of and understand the basics of occupational health and safety, and your rights as a worker in your jurisdiction. The following sections highlight the rights of all workers within the Canadian environmental workforce as well as the basics of the insurance practices for workplace injuries and illnesses.

<u>Basic Occupational Rights</u>

There are laws in place across Canada that protect those in the workforce. The occupational health and safety legislation outlines workers rights that ensure they are safe on the job and have the freedom to take part in health and safety activities in their workplace (CCOHS, 2020). These rights are:

- The right to know what hazards are present in the workplace.
- The right to participate in keeping your workplace healthy and safe.
- The right to refuse work that you believe to be dangerous to yourself or your co-workers.

Safe Work Practices

Another element of the EHS management can be attributed to Safe Work Practices (SWP) and Safe Job Procedures (SJP) (Health and Safety Government of Yukon, 2020). SWPs tend to be guidelines set in establishing the "dos and don'ts" on a specific task that may not be performed the same way every time. The SJP is a step-by-step description of how a job is to be completed in an efficient and safe manner from start to finish.

Workers' Compensation Boards

Being provincially and territorially regulated throughout Canada, the purpose of a workers' compensation board, is to provide insurance for workplace injuries and illnesses. Although the workers' compensation boards work closely with their respective provincial government, the insurance programs are funded by the employers who require this coverage. (Moskal, 2013). The Workers' Compensation Acts provide the typical roles and responsibilities endowed upon the worker, employers, and the respective workers compensation board if and when an injury or illness occurs in the workplace (Moskal, 2013).

3.4.2 Environmental Impact Assessment

Environmental assessment (EA) and impact assessment (IA) are synonymous terms used by regulating agencies to describe the process of predicting the environmental effects or impacts of proposed initiatives before they are carried out. A thorough EA / IA will consider cumulative effects as they relate to environmental, social, and economic factors.

EAs / IAs are designed to (Impact Assessment Agency of Canada, 2019):

- Identify potential adverse environmental effects
- Propose measures to mitigate adverse environmental effects
- Predict whether significant adverse environmental effects will remain following implementation of mitigation measures
- Include follow-up programs to verify the accuracy of the EA / IA and the effectiveness of the mitigation measures

As part of the environmental impact assessment process, Environmental Professionals must be aware of the following:

- Environmental assessment/impact assessment framework and process
- Legislation and regulations
- Cumulative effects
- Determination of significance
- Precautionary principle

3.4.2.1 Environmental Assessment/Impact Assessment Framework and Processes

An EA / IA is conducted in an effort to minimize or avoid adverse environmental effects before they occur, and to incorporate environmental factors into the decision-making process early in the planning

stage of a development initiative (Impact Assessment Agency of Canada, 2019). An EA / IA should be conducted as early as possible in the planning stage of a designated project to appropriately consider the analysis in the proposed plans; these plans should incorporate appropriate mitigation measures to address adverse environmental effects (Impact Assessment Agency of Canada, 2019). By initiating an EA / IA early in the planning phase, the proponent can reduce the risk of project costs and delays resulting from stakeholder, public and regulatory agency consultation.

A general EA / IA framework is presented in **Figure 6** (Sheath, 2018). The regulated processes and environmental timelines for environmental assessments vary by region, owner and the scope and nature of the project.

Figure 6: Environmental / Impact Assessment General Framework (Sheath, 2018)

When completing an EA / IA process, the professionals completing the assessment must consider (Impact Assessment Agency of Canada, 2019):

- Stating the purpose of the project
- Identifying alternative means / designs of carrying out the project

- Determining the environmental effects, including those caused by accidents and malfunctions, and cumulative environmental effects
- Determining the significance of identified environmental effects
- Soliciting and including public comments
- Designing and implementing mitigation measures and outline follow-up program requirements
- Recognizing changes to the project caused by the environment
- Incorporating the results of relevant regional studies

3.4.2.2 Legislation and Regulations

As previously mentioned, the legislative requirements in Canada vary by province, and by project. This section highlights when federal processes apply, namely on federal lands and on projects carried out by federal authorities. The federal legislation governing environmental / impact assessment processes is the *Impact Assessment Act,* 2019 (Impact Assessment Agency of Canada, 2019). Section 82 of this Act indicates when the Act applies (Impact Assessment Agency of Canada, 2019):

> ***82*** *An authority must not carry out a project on federal lands, exercise any power or perform any duty or function conferred on it under any Act of Parliament other than this Act that could permit a project to be carried out, in whole or in part, on federal lands or provide financial assistance to any person for the purpose of enabling that project to be carried out, in whole or in part, on federal lands, unless*
>
> > ***(a)*** *the authority determines that the carrying out of the project is not likely to cause significant adverse environmental effects; or*
> > ***(b)*** *the authority determines that the carrying out of the project is likely to cause significant adverse environmental effects and the Governor in Council decides, under subsection 90(3), that those effects are justified in the circumstances.*
>
> ***83*** *A federal authority must not carry out a project outside Canada, or provide financial assistance to any person for the purpose of enabling that project to be carried out, in whole or in part, outside Canada, unless*
>
> > ***(a)*** *the federal authority determines that the carrying out of the project is not likely to cause significant adverse environmental effects; or*
> > ***(b)*** *the federal authority determines that the carrying out of the project is likely to cause significant adverse environmental effects and the Governor in Council decides, under subsection 90(3), that those effects are justified in the circumstances.*

Provincially, environmental assessment acts are regulated through the primary environmental regulating authority. For example, in Newfoundland and Labrador it is the Minister of Municipal Affairs and Environment, in British Columbia it is the Minister of Environmental Protection and Sustainability,

and in Ontario it is the Ministry of Environment, Conservation and Parks. Provincial Environmental Assessment Legislation is generally supported by environmental regulations.

The Impact Assessment / Environmental Assessment process in Canada's northern territories is based on a co-management approach; this approach is rooted in the legal and cultural frameworks of land claims agreements with Indigenous peoples. Each territory thus has its own regulatory regime, defined in legislation specific to the region (Crown-Indigenous Relations and Northern Affairs Canada , 2018):

- Yukon: *Yukon Environmental and Socio-economic Assessment Act, 2003*
- Northwest Territories: *Mackenzie Valley Resource Management Act, 1998*
- Nunavut: *Nunavut Planning and Project Assessment Act, 2013*

3.4.2.3 Cumulative Effects

Cumulative effects are defined as changes to environmental, social, and economic values caused by the combined effect of past, present, and potential future human activities and natural processes (Government of BC, 2020). A cumulative effects assessment is a systematic process that identifies, analyses, and evaluates cumulative effects (CCME, 2014). Following the assessment, cumulative effects management can be implemented, where it is defined as implementations to control, minimize or prevent adverse cumulative effects as determined through the cumulative effects assessment (CCME, 2014).

The guiding principles for cumulative based management include (CCME, 2014):

- Knowledge based assessment to measure performance and support development outcomes and objectives
- Outcomes and environmental objectives are determined recognizing economic, social, and environmental implications
- Future-focused, forward-looking approach balancing environmental, social, and economic factors
- Place-based and site-specific with the intention of bringing people and their activities together
- Collaborative approach, although this principle can pose significant challenges
- Adaptive and corrective actions are identified and implemented if outcomes or objectives are not achieved
- Comprehensive use of regulatory and non-regulatory approaches

3.4.2.4 Determination of Significance

For the purposes of an Impact Assessment / Environmental Assessment, an effect is defined as the change to valued environmental components because of project activities (CEAA, 2018). Significance is determined from what is important, desirable, or acceptable, and the degrees of importance for environmental factors (CEAA, 2018). The Impact Assessment / Environmental Assessment process identifies valued ecosystem components and their baseline conditions; assesses the anticipated impacts of the project; and determines appropriate mitigation measures. Project related effects that remain

after mitigation are called residual environmental effects. Where project-related residual environmental effects remain, they may be characterized using specific criteria (*e.g.,* magnitude, geographic extent, duration, frequency, reversibility, and ecological/socioeconomic context), for a determination of significance. In other words, determinations of significance consider the interplay between residual impact criteria and the characteristics of the receiving environment (e.g., environmental significance, sensitivity, resilience, scarcity, stability, capacity) (CEAA, 2018). The determination of significance can vary depending on perspective and may vary among individuals, groups, and communities.

Before approving a development or a project proposal, regulating agencies will consider:

- If the residual environmental effects are adverse
- If the adverse environmental effects are significant
- If significant environmental effects are likely

For a project to have *significant environmental effects* on a valued environmental component, individuals would have to be affected to the extent that there would be a permanent adverse change to survival and reproduction at the population level (CEAA, 2018). **Figure 7** provides a decision tree to help determine significance (i.e., not significant, or significant) based on the sequential interaction between the magnitude, geographic extent, and frequency criteria for effects (defined as low, medium, or high) (CEAA, 2018).

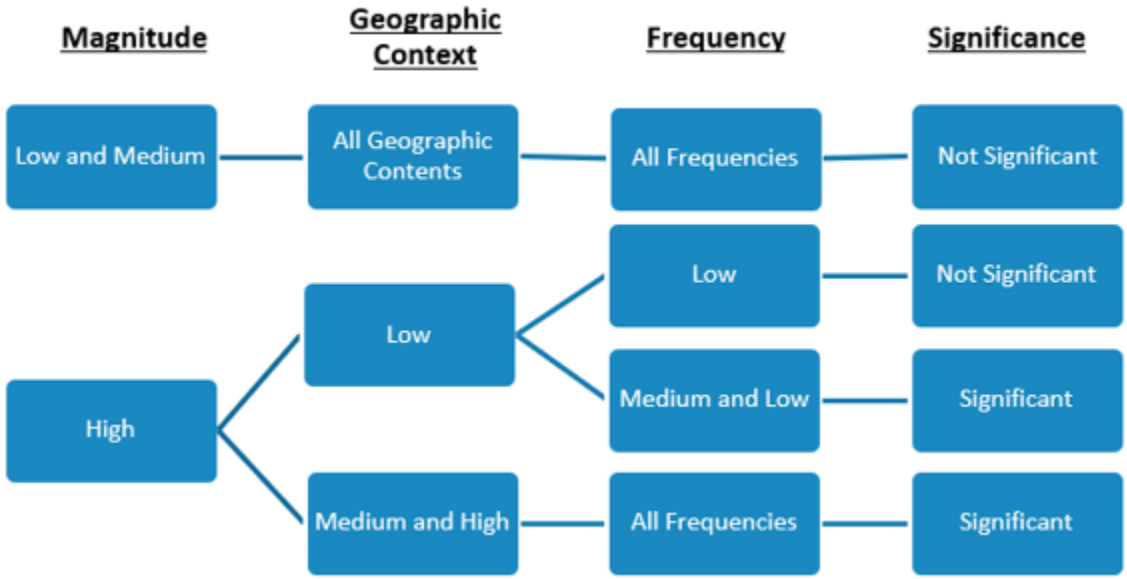

Figure 7: Significance Determination – Decision Tree

3.4.2.5 Precautionary Principle

The precautionary principle, when applied in an environmental context, is described as: "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (UNESCO, 2005).

The Precautionary Principle is a strategy to manage potential risks and impacts where scientific understanding is incomplete. Environmental Assessment / Impact Assessment processes are designed to manage risks using the precautionary principle, such that actions (mitigation measures) are applied before harm occurs to avoid or diminish the harm (UNESCO, 2005). Recommended mitigation measures should be proportional to the potential harm; the EA / IA determination must consider both the positive and negative consequences and assess the moral implications for both action and inaction (UNESCO, 2005).

3.4.3 Reclamation and Restoration

Environmental reclamation and restoration are two impact management techniques to restore and offset negative environmental effects. Environmental reclamation is defined as returning the disturbed environment back into either economically productive or natural habitats (Medicine Hat College, 2020). Environmental restoration is the process of mitigating environmental damage and may involve returning conditions or a region to its original state; however, it does not commit to returning the environment to a natural state but may involve making changes to lessen previous damage and prevent further damage in the future (Miller, 2020).

Mitigation, as a concept, relies on the baseline studies conducted during project planning phases. The mitigation hierarchy is defined, in order of preference as – avoidance, minimization, and restoration and offsetting (Cross Sector Biodiversity Iniatiative , 2017). Avoidance and minimization of environmental effects are typically managed through the planning and construction phases of a project, such that alternative designs are considered, sensitive areas avoided, and project footprints reduced to the extent practicable.

Following project completion and decommissioning, restoration and offsetting are implemented as needed. Restoration may include re-establishing biodiversity values, habitat types and/or ecosystem services (Cross Sector Biodiversity Iniatiative , 2017). Environmental compliance monitoring and auditing programs are integral in determining when, how and to what extent environmental restoration and reclamation are practicable.

Reclamation is a term generally used for soil and land-based processes. One technique for land reclamation is to make the land itself more productive than it was before the project; this reclamation technique could include artificial enhancements or reforestation (Green Growing, 2020). When large portions of land are excavated, for example, in open pit mining and aggregate resource extraction, plants are prevented from growing. In these cases, transplanting vegetation and making the soil more workable to support terrestrial ecosystems is an available reclamation technique (Green Growing, 2020).

Oil sands reclamation is an essential step in the mining of petroleum in western Canada. Its objective is to return land used for oil sands mining or tailings storage back to its original, natural state, with the goal being to "return land back to nature" (Stenhouse, Hanania, Sheardown, & Donev, 2019). Reclamation generally involves recontouring and stabilizing slopes, placing topsoil, and re-vegetating the

land. Monitoring of the reclaimed land is important to ensure that the efforts have been successful. Once standards set by government regulation have been met, sites are "certified reclaimed" and are permanently returned to the Crown.

In Ontario, rehabilitation of pits and quarries is governed by the *Aggregate Resources Act*, enacted in 1990. The Act ensures that extraction is only a temporary land use, and that rehabilitation returns each extracted site to its initial use or to uses compatible with surrounding land uses (OSSGA, 2011). Although beset by many challenges, pits and quarries are returned to other land uses such as for recreation, as naturalized areas including wetlands, or for new home construction. Studies continue to identify the best approaches for rehabilitation, including reusing local soils, planting native seeds, and assessing the results against baseline conditions. An example of a successful rehabilitation is the Milton Limestone Quarry, now the Kelso Quarry Park owned by Conservation Halton, home to a 19-ha lake, bordered by limestone cliff, beach and shallow marsh (OSSGA, 2019).

3.4.3.1 Progressive Reclamation Techniques

Progressive reclamation ("interim reclamation") is a Best Management Practice (BMP) that refers to 'cleaning up while you work' (CAPP, 2019). Progressive reclamation reduces ongoing environmental liability at a site that is no longer required by re-establishing part of the disturbed area (CAPP, 2019). For example, when drilling a natural gas well is complete and the well is producing, the drilling area can be recontoured and reseeded, given that the well may continue to produce for the next 20 to 30 years (CAPP, 2019). Another example of progressive reclamation from the aggregates industry, involves benching as part of quarry design where vertical quarry walls are restored to slopes as the stages of the extraction advance.

In the example of the Alberta Oil Sands, a reclamation certificate is issued when producers return reclaimed lands to the province, and state of the lands meets all regulatory requirements and landowner approval (CAPP, 2019).

3.4.3.2 Soil Testing

Prior to any reclamation activities occurring, testing soil quality is imperative. A soil survey with relevant interpretations is one of the first steps to be taken; a soil survey is planned and conducted in such a manner to allow for materials handling and soil reconstruction from the provided information (Alberta Agriculture, Food and Rural Development, 2004). Chemical composition of the soil, contaminant concentrations and physical experiments to test for erosion and collapse are all BMPs (OSSGA, 2019).

3.4.3.3 Testing Willow Species

Willow trees and shrubs are a highly adaptive species and are common in a wide range of site conditions in Canada (Natural Resources Canada, 2019). The Canadian Forest Service is testing the ability of willow species to revegetate disturbed mine sites (Natural Resources Canada, 2019). These tests involve investigating species characteristics that can be used to determine those best suited for achieving rapid

land reclamation and potential biomass production for commercial purposes (Natural Resources Canada, 2019).

3.4.4 Environmental Site Assessment and Remediation

Environmental Site Assessment (ESA) is the process that identifies the potential existence and severity of land contamination. “Remediation” is the term used to clean up the land contamination or otherwise mitigate its risks. An Environmental Professional should be aware of the overall context of contaminated sites, the associated legislation, the purpose of and potential content included in an ESA, and that remediation will be required to mitigate risk to health and the environment.

The Environmental Site Assessment and Remediation section of Core Knowledge is divided into the following:

- Contaminated sites and brownfields
- Federal and provincial regulations
- Environmental site assessment
- Remediation

3.4.4.1 Contaminated Sites and Brownfields

Contaminated sites have contaminants like heavy metals and petroleum hydrocarbons that interfere with their use. A famous example of a contaminated site is Love Canal, which was a toxic dump site in Niagara Falls, New York. By 1978, the land around the canal had been developed as a residential community with an elementary school on the in-filled canal. Negative health impacts, ranging from cancer, miscarriages and birth defects were observed to have resulted from exposure to the contamination (Thompson, 2016). Today, society better understands the negative effects of spilled, or deposited contaminants on property. Many of us have watched movies on this topic, for example Erin Brockovich and A Civil Action (about hexavalent chromium and about trichloroethylene in groundwater, respectively). Today, an unresolved example of a contaminated site is on the Grassy Narrows First Nation in northwestern Ontario. Over many decades, mercury from a pulp and paper manufacturing process was spilled into the environment contaminating the community’s food and water and resulting in adverse health effects (Gilson, 2019).

Once contamination is present on a site, it is very expensive to clean it up. This is the reason why studies into the environmental quality of land are now such an important part of the due diligence process (i.e., when a buyer undertakes studies to assess the value of the asset) during the purchase and sale of property. Banks and insurance companies are participants in the due diligence process associated with property sales; they advocate for better accuracy and certainty in assessment.

Governments own many contaminated sites, either because their operations caused contamination (e.g., spills at a Canadian Forces Base) or because the parties responsible for the contamination are unknown, unable, or unwilling to pay for needed remedial actions. These latter properties are known as “orphan sites”. Federal contaminated sites are tracked in the Federal Contaminated Sites Inventory

(FCSI), which is maintained by the Treasury Board of Canada Secretariat. As of 2020, 23,663 sites were listed in the FCSI. The Federal Contaminated Sites Action Plan (FCSAP) addresses the federal contaminated sites that pose the highest risks to human health and the environment through remediation and risk management. FCSAP funds custodian departments; $5 billion are budgeted for from its inception in 2005 to 2024. To ensure that custodians take a common approach to managing federal contaminated sites, the FCSAP follows a 10-step process set out in A Federal Approach to Contaminated Sites (Comtaminated Sites Management Working Group, 1999).

With increasing urbanization and population density of cities, the idea of brownfield development has emerged. A brownfield is a former industrial site, which, because of the prohibitive cost of cleanup, is vacant or underutilized. Municipalities provide incentives for brownfield development, often in the form of tax breaks (Federation of Canadian Municipalities , 2020).

3.4.4.2 Federal and Provincial Regulations

Federal and provincial laws prohibit release of toxic substances into the environment and therefore, prohibit the harmful effects that these releases have on the environment, including human and ecological health. These prohibitions are relevant to owners of contaminated sites because these sites might, by their nature, be in contravention of these laws. If a contaminated site is causing dangerous levels of toxic chemicals in well water, for example, a government will have the right to order a remedy.

Environmental protection Acts, like the *Environmental Management Act* in British Columbia, and the *Environmental Protection and Enhancement Act* in Alberta, set out the ways that contaminated sites are regulated and give governments powers to designate, regulate, and order clean-up. Typically, these Acts are supported by regulations that set out how contaminated sites are assessed, made known to the public, and remediated to specific standards. Examples of such regulations include the Ontario Regulation 153/04 – Records of Site Condition, the British Columbia Contaminated Sites Regulation, and the Alberta Remediation Regulation. A major emphasis of these regulations is the apportionment of liability for the cost of cleanup of contaminated sites, and relief from such liability when sites are cleaned up to the standards of the day.

3.4.4.3 Environmental Site Assessment

Environmental Site Assessment (ESA) is the process of investigating the existence of contamination on a property. Environmental Site Assessments are conducted in phases including:

- Phase 1 ESA. Phase 1, as defined in the CSA Z768-01 Standard, identifies potential site contamination through a process of reviewing background documents, collecting current visually accessible evidence on the site, and interviewing person(s) familiar with the site and its history. Phase I ESAs are non-intrusive (no sampling).
- Phase II ESA. Phase II ESA, as outlined by the Canadian Standard Association (CSA) Phase II ESA Standard Z769-00, confirms the presence of and characterizes the substances of concern at the given site. The Phase II ESA scope of work is intrusive and general consists of the following tasks: investigating subsurface soil and groundwater by advancing boreholes and installing monitoring

wells; conducting chemical analysis of representative soil vapour, soil, and groundwater; surveying groundwater levels to verify the groundwater flow direction; and preparing a report with findings.

Canadian Standards Association (CSA) publishes the standards for carrying out the phases of environmental site assessment. Although the CSA standards for ESA are comprehensive and often used as the standard for "due diligence" assessment of land, many other provincial and federal standards and guidelines may apply depending on the site and the purpose of the assessment. Examples include the "Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, CCME, 2016" for use when characterizing a federal site. Another example is the "*Alberta environmental site assessment standard*" which sets out the minimum requirements for Phase I and II ESA in that province.

3.4.4.4 Remediation

Remediation is the term used for the cleanup of contaminated lands. The scope and nature of remediation varies widely depending on the technical complexity, cost, and the drivers behind the effort. Where possible, for example, a petroleum company may entirely clean up a contaminated gasoline service station as part of a routine maintenance program, by excavating and disposing of the contaminated soil around its tanks. However, where the contamination is widespread and too expensive to clean up entirely, efforts, like encapsulating solid waste to prevent accidental exposure from above or pumping and treating of contaminated groundwater before it moves on to contaminate a drinking water source, are more common.

The drivers for cleaning up contamination are diverse. Governments have duties to protect the environment and people from harm; therefore, it is common for governments to clean up sites that they have adopted from bankrupt owners. For example, in the Giant Mine Remediation Project in Yellowknife, a freezing technique is being used to prevent arsenic trioxide from leaching out from underground chambers and stopes (Government of Canada, 2020). Corporations and owners of contaminated land may be driven to remediate land as a standard part of their operations, or by fear of charge under environmental law.

Remediation is a complex and emerging field, driven both to find alternative solutions to the traditional "dig-and-dump" approach involving heavy use of the local landfill, and to solve increasingly large and complex contamination problems. Common techniques for treating hydrocarbon contaminated soil use natural or introduced bacteria that degrade the hydrocarbons and make them non-toxic. These techniques, which can be completed ex-situ (i.e., with dug-up soil), rely on control of oxygen and moisture. A common technique for remediation of organic substances such as chlorinated solvents (i.e., perchloroethylene, or dry-cleaning fluid) is "in situ chemical oxidation" (ISCO) (EPA, 2012). In this technique, chemical oxidants are introduced to the subsurface causing a redox reaction and breakdown of the harmful compounds thereby avoiding excavating the contaminant soil. Research continues on thermal techniques, such as using electrical current to heat the ground and boil off difficult to access and mobilize coal tar (i.e., the by-product of coal gasification, which was used to make coal gas for street

lighting and heating in many city centers around the world) (LaChance, et al., 2013). Another example of an innovating remediation technique is phytoremediation, wherein plants are used to take up contaminants within their root systems (CPEO, 2020).

Increasingly, the techniques of human health and ecological risk assessment (HHERA) are used to identify source, pathway, and receptor of contaminants (Indigenous and Norther Affairs Canada, 2018). In fact, the compound-specific standards that governments have developed to assess the quality of environmental media (i.e., soil, groundwater, sediment, etc.) are based on this approach, using conservative, not site-specific, assumptions. Practitioners of HHERA consider the specifics of the site and its surroundings to derive safe levels of contaminants to support the development of engineering solutions to the most complex contamination problems.

3.4.5 Historical Resources

Historical resources, also known as heritage resources, are works of nature or human elements that have prehistoric, historic, cultural, natural, scientific, or aesthetic value. These resources can include artifacts such as arrowheads or paleontological objects like fossils (Manitoba Culture, Heritage and Citizenship, 1995); historic landscapes, structures, or buildings; or exterior sections of a building or structure.

Before development can be undertaken, a Historical Resource Impact Assessment (HRIA) may be required to help protect and understand the historical resources on the affected lands. This assessment is a process that locates, studies, and manages archaeological, historical, and paleontological resources and must be completed before industrial, private and government organizations can begin development (Lifeways of Canada Limited, 2019). A HRIA study can mitigate the possible destruction of heritage resources at the risk of a last-minute discoveries.

HRIA are field studies that determine if there is evidence of any historical resources conflicting with a proposed development. Field studies must be completed under snow-free and frost-free conditions and abide by all relevant regulations and requirements. HRIA reports often are thorough and detailed providing strong background information regarding the project and its potential impact to historical resources along with the methodologies exercised to undertake the assessment (Lifeways of Canada Limited, 2019). The reports should have clear recommendations on site significance, if the site should be mitigated, and what the mitigation options would be.

3.4.6 Environmental Management

Environmental management integrates ecology, policy making, planning and social development. It is described as an approach towards environmental sustainability (Barrow, 1999). Environmental management is interdisciplinary in that it aims to balance the needs of business and science while meeting the requirements of environmental law (Learn.org, 2020). Environmental management includes knowledge of a wide range of issues including pollution prevention practices, waste materials

management, natural heritage, socio-economic development, and the management of water and land resources (Learn.org, 2020).

Environmental management includes efforts to reduce environmental impacts ensuring all legislative requirements are met, and implementing environmental awareness projects, sustainable development, fundraising, and environmental consultation programs. These objectives can be met though Environmental Management Systems and best management plans and programs.

3.4.6.1 Environmental Management Systems

Environmental Management Systems (EMS) are a business management aid that develop plans with environmental considerations into business operations (Learn.org, 2020). An effective EMS decreases an organization's negative effects on the environment. An EMS can be described as an ongoing, cyclical process whereby an organization plans, implements, reviews, and improves actions and processes in order to meet its goals (Learn.org, 2020).

ISO 14001:2015 provides a framework and self-audit checklist for Environmental Management Systems. The checklist outlines ten high-level clauses that can help an organization implement an Environmental Management System compliant to ISO 14001:2015. These clauses include:

- Scope
- Normative references
- Terms and definitions
- Context of the organization
- Leadership
- Planning
- Support
- Operation
- Performance evaluation
- Improvement

Although the self-audit checklist is an effective tool for implementing an Environmental Management System, it is not a replacement for a third-party certified body. The checklist can help identify problem areas and successfully apply principles of continuous improvement while it defines a high level-overview of an organization’s performance (Process St., n.d.).

The concept of EMS stems from the realization that an integrated and proactive approach regarding environmental issues is necessary. These systems are designed to help organizations fulfill environmental regulations, obtain technical and economic benefits, and ensure environmental policies and objectives are adopted and abided by (Barrow, 1999). Generally, EMS follow the “Plan, Check, Do, Act” framework, as described by the Environmental Protection Agency (EPA, 2019) and illustrated in **Figure 8** that follows.

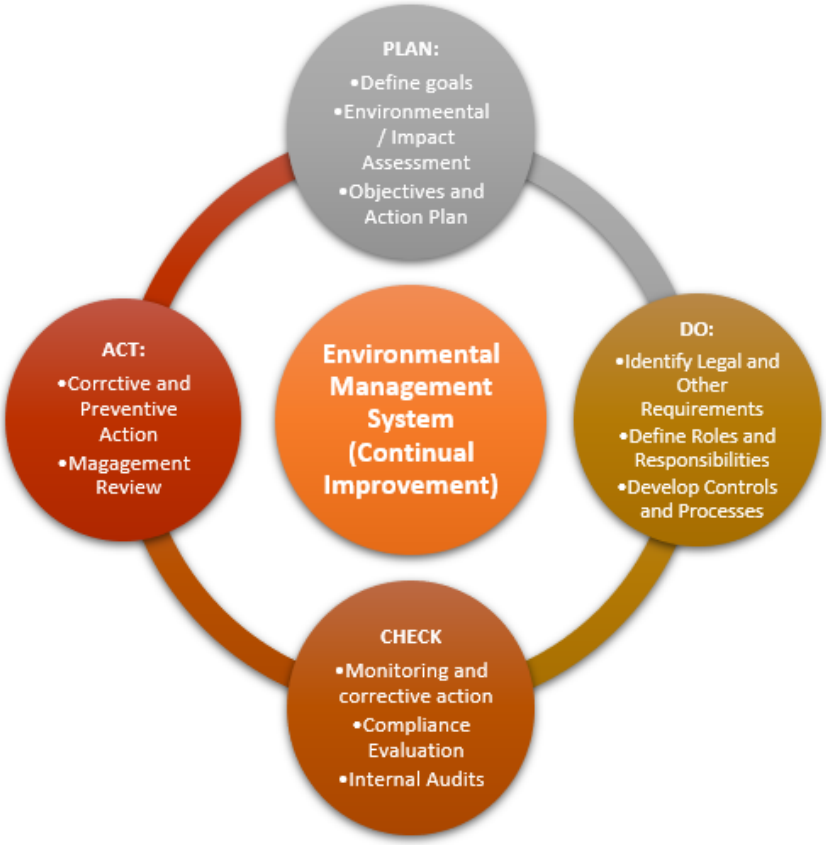

Figure 8: Environmental Management Systems Framework (EPA, 2019)

3.4.6.2 Best Management Plans and Programs

Best management plans (BMPs) and programs are science-based recommendations, which help organizations meet required standards or achieve the desired objectives. BMPs are typically developed for pollution prevention, but can also be developed on other topics, such as management of invasive species, the management of contaminated materials, etc.

In the field of water pollution control, the term BMP is used to describe supporting or auxiliary functions to engineered systems. For example, a water treatment system is a physical or engineered system, but the operation of it, including the chemicals used in its operation and the operator training and equipment maintenance is part of a best management plan or program. Environmental Professionals working in the field of environmental engineering will do work governed by and contributing to BMPs.

BMPs are also common in agriculture because of their focus on addressing non-point sources of pollution by disseminating knowledge. In Ontario, for instance, the Ministry of Agriculture, Food and Rural Affairs publishes a BMP series defined as “a practical, affordable approach to conserving a farm's soil and water resources without sacrificing productivity” (Ministry of Agriculture, Food and Rural Affairs, 2020). This series of documents, designed by and used by farmers, covers many topics including drainage, fertilizer use, manure management, etc.

Another example of the strengths and limitations of a BMP is Ontario's "Management of Excess Soil - A Guide for Best Management Practices" (Environment and Energy, 2019). The BMP, published in 2012, provided guidance on managing excess soil including the roles and responsibilities for both the source and the receiver and on how to handle excess soil generated from redevelopment and construction projects. The high-level guidance was useful to understand how projects could stay within Ontario environmental law but provided little regulatory control. As of 2019, the BMP has now largely been replaced by regulations (notably O. Reg. 406/19: On-Site and Excess Soil Management) (Government of Ontario, 2019).

3.4.7 Environmental Auditing

An environmental audit analyses an organization's products and processes to evaluate its performance from an environmental perspective. Environmental audits include:

- Compliance audits that determine if a business is meeting internal and external environmental guidelines and legislation.
- Management systems audits that measure if a business is meeting the criteria for management systems (i.e., environmental management systems as described previously).
- Functional environmental audits that determine the quality, exploitation and other aspects related to electricity and water.

Environmental auditing measures the conformity with requirements to conserve and protect the environment. In accordance with the universal standard for audits, ISO 19011:2018, audits can be understood as a "systematic, independent and documented process for obtaining evidence and evaluating it objectively to determine the extent that the audit criteria are fulfilled" (ASQ, 2020). Auditing scheduling is based on risk and often part of ongoing operations rather than projects. Environmental auditing is not conducted in conjecture with government agencies.

3.4.7.1 Compliance Auditing

Environmental compliance audits evaluate a projects or owner's legal compliance status, generally in an operational context. Compliance audits begin by determining the applicable legislated compliance requirements against which the operations will be assessed. Environmental auditing can happen in a variety of ways in Canada given many industries, regulators and provincial and federal ministries overseeing them (the ISOEDGE Ltd., 2020). Environmental compliance audits are a way to keep track of due diligence objectives and regulatory requirements and examine or evaluate internal processes. Although the following list is not exhaustive, environmental compliance audits may be completed for the following:

- Waste processing
- Bookkeeping and reporting
- Handling of hazardous chemicals/waste
- Permit compliance (the ISOEDGE Ltd., 2020)

3.4.7.2 Environmental Management Systems Auditing

Organizations conduct Environmental Management System audits to determine how it is meeting its own environmental performance expectations. When an organization considers conducting an Environmental Management System audit or implementing an audit program, it must first understand the benefits and limitations of auditing. Background research will provide a clear understanding of the scope of auditing, allowing informed decisions to be made based on the audits and methods of application. Environmental management systems audits are summarized in **Figure 9** as a five-step process (Gough, 2013).

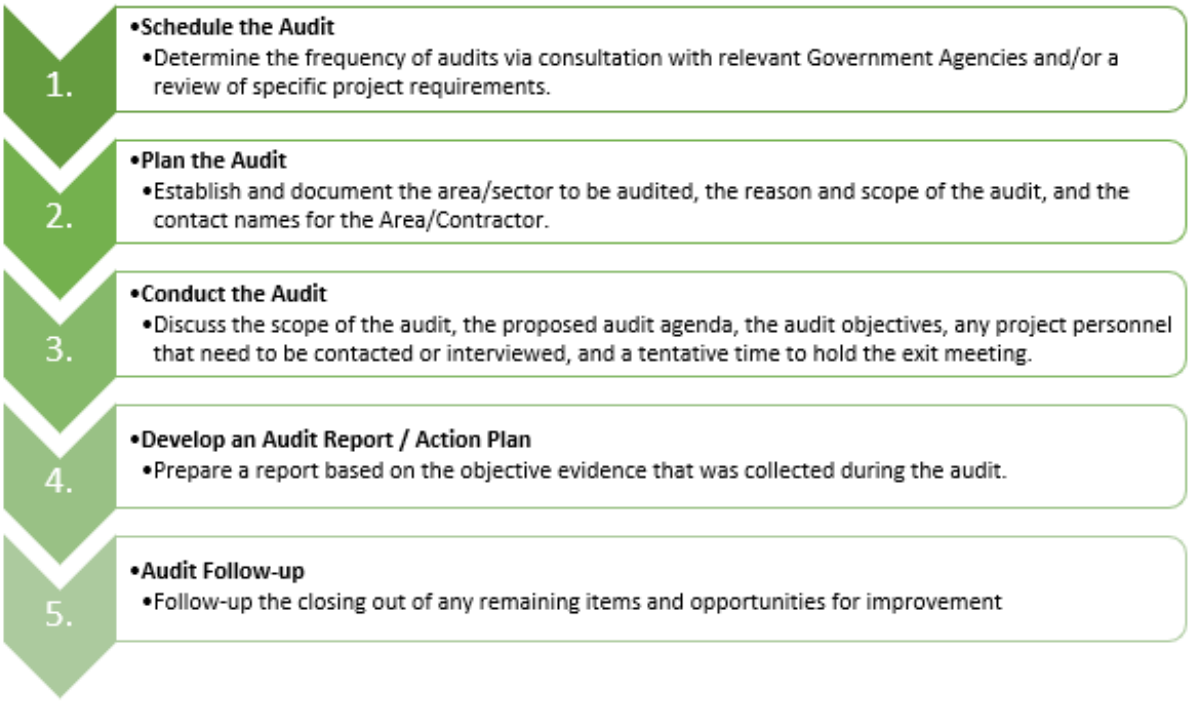

Figure 9: Environmental Management Process Audit - 5 Step process (Gough, 2013)

3.4.7.3 Functional Environmental Audits

A functional environmental audit is conducted to monitor quality, wholesomeness, utility, exploitation, and other aspects as they relate to electricity and water (Environmental Auditors, 2018). A functional environment audit provides the organization with:

- Legal requirements that can be met by the organization
- Specific statutory reporting requirements and how they are met.
- How the organization is environmentally responsible and how their environmental policy is implemented.
- Activities, products, and services environmental interactions.
- Recommendations on how to save money and improve environmental performance

3.5 Results Management

Environmental Professionals must effectively manage and communicate the results of their work and their findings. This core knowledge area discusses the planning, development and implementation, interpretation, presentation, and communication of environmental scientific data.

3.5.1 Environmental Project Management

Environmental project management requires a meticulous approach to project planning, organization, communications, implementation, and documentation. This thorough approach ensures federal, provincial, and local regulations, commitments and best management practices are developed and appropriately applied. Environmental project management phases include:

- Project initiation (triggers for the project)
- Project conception (relationship/role of projects to performing organizations)
- Project definition
- Project planning
- Implementation
- Close-out

Environmental project management, similar to any project management skill set, includes processes, best practices, technologies, and guidelines that are accepted as standards within the project management industry. Additional considerations for environmental project management include the impact that internal and external partners and stakeholders may have on project scope, budgets, and schedules.

3.5.2 Interdisciplinary Oversight

Governing agencies at the municipal, regional, provincial, and federal level provide interdisciplinary oversight of environmental projects to the scope of work and the associated potential project impacts. Interdisciplinary oversight is often coordinated through the Environmental Assessment / Impact Assessment process with agencies providing input and oversight in the areas under their specific specialty. Departments and agencies must work with each other to coordinate regulatory efforts and should examine ways to reduce regulatory duplication, promote efficiencies, and share relevant information to support the consideration of the cumulative impacts of regulations on stakeholders (Government of Canada, 2019). On complex projects, environmental consultants often work with other environmental consulting firms when reviewing their assessment, remediation and recommendations to clients, stakeholders, and regulators.

When projects are in the planning phase, regulating agencies determine their required level of involvement in the planning, construction, operational and decommissioning phases of projects. Prior to issuing approval, governing agencies may require certain conditions be met, including specific mitigation measures, pre-and post-construction and operational surveys, and monitoring programs.

3.5.3 Reporting and Communication of Results

Effective communication throughout the project, from planning through decommissioning and abandonment is essential for project success and maintaining positive working relationships with stakeholders. Stakeholders are vital to all projects; open communication and transparency with stakeholders is important to gain respect. While public consultation and some forms of stakeholder engagement rely more heavily on oral and visual communication techniques, reporting of findings, including the outcomes of the consultation sessions is often a technical writing exercise.

Environmental reporting refers to the presentation of unbiased scientific data and information relating to the environment and making that data accessible to non-technical audiences. Environmental reporting principles may include, but are not limited to (Environmental Reporting BC, n.d.):

- Using open and best available data, information, and knowledge
- Using rigorous, open, and repeatable scientific investigation
- Considering community, social and Traditional Knowledge
- Using leading edge science communication practices

Environmental reporting is often related to performance of environmental indicators, as determined through federal, provincial, and municipal approval, and permitting processes. Environmental indicators are defined as simple measures that present a clear picture of what is happening in the environment, and generally represent the status or trends of various environmental components (Environmental Reporting BC, n.d.). Certain environmental indicators may measure human activities with the potential to affect the condition of the environment and our responses to this change (Environmental Reporting BC, n.d.). Some key considerations for determining which environmental indicators to include in results reporting, include but are not limited to, components that are (Environmental Reporting BC, n.d.):

- Scientifically credible and accepted
- Relatively simple and cost effective
- Representative of key issues and broader impacts
- Responsive to changes within a useful reporting time scale
- Useful for prediction
- Relevant to the needs of policymakers
- Compatible with other indicators
- Readily communicable, interesting, clear, and easy to understand

3.6 Relationship Management

Relationship management is a core knowledge area for Environmental Professionals. It is a complex and dynamic challenge for the environmental field. Environmental problems require flexible and transparent decision-making processes that embrace diverse knowledge and values. Several participatory approaches are available in different disciplinary and geographical contexts.

This section of Core Knowledge for Environmental Professionals describes consultation approaches for diverse groups of people who may have an interest or have legal rights related to projects. This material is divided into the following subsections:

- Indigenous peoples and communities
- Stakeholder Identification
- Public engagement

3.6.1 Indigenous Peoples and Communities

The Government of Canada recognizes 619 First Nations, in addition to other various Indigenous, Métis and Inuit groups (Government of Canada, 2020). Indigenous rights and title are not granted from an external source but are the result of Indigenous peoples' own occupation of, and relationship with, their home territories as well as their ongoing social structures and political and legal systems (Indigenous Foundations, 2020). Indigenous title and rights are, therefore, separate from rights afforded to non-Aboriginal Canadian citizens under Canadian common law. Aboriginal title is recognized by the Canadian legal system as a unique collective right to use of and jurisdiction over a group's ancestral territories (Indigenous Foundations, 2020).

The Government of Canada is committed to achieving reconciliation (defined as the ongoing process that occurs in the context of evolving Indigenous-Crown relationships) with Indigenous peoples through nation-to-nation, government-to-government, and Inuit-Crown relationships based on the recognition of rights, respect, co-operation, and partnership (Government of Canada, 2018). Consultation and accommodation play a key role in the fulfillment of these reconciliation objectives. According to Indigenous and Northern Affairs Canada, reconciliation has two primary objectives:

- Reconciliation between the Crown and Aboriginal peoples
- Reconciliation by the Crown of Aboriginal and other societal interests (Indigenous and Northern Affairs Canada, 2011)

In 2008, under the terms of the Indian Residential Schools Settlement Agreement, the truth and reconciliation Commission of Canada was established (TRC, 2015). This commission was mandated to:

- Reveal the complex truth about the history and the ongoing legacy of the church-run residential schools, in a manner that fully documents the individual and collective harms perpetrated against Aboriginal peoples, and honours the resilience and courage of former students, their families, and communities.
- Guide and inspire a process of truth and healing, leading toward reconciliation within Aboriginal families, and between Aboriginal peoples and non-Aboriginal communities, churches, governments, and Canadians. The process was to work to renew relationships on a basis of inclusion, mutual understanding, and respect.

The following sections provide a high-level overview of Traditional Knowledge, belief systems and Indigenous and local rights. It is, however, important to emphasize that each Indigenous group will have

its own set of customs, beliefs, and acceptable consultation practices. Those initiating Indigenous relationships are advised to learn about the local customs and respect them as much as possible.

3.6.1.1 Traditional Knowledge

Traditional Indigenous Knowledge is a holistic, dynamic, and intergenerational know-how, linked to experience on traditional lands (Batiste, 2005). For Indigenous people, Traditional Knowledge includes all species and the Earth, as well as a deep understanding of the importance of sustainable, respectful, and sacred connections to the land. Indigenous knowledge may be shared in many ways including stories, traditions, skills, values, and myths. Traditional Indigenous Knowledge and traditional resources have been managed by Indigenous communities since time immemorial.

Figure 10 illustrates some of the shared knowledge and common ground between knowledge systems and western science and highlights some of the integral elements when comparing these two ways of knowledge (Stephens, 2003). When examined together, two ways of knowing provide for a more culturally responsive understanding. This figure was adapted from the Handbook for Culturally Responsive Science Curriculum (Stephens, 2003).

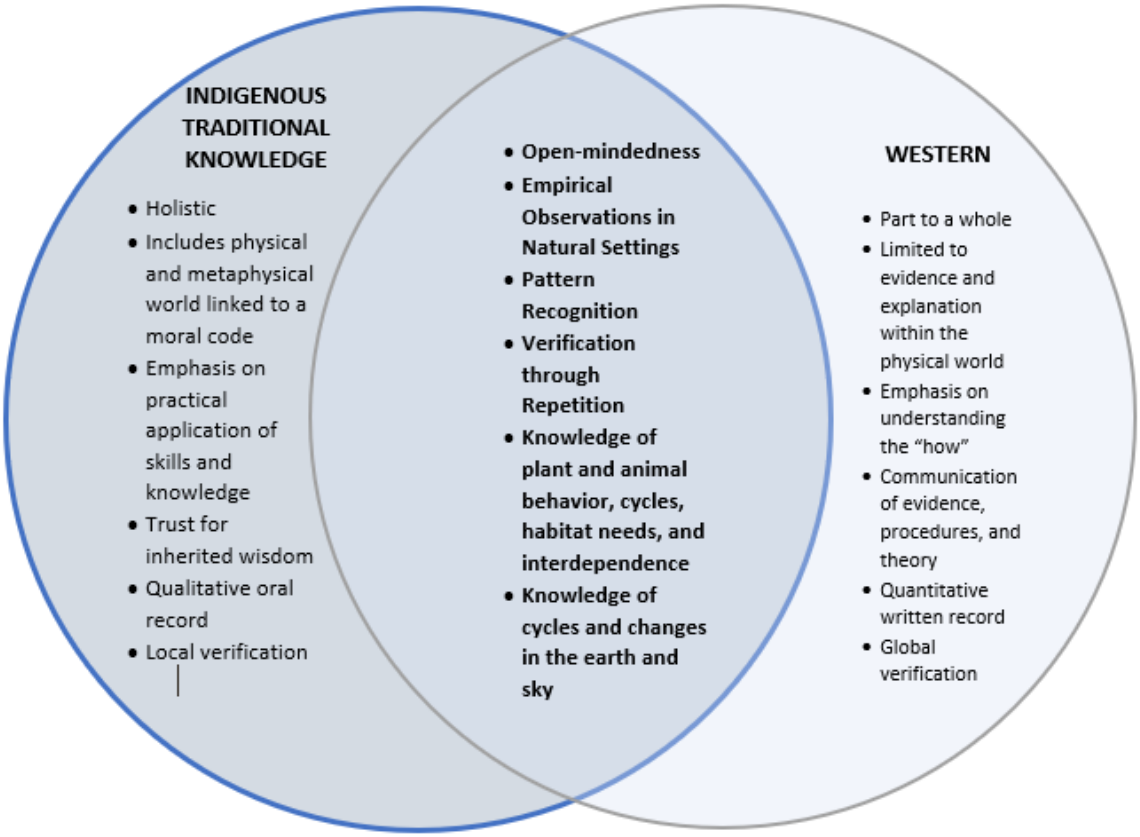

Figure 10: Indigenous Traditional Knowledge / Western Science Shared Knowledge and Common Ground (Gough, 2013)

The *Impact Assessment Act, 2019* contains a broad set of factors including requirements to consider Indigenous Traditional Knowledge to support holistic and integrated decision making. When working with Indigenous groups, however, it is important to remember that Indigenous Traditional Knowledge belongs to specific individuals and communities. The knowledge is often only shared based on mutual trust and respect, and with the understanding that certain details shall remain private as a means of protecting the physical and spiritual health of the individual, community, and the natural world.

3.6.1.2 Belief Systems

Spiritual beliefs and cultural practices of contemporary Indigenous peoples in Canada are deeply personal and vary widely (Smith, Parrott, & Filice, 2015; 2018). Commonalities within these spiritual beliefs and cultural practices include the presence of creation stories, the role of supernatural beings and the importance of sacred organizations (Smith, Parrott, & Filice, 2015; 2018). Traditional ways of life are intermingled with Indigenous Spirituality and belief systems, with many referring to Indigenous Spirituality as a "way of life" and "way of knowing" (Ontario Human Rights Tribunal, n.d.). For many, Indigenous Spirituality may be inseparable from their traditional Indigenous culture and identity (Ontario Human Rights Tribunal, n.d.).

Some Indigenous spiritual practices include partaking in specific activities, sometimes at times of the day, week, or year. Examples of spiritual practices may include life ceremonies, such as birth, naming, and death; spiritual ceremonies including full moon, solstice, and harvest ceremonies; and seasonal hunting such as for goose or caribou that are dictated by nature and the season. These Indigenous spiritual practices are protected human rights; they are under the United Nations Declaration of the Rights of Indigenous Peoples, which is a global affirmation of Indigenous peoples' existing rights (United Nations, 2008). Environmental Practitioners must be aware of how these practices may affect their projects, schedules, and budgets. For example, where community consultation or engagements are scheduled, they may need to be canceled or rescheduled in the event of a death in the community.

3.6.1.3 Indigenous and Local Rights

Indigenous rights and title are affirmed according to Section 35 of the *Constitution Act*, 1982. Generally, Aboriginal / Indigenous rights are fact and are site specific with reference to the practices, traditions and customs that are integral to the distinctive culture of the group claiming the right that existed before contact with Europeans (Indigenous and Northern Affairs Canada, 2011). For Métis groups, these rights refer to the time before Europeans effectively established political and legal control in the claimed area (Indigenous and Northern Affairs Canada, 2011).

Generic Aboriginal Rights are held by all Indigenous peoples in Canada (Hanson, Aboriginal Rights, n.d.), and include:

- Rights to the land (title)
- Rights to subsistence activities and resources
- The right to self-determination and self-government
- The right of cultural integrity

- The right to enter treaties

Specific rights are on described as those held by an individual Aboriginal group, and may be recognized as conditions found within treaties, or those defined as a result of a court case (Hanson, Aboriginal Rights, n.d.). Aboriginal rights are collective rights that come from Aboriginal peoples continued use and occupation of certain areas; therefore, Aboriginal rights tend to be different from the rights given to non-Aboriginal Canadian citizens under the Canadian common law (Indigenous Foundations, 2020).

Aboriginal title refers to an Aboriginal right to the exclusive use and occupation of land; it is possible for two or more Aboriginal groups to establish Aboriginal title to the same land (Indigenous and Northern Affairs Canada, 2011). This right comes as a result Aboriginal people's own occupation of and relationship with their home territories along with continual social structures and legal and political systems (Indigenous Foundations, 2020).

3.6.1.3.1 United Nations Declaration on the Rights of the Indigenous Peoples (UNDRIP)

In 2010, the Government of Canada endorsed the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), which provides an internationally recognized framework for measuring the human rights of Indigenous peoples (Ontario Human Rights Tribunal, n.d.). Some of the UNDRIP Articles that relate to the rights of Indigenous peoples pertaining to spirituality include (United Nations, 2008):

- **Article 12(1):**
  Indigenous peoples have the right to manifest, practice, develop and teach their spiritual and religious traditions, customs and ceremonies; the right to maintain, protect, and have access in privacy to their religious and cultural sites; the right to the use and control of their ceremonial objects; and the right to the repatriation of their human remains.
- **Article 25:**
  Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard.
- **Article 34:**
  Indigenous peoples have the right to promote, develop and maintain their institutional structures and their distinctive customs, spirituality, traditions, procedures, practices and, in the cases where they exist, juridical systems or customs, in accordance with international human rights standards.

These UNDRIP articles highlight the importance of engaging Indigenous groups early in project planning; when inherited treaty rights are infringed, the duty to consult is required. Identification and protection of key Indigenous Spiritual areas, burial grounds, and hunting and fishing territories, for example, is not only regulated by Canadian and provincial environmental law, but also upholds protected human rights.

3.6.1.3.2 Constitution Act, 1982 – Section 35

'Duty to Consult' is a statutory, contractual, and common law requirement that must be fulfilled by the Crown before taking actions or making decisions that may have consequences for the rights of Indigenous peoples in Canada (Irwin, 2018). Section 35 of the *Constitution Act, 1982 affirms t*hese requirements.

Section 35 of the Constitution Act (1982) recognizes and affirms Indigenous / Aboriginal rights, and states:

> **32**(1) The existing aboriginal and treaty rights of the aboriginal peoples of Canada are hereby recognized and affirmed.
>
> (2) In this Act, "aboriginal peoples of Canada" includes the Indian, Inuit and Métis peoples of Canada.
>
> (3) For greater certainty, in subsection (1) "treaty rights" includes rights that now exist by way of land claims agreements or may be so acquired.
>
> (4) Notwithstanding any other provision of this Act, the aboriginal and treaty rights referred to in subsection (1) are guaranteed equally to male and female persons.

Section 35 falls outside of the Charter of Rights and Freedoms; it begins Part II of the Constitution Act. Section 35, therefore, is exempt from the "notwithstanding clause" that applies to the Charter, and thus, the federal government cannot override Aboriginal rights (Hanson, Constitution Act, 1982; Section 35, 2009).

3.6.1.3.3 First Nation Protocol on Traditional Territory

It can be expected that when one First Nation is within the traditional territory of another, the host Nation Peoples and their traditional territory are recognized at the outset of any meeting (Indigenous Corporate Training Inc., n.d.). Although many Indigenous traditions have been lost, this basic protocol has survived. Respectful acknowledgement of Indigenous protocol is increasingly becoming the norm because it acknowledges and recognizes the land of a Nation that has had a relationship with the land since time immemorial (Indigenous Corporate Training Inc., n.d.).

Acknowledging Indigenous territory at the beginning of meetings, conferences, and information sessions shows recognition of and respect for the Indigenous peoples. Relationships built on recognition, respect and healthy reciprocal relations are integral to reconciliation.

The wording used in an acknowledgement is dependent on whether the territory is First Nations, Métis, or Inuit land (Government of Canada, 2020). Prior to acknowledging traditional territory, it is important to determine whether a modern territorial agreement or treaty exists between the Nation and Canada. When a modern territorial agreement or treaty exists, the wording of the territorial acknowledgement

will refer to “traditional territory.” When no such modern territorial agreement or treaty exists, the wording will refer to “unceded traditional territory.”

If acknowledging Métis Nation territory, do not to refer to it as “traditional” (Government of Canada, 2020). When several Indigenous Nations occupy the same territory, it is important that all be named in the acknowledgement (Government of Canada, 2020).

3.6.2 Stakeholder Identification

Stakeholders include Indigenous Peoples, their communities or Indigenous Peoples and their communities, and individuals or groups who may have a direct or indirect interest in the project. Stakeholders include people who are simply interested in the matter, and people who are potential beneficiaries or risk-bearers. They may be internal, people from within the organization, and may include owners, managers, employees, shareholders, volunteers, interns, or students (BC Campus Open Ed - Press Books, n.d.). Stakeholders also include those external to the organization, including but not limited to, community members or groups, investors, suppliers, consumers, policy makers (BC Campus Open Ed - Press Books, n.d.).

3.6.2.1 Consultation Process

Environmental problems are often complex and dynamic, requiring flexible and transparent decision-making that acknowledges and embraces a diversity of values and ways of knowing (Reed, 2008). Consultation can happen many capacities including various levels of engagement. Consultation can range from simply informing people and providing information, to actively seeking consent as illustrated in **Figure 11** that follows (BC Campus Open Ed - Press Books, n.d.).

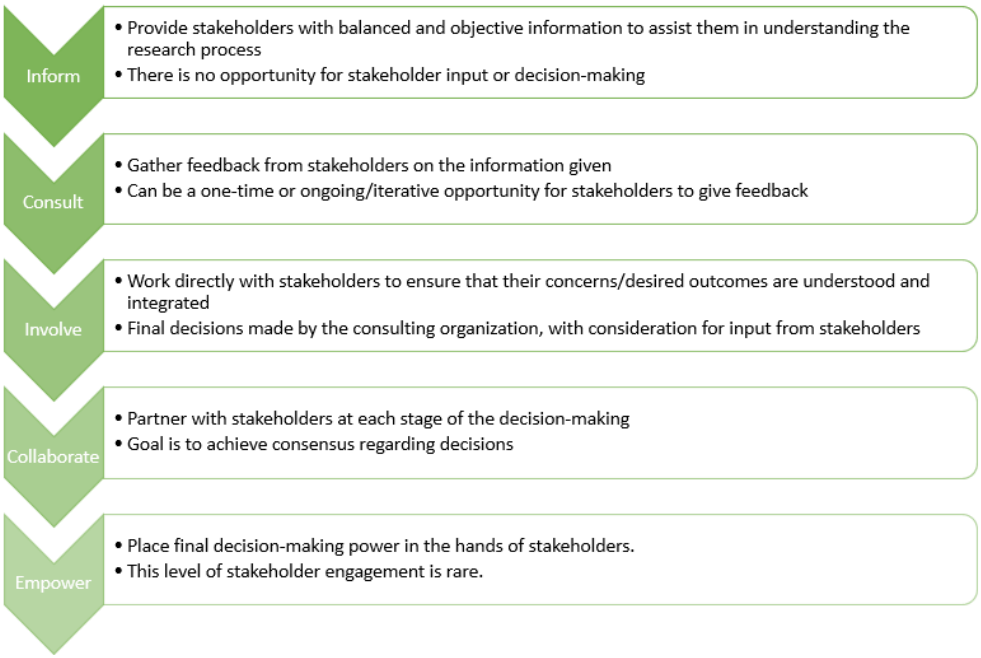

Figure 11: Stakeholder Engagement Spectrum (BC Campus Open Ed - Press Books, n.d.).

The level of stakeholder engagement may vary by project, by the potential impacts and by the types and needs of stakeholders (BC Campus Open Ed - Press Books, n.d.). A broad spectrum of levels and strategies of engagement exist. When planning and implementing projects, proponents must choose which ones to use.

3.6.2.2 Respectful Engagement

Respectful stakeholder engagement promotes learning and innovation through fair, transparent, inclusive, and responsive processes. Learning from stakeholders, Indigenous groups and communities means respecting and acknowledging the contribution they can make to projects. Respectful engagement is more likely to result in environmentally sustainable, socially equitable, and economically viable projects. Stakeholder participation should be supported by a philosophy that emphasizes empowerment, equity, trust, and learning (Reed, 2008).

3.6.2.3 Stakeholder Identification

Within the consultation process, it is often critical for the proponent to engage, properly inform, and encourage stakeholder participation. Early in the planning phases of a project, stakeholders must be identified including their level of interest in the project, the potential impact it will have on them, and the power they have to shape the process and the outcome. Brainstorming potential stakeholders, engaging known stakeholder agencies, and ensuring meaningful engagement by the project proponent will help in identifying stakeholders.

3.6.2.4 Affected vs. Interested Parties

Following stakeholder identification, it is good practice to organize them into categories or a matrix. One standard method of organizing stakeholders is to determine which stakeholders likely support the project and which ones likely oppose it; then determine how much power or influence each of those groups has (BC Campus Open Ed - Press Books, n.d.). Another method involves organizing the interested parties into interest groups such as business groups, regulating authority/government agency groups, and public advocacy or local interest groups. This approach allows specific meetings to be catered to the audience and to the varying interests.

Affected parties are stakeholders whose “stake” in the project will be impacted or affected in some way. These affected parties may include adjacent property owners, regulating agencies, and those with economic interest in the project. Interested parties may have an interest in the project and knowledge to support or oppose the project, but do not have a vested interest in the project.

3.6.3 Public Engagement

This section of Core Knowledge for Environmental Professionals provides a comprehensive overview of techniques to enrich relationships, cultivating a strengthened environmental practice. This material is divided into the following subsections:

- Appreciating different ways of knowing
- Legal requirements

- Public engagement methodology
- Seeking common ground

3.6.3.1 Appreciation of Different Ways of Knowing

It is beneficial to always appreciate different ways of knowing. Section 3.6.1 of this document, Indigenous Peoples and Communities, describes the importance of Indigenous Traditional Knowledge in understanding our world and the commonalities between this knowledge and western science. Apart from the specific legal rights that apply to Indigenous peoples, these principles also apply to local knowledge holders, in general. Local interest groups may include but are not limited to bird enthusiasts, anglers, conservationists, and cycling and active transport enthusiasts. Individuals and groups who are actively engaged and aware of their natural and social worlds hold a deep understanding of local conditions. When Environmental Professionals have an appreciation for different ways of knowing, they can add value to the project.

3.6.3.2 Legal Requirements

Within an environmental context, legal requirements for stakeholder and public engagement exist at the federal, provincial, and municipal governance levels. The *Impact Assessment Act, 2019,* as illustrated in **Figure 12**, identifies opportunities for stakeholder and public engagement in all phases of the EA / IA process, (Government of Canada, 2019). Although the public is not engaged during the decision-making phase, public interest is at the center of impact assessment decisions (Government of Canada, 2019).

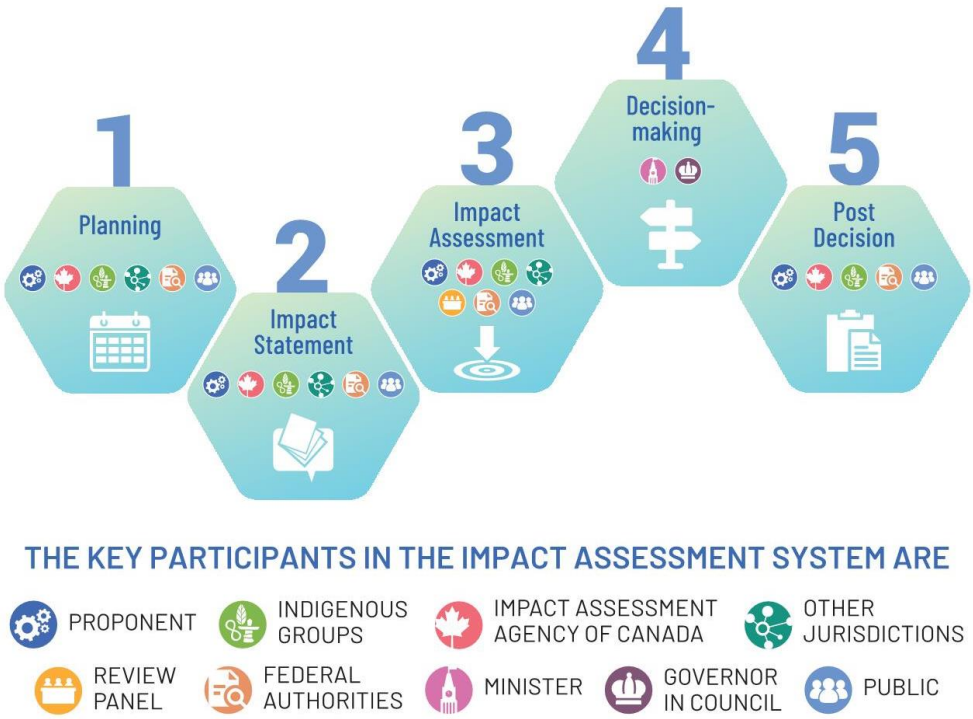

Figure 12: Impact Assessment Act Participant / Participation Overview (Government of Canada, 2019)

In addition to the requirements of the Impact Assessment Act for public engagement, provincial environmental / impact assessment frameworks also require public and stakeholder consultation during other phases of project planning. Public participation and consultation generally include legislated timeframes in which the proponent must post key project documents and decisions to allow the public time to review and comment or notify the appropriate regulating authorities of concerns. Public notification for key project phases including project commencement and completion may also be required under the legislative requirements.

3.6.3.3 Public Engagement Methodology

Stakeholder and public engagement can take many forms and follow a variety of legislated processes or methodologies. The Stakeholder Engagement Framework, illustrated in **Figure 13,** highlights the basic concepts that must be considered when creating consultation or engagement strategies for a project. Please remember that public and stakeholder engagement processes are not static but must remain flexible and responsive to maintain a respectful engagement process. It is the responsibility of the Environmental Professional to maintain a current understanding of legislative requirements, engagement processes and respondent requests, and current best practices for meaningful public and stakeholder engagement.

Figure 13: Stakeholder Engagement Framework

When engaging the public, proponents and Environmental Professionals must recognize the varying levels of background knowledge and education of the audience. Pictures, diagrams, videos, and virtual reality presentations all represent ways to communicate information, such as environmental effects, that allow it to be accessible to a wide range of audience members (Hao, 2016). Accessibility requirements, such as those defined in the *Accessibility for Ontarians with Disabilities Act* remove barriers in communicating with a broad and diverse audience.

3.6.3.4 Seeking Common Ground

When seeking common ground between stakeholders, the public, local interest groups, Indigenous groups, and the proponent, conflicting interests and priorities are inevitable. Where challenges present themselves in project planning and development, increased involvement (consultation and collaboration) from select stakeholders may help find common ground. Working groups, facilitated dialogue, workshops and other forms of engagement that give stakeholders a voice in the overall outcomes, are more likely to resolve issues in a timely manner. Creating a stakeholder mapping matrix, as illustrated in **Figure 14**, will help to identify the level of engagement required for various stakeholders (BC Campus Open Ed - Press Books, n.d.).

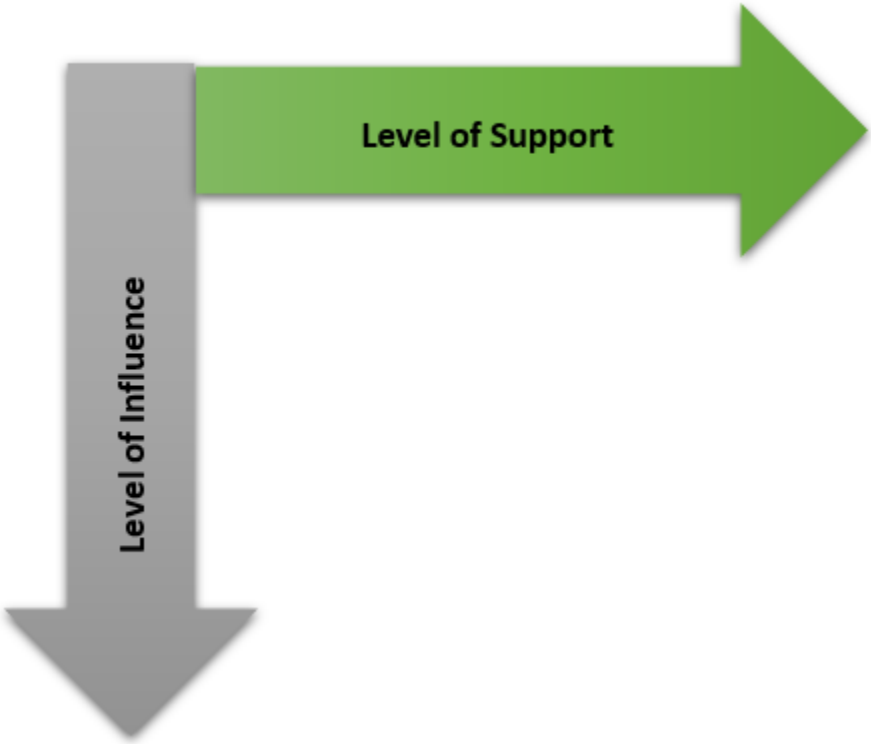

Figure 14: Stakeholder Mapping Matrix

Section D
Specialized Knowledge and Technical Competencies

The environmental sector is vast and influences many industries and therefore it can be challenging for Environmental Professionals when they try to find an area, or areas, of specialization that best represent their unique skills and experience. ECO Canada refers to these areas as specializations because each one has a distinct profile and set of skills required to be proficient at it.

As part of becoming an Environmental Professional (EP), applicants select the area(s) of specialization that best align with their values and expertise. Each of the listed EP specializations is based on the National Occupational Standards (NOS) for Environmental Employment. These specializations become a part of the EPs professional profile and reflect the type of work that they are passionate about and that they also have the technical competencies needed.

Technical competencies are defined as *"the demonstrated ability to perform a task or series of tasks to the satisfaction of the employers or otherwise established norms"*.

Through the NOS for Environmental Employment, ECO Canada has classified environmental roles into three main sectors including:

- Sector A: Environmental Protection
- Sector B: Resource Management
- Sector C: Environmental Sustainability

Each sector has its own persona and 14 subsectors that translate into *specializations*. Each *specialization* has competencies that Environmental Professionals can check their skills against. The EP Sector Venn Diagram shown as **Figure 15** that follows illustrates the relationships between these main sectors of the environmental industry and their relationship with an environmental manager.

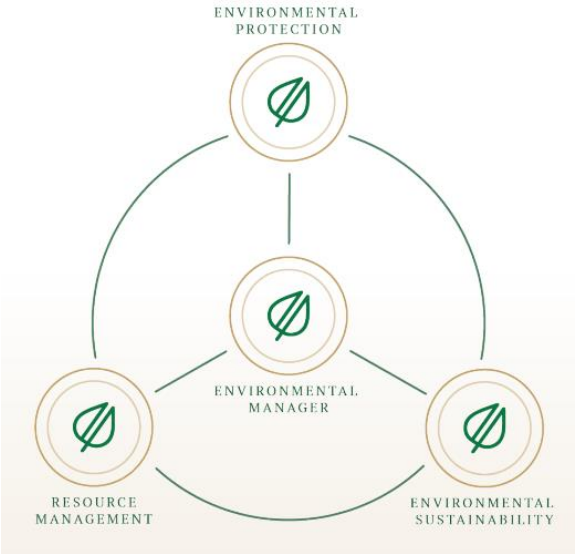

Figure 15: EP Sector Venn Diagram

The following subsections define each of these sectors and outline the *specializations* included in each sector. Environmental Professionals can compare their skill sets with each *specializations'* competencies and potentially identify where they fit.

4.1 SECTOR A: Environmental Protection

This planet is our home –your work as an Environmental Professional makes a difference in lessening the disturbance of the land, air, water, and ecosystems that we inhabit. This contribution could mean working on projects that promote health living, help the overall temperature of our atmosphere, and support biodiversity.

The environmental protection sector involves activities that protect the health of humans and ecosystems through pollution prevention, waste minimization, remediation, rehabilitation, and reclamation in the air, water, and land. Sector A also includes human health and safety because these factors depend on the quality of the environment. The five specializations within the environmental protection sector include:

1. Air Quality
2. Water Quality
3. Site Assessment and Reclamation
4. Waste Management
5. Health and Safety

4.1.1 Air Quality

The Air Quality specialization involves the supply of goods and services for assessing the state of the atmosphere. Main functions may include:

- Air quality monitoring and development of related equipment

- Air pollution management systems and technologies
- Air quality assessment, testing and monitoring
- Application and use of air emissions standards
- Air quality compliance monitoring, indoor air evaluation and impact assessment modelling

4.1.2 Water Quality

The Water Quality specialization involves the protection of water quality and quantity for humans and aquatic life, and water pollution control. Main functions may include:

- Researching and analysing water quality and quantity
- Developing legislation, guidelines, regulations, and standards
- Conducting site characterization, impact assessments or remediation related to water quality and quantity, compliance monitoring and permitting
- Designing and operating water and wastewater treatment plants and stormwater management facilities and low impact development technologies
- Completing assessments that support the planning and design processes of water, stormwater, wastewater, infrastructure, and natural water course flood, erosion, and other land drainage issues

4.1.3 Site Assessment and Reclamation

The Site Assessment and Reclamation specialization involves evaluating the presence of contamination, removing, or managing it, returning the land back to its original use or an equivalent capability or any combination of these activities. Site assessment and reclamation may include:

- Preventing and controlling land pollution, soil, or groundwater contamination
- Interpreting historical site information (Phase I ESA), and site characterization (Phase II ESA) and management planning
- Sampling and analysis of soil, vapour, vegetation, and groundwater; including materials for testing mechanical, biological, and chemical properties
- Studying the landforms and drainage
- Obtaining necessary clean-up permits and approvals and regulatory compliance monitoring

4.1.4 Waste Management

The Waste Management specialization involves the collection, diversion, or disposal of hazardous and non-hazardous waste. The main functions in this specialization may include:

- Managing the treatment of beneficial reuse of hazardous and non-hazardous wastes
- Designing waste related facilities or managing the end use of waste streams
- Implementing methane control systems or leachate control
- Developing, enforcing, or interpreting legislation, guidelines, regulations, and standards related to waste management

- Designing, executing, or implementing programs for waste collection systems and their management

4.1.5 Health and Safety

The Health and Safety specialization involves developing and implementing policies, standards, legislation, and programs that improve the environment and health and safety of workers and the community. The main functions of the Health and Safety specialization can include:

- Conducting compliance monitoring, including inspections and auditing
- Leading health and safety risk assessments
- Conducting industrial or occupational hygiene assessments
- Developing emergency response plans or workplace health and safety programs
- Advising senor management and leadership teams on environmental health risks and responsibilities
- Facilitating stakeholder consultations and communications

For a more comprehensive list of competencies, please consult the National Occupational Standards (NOS) for Environmental Employment.

4.2 SECTOR B: Resource Management

Water, coal, oil, natural gas, phosphorus, forests, soil, iron, renewable sources of energy, biological and other natural resources are all critical to the future of our communities. Finding a way to conserve these valuable assets and respect the gifts that nature provides for our survival with a goal of sustainability is important work.

The resource management sector involves activities aimed at integrating environmental and economic decisions with principles of stewardship when using natural resources. Functions performed in this sector involve the sustainable use of fish, wildlife, and natural resources.

The three specializations within resource management sector include:

- Energy
- Fisheries and Wildlife
- Natural Resources

4.2.1 Energy

The Energy specialization involves the provision of energy commodities and services in a manner that considers how extraction, refinement, transmission, and end use are managed. Functions in this specialization may include:

- Project planning including pre-development environmental assessment and mitigation
- Obtaining environmental approvals or licensing

- Internal and external liaising for environmental performance, including community consultation and partnerships
- Conducting research and development for energy efficiency including new sources of energy, energy storage, and energy transmission
- Creating sustainable development plans that relate to the overall management strategies of their organizations, including alternative sources of energy

4.2.2 Fisheries and Wildlife

The Fisheries and Wildlife specialization involves work for or with companies and organizations that manage or are concerned with using and preserving species and their habitats. The main functions in this specialization may include:

- Conducting research on fish and wildlife populations, species at risk, ecosystems (wetlands and other sensitive areas), biodiversity and ecosystem processes, and conservation, mitigating and preservation practices
- Preparing and distributing reports, peer reviewed papers or presentations related to aquatic and terrestrial ecosystems
- Conducting specific field surveys to identify fish and wildlife issues, species at risk and environmentally sensitive and ecologically important areas
- Monitoring the presence of fish and wildlife species, their populations, densities, and trends, in addition to determining habitat availability, quality and required ecological needs
- Having knowledge of and adherence to fish and wildlife regulations

4.2.3 Natural Resource Management

The Natural Resource Management specialization involves balancing human needs and pressures with the conservation and preservation of natural resources with the flora/fauna and other living organisms within them. The main functions in this specialization may include:

- Integrating socio-economic, cultural, and environmental factors to support and evaluate the ecological health of the planet
- Strategic planning, development, implementation, and application of environmental practices and policies
- Conducting integrated land use planning and sustainable planning related to flora and fauna
- Protecting ecosystems and conserving their resources
- Planning and managing park operations, including eco-tourism, public education and the establishment and maintenance of infrastructure
- Being involved in the regulatory compliance of the use of natural resources and reserves
- Developing public and aboriginal engagement to incorporate social needs and concerns

For a more comprehensive list of competencies, please consult the National Occupational Standards (NOS) for Environmental Employment.

4.3 SECTOR C: Environmental Sustainability

Environmental Professionals working in the environmental sustainability sector are dedicated to educating and clearly explaining the best ways to preserve the finest of nature for generations to come. This philosophy shifts away from a culture of waste. These activities center on developing, disseminating and applying knowledge in support of the other sectors of Environmental Protection and Natural Resource Management.

Functions performed in the environmental sustainability sector include facilitating stakeholder engagement, addressing the ethical implications of activities impacting the environment, and capacity-building through the application of intellectual innovation, communication, or public policy in order to balance human needs with a sustainable planet.

The five specializations within this sector include:

1. Sustainability
2. Education and Training
3. Research and Development
4. Policy and Legislation
5. Communications and Public Awareness

4.3.1 Sustainability

This specialization involves providing strategic advice on matters of sustainability to protect environmental integrity and social justice, while creating economic value. Sustainability professionals help support a sustainable use of resources. The main functions in this specialization may include:

- Monitoring and reporting sustainability trends over time
- Developing and using sustainability indicators to increase the quality of data used for decision making
- Educating others on ethical and social concerns as well as the guidelines relevant to achievement of sustainability objectives
- Developing environmental and environmental sustainability management and other forecasting or back casting systems
- Promoting sustainable societies at the global level, in which environmental, social, and economic systems are developed and evolve

4.3.2 Education and Training

The Education and Training specialization involves being responsible for the development of an environmental curricula that stresses the cross-disciplinary nature of environmental work and emerging areas. The main functions in this specialization may include:

- Delivering environmental education, including outreach, for public awareness and education
- Identifying learning outcomes and competencies, and designing curricula to promote them
- Measuring of the outcomes of environmental education

- Assessing the need for environmental education programs
- Developing, reviewing, and assessing environmental education curricula that may stress the cross-disciplinary nature of environmental work and emerging areas

4.3.3 Research and Development

The Research and Development specialization involves supporting and promoting scientific study to advance the practical application of knowledge to the environmental sector and may involve:

- Developing and advancing environmental knowledge through the process of peer review
- Making scientific data available that help prevent, improve, or resolve environmental problems
- Providing data or knowledge aimed at facilitating long-term economic, social, or environmental benefits

4.3.4 Policy and Legislation

The Policy and Legislation specialization involves enabling positive practice and results through the formulation and enforcement of public and corporate policy, legislation, regulations, and standards. Duties in this specialization may involve:

- Providing awareness or advice on existing or developing environmental legislation and regulations
- Collecting, analyzing, and interpreting information and data to support policy and planning programs
- Identifying opportunities for improved regulations and guidelines in environmental protection
- Engaging and consulting key stakeholders on issues related to the protection of the environment; social, cultural, economic, and environmental sustainability

4.3.5 Communications and Public Awareness

The Communications and Public Awareness specialization involves using publications and communications to inform about environmental issues, responsibilities, conservation, or corporate environmental performance. The main functions in this specialization may involve:

- Preparing written, audio-visual, and electronic communications
- Organizing, coordinating, and presenting expert information on environmental matters at conferences, clinics, or gatherings of stakeholders and policy makers
- Developing environmental awareness and action programs
- Implementing public relations and communication strategies on environmental issues
- Simplifying scientific, technical, or legal environmental matters for the public

For a more comprehensive list of competencies, please consult the National Occupational Standards (NOS) for Environmental Employment.

4.4 Environmental Manager at the Core of Sectors A, B and C

At the centre of each sector is the Environmental Manager. Although this category is not technically a 'sector', the Environmental Manager role is a unique *specialization* for certification and has its own profile.

Environmental managers have a broad high-level knowledge of all the functions and activities within the sector model. They understand each of the main competencies at the level of oversight, not at a technical "on the ground" level; environmental managers maybe specialized in other areas as well. Environmental managers are involved in providing leadership, accountability, and direction in the environmental disciplines of their organizations. They work to integrate knowledge, professional ethics, and strategic decision-making in the management of environmental and social issues.

The main functions in this specialization may include:

- Managing of environmental projects or supervising other professionals
- Having a broad understanding of regulatory requirements and international standards and anticipating future impacts of proposed legislation and regulation
- Understanding how economic, social, environmental and operations factors can impact projects
- Providing expert consultation within the organization and with clients, professionals, and public
- Appling baseline environmental technical expertise and knowledge, complemented with ad-hoc multidisciplinary training in the social sciences, business, finance, project, and human resource management
- Identifying learning outcomes and competencies and designing curricula to promote them
- Measuring of the outcomes of environmental education

For a more comprehensive list of competencies, please consult the National Occupational Standards (NOS) for Environmental Employment.

Closing Statement

The EP Body of Knowledge is a book comprised of broad learning areas that all Environmental Professionals must have working and specialized proficiency in the following areas:

Ethics: The five tenets encompassed in the EP Code of Ethics set the values, rules of conduct and expected behaviours of Environmental Professionals. To protect the public welfare, EPs must conduct themselves according to the highest ethical and professional standards.

Core Enabling Competencies: The transferable skills that Environmental Professionals posses contribute to the influence they have within their roles. These competencies help create trust, build relationships, and contribute to the EP's success.

Core Knowledge Areas: The quality of the EP lies within their proficiencies, knowledge, and insights in order to safeguard the public and the environment. This section of the Body of Knowledge represents the areas of knowledge that EPs need to be an authority within the environmental sector.

Specialized Knowledge: As the environmental sector expands and mandates become more stringent, Environmental Professionals need well-defined competencies and specializations that allow them to align their expertise and experiences. These specializations assure that EPs work within the scope of their competency areas.

While the primary purpose of this Body of Knowledge is to act as reference material candidates to the Environmental Professional designation and their EP Exam, it also serves as a wonderful reminder to certified members and the public of the expertise, professionalism, and ethical knowledge that the EP designation represents.

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