

Municipality of North Cowichan

Environmental Advisory Committee

AGENDA

Tuesday, May 18, 2021, 1:30 p.m.
Electronically

Pages

1. CALL TO ORDER

This meeting, though electronic, is open to the public and all representations to the Environmental Advisory Committee form part of the public record. At this time, due to the COVID-19 Pandemic, public access to meeting rooms at North Cowichan Municipal Hall is not permitted, however, this meeting may be viewed on the District's live stream webcast at www.northcowichan.ca/meetings.

2. APPROVAL OF AGENDA

Recommendation:

That the Committee approve the agenda as circulated [or as amended].

3. ADOPTION OF MINUTES

2 - 4

Recommendation:

That the Committee adopt the minutes of the meeting held May 4, 2021.

4. BUSINESS

4.1. Diamond Head Consulting Presentation regarding the Environmental Policy review

5 - 41

Purpose: Diamond Head Consulting will present their findings from the North Cowichan Environmental Policy and Regulation Review.

4.2. Discussion regarding a Green Circular Economy Eco-Industrial Park concept

42 - 86

Purpose: To consider the correspondence regarding Green Circular Economy Eco-Industrial Business Park for Vancouver Island that was referred to the Environmental Advisory Committee by Council for consideration.

5. NEW BUSINESS

6. ADJOURNMENT

Municipality of North Cowichan Environmental Advisory Committee MINUTES

**May 4, 2021, 1:30 p.m.
Electronically**

Members Present	Councillor Kate Marsh, Chair Neil Anderson Cam Campbell Bruce Coates David Coulson Per Dahlstrom Dr. Jana Kotaska Sandra McPherson Ashley Muckle Dr. Jesse Patterson Dr. Geoffrey Strong Dr. Shannon Waters
Staff Present	David Conway, Director, Engineering Projects Dave Preikshot, Senior Environmental Specialist Shaun Chadburn, Environmental Programs Coordinator Tricia Mayea, Deputy Corporate Officer
Others Present	Dr. Gordon McIntosh, Facilitator Jeremy Murphy, SSG Consultant

1. CALL TO ORDER

There being a quorum present, the Chair called the meeting to order at 1:30 p.m.

2. APPROVAL OF AGENDA

IT WAS MOVED AND SECONDED:

That the Committee approve the agenda as circulated.

CARRIED

3. ADOPTION OF MINUTES

IT WAS MOVED AND SECONDED:

That the Committee adopt the minutes of the meeting held April 20, 2021.

CARRIED

4. BUSINESS

Dr. Gordon McIntosh facilitated the business of this meeting and assumed the Chair.

4.1 CAEP Actions - Sorting, Prioritization and Responsibility Process - Part 2

The Committee reviewed the draft CAEP Actions list and prioritized the 'High' significance actions by assigning a Now, Next or Later priority to them.

Dr. Jana Kotaska and Dr. Shannon Waters left the meeting at 4:14 p.m., Dr. Geoff Strong left the meeting at 4:15 p.m., Bruce Coates left the meeting at 4:16 p.m.

IT WAS MOVED AND SECONDED:

That the meeting be extended to 5:00 p.m.

CARRIED

Ashley Muckle left the meeting at 4:45 p.m.

IT WAS MOVED AND SECONDED:

That the Environmental Advisory Committee recommends the following High Significant CAEP Actions be given a 'Now' priority and forwarded to Council for their consideration for 2021 implementation and when developing the Environmental Business Plan in future years:

Within Current Capacity to develop

1. **Official Community Plan** – Policy development consideration
 - a. Infill development (Item #1 on CAEP Action List)
 - b. Energy plan for new development (Item #4 on CAEP Action List)
 - c. Tree Canopy targets (Item #5 on CAEP Action List)
 - d. EV readiness requirement (Item #22 on CAEP Action List)
2. **Climate Lens for new development** – checklist & policy (Item #2 on CAEP Action List)
3. **Energy & Emissions Tracking System** (Item #42 on CAEP Action List)
4. **District Energy potential in hospital precinct** – meet with VIHA (Item #32 on CAEP Action List)
5. **Annual municipal tree planting target** (Item #38 on CAEP Action List)

Require staff work program changes or resources to retain personnel to undertake work

1. Facilitate **industry meeting** re: potential CAEP related efforts (Item #13 on CAEP Action List)
2. Review **revolving loan fund** (& alternatives) (Item #44 on CAEP Action List)
3. **CAEP Update** to consider:
 - a. Fair share carbon budget as a guide (Item #40 on CAEP Action List)
 - b. Strengthen presence of agriculture recommendations (New Item #45 on CAEP Action List)
 - c. Research practices – climate lens for decision making and strategic planning (Item #41 on CAEP Action List)
 - d. Regional Gas Tax (CVRD?) (Item #49 on CAEP Action List)

CARRIED

Councillor Marsh resumed the Chair.

5. NEW BUSINESS

The next meeting will include a presentation from Diamond Head Consulting regarding the Environmental Policy review and discussion regarding a Green Circular Economy Eco-Industrial Park concept.

6. ADJOURNMENT

The meeting ended at 4:58 p.m.

Certified by Recording Secretary

Signed by Chair

North Cowichan Environmental Policy and Regulation Review



February 16, 2021

Submitted to:

Rob Conway
Municipality of North Cowichan



DIAMOND HEAD

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Executive summary

Diamond Head Consulting was engaged to review North Cowichan's environmental policies and regulations. The objective of this review is to identify opportunities that will position North Cowichan as a leader in municipal environmental policies and regulation. A total of 32 policies and bylaws were reviewed to identify weaknesses and opportunities to strengthen the municipality's policies so that they comply with current best management practices and align with other local governments. This report summarizes the findings and recommendations from this review.

North Cowichan's current environmental policies and regulations provide the municipality with a strong basis for environmental protection. **The successful implementation of these recommendations will require careful considerations to ensure that sufficient staffing and adequate resources are provided for effective implementation, communications with the public and bylaw enforcement.** Detailed recommendations to update, clarify and strengthen existing policies and regulations are made Appendices 1 and 2.

The following high-level recommendations provide an overview of actions that the municipality could take in order to strengthen its environmental leadership over the coming years. They include:

Recommendation 1. Provide consistent definitions across DPs/bylaws/etc. Alternatively, refer to a document where all definitions can be referenced and updated.

Recommendation 2. Update bylaws to keep definitions, references to, and requirements consistent with current federal and provincial legislation. Examples of legislation that has been updated in recent years includes the federal Fisheries Act; provincial Riparian Areas Protection Regulation; Water Sustainability Act; and Environmental Management Act.

Recommendation 3. Update and publish mapping to clearly and accurately show DP areas. Use a combination of desktop techniques (i.e., LiDAR and accurate contour data) and ground truthing for best accuracy.

Recommendation 4. Review DPA guidelines to ensure that broad, difficult to enforce ideas are included in the objectives, with specific requirements under the guidelines. For example, guideline 3.4.2.h of the Natural Environment DPA 3 states "Protect and enhance biodiversity within terrestrial ecosystems". This is more of a goal than a quantifiable measure.

Recommendation 5. Define professional qualification requirements in existing bylaws and consider consolidating those requirements into the Development Procedure Bylaw's development approval information. There are inconsistencies across a number of bylaws/DPAs as to required designations.

Recommendation 6. Review watercourse protection in the municipality:

- Disconnected features (which are not protected by RAPR), are currently protected in the Municipality's zoning bylaw, however, the values behind their

protection are not clear. The intent of this should be reviewed and guidelines provided to developers and QEPs. For example, it's unclear if section 13.1.c of the zoning bylaw is intended to protect amphibian habitat, sources of water for people or wildlife, or for stormwater management.

- Consider increasing the setback requirements for streams. Many municipalities choose to develop additional watercourse setbacks above and beyond the RAPR requirements. Often this includes measuring setbacks from the top of bank instead of the stream boundary. However, this would require additional review and resources at the Municipality's level, as the Municipality would be reviewing QEP reports as opposed to relying on the province.

Recommendation 7. Use the Official Community Plan engagement findings to confirm support for new or updated policy that protects environmental values. Consider additional engagement for any policies that are new or contentious.

Recommendation 8. Develop restoration guidelines for development impacts or encroachment in protected natural areas or riparian setbacks. These should be placed in the Development Permit Area 3 Guidelines and become a requirement of development.

Recommendation 9. Review the list of "absent" policies and regulations identified in this review to determine which are needed in North Cowichan. Prioritize their development and implementation in a way that best represents the values and needs of the community. For instance:

- Consider developing guiding environmental policies that will provide a framework for bylaw and DP updates. Examples include a Biodiversity Strategy and Community Forest Strategy.

Recommendation 10. Consider introducing tree protection measures through a tree bylaw and/or the subdivision approval process to prevent unnecessary tree clearing.

Recommendation 11. Review staffing and resourcing needs to improve North Cowichan's capacity to implement, communicate and enforce current bylaws and regulations.

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1.0 Environmental Policy Review Framework

The Municipality of North Cowichan retained Diamond Head Consulting (DHC) to review their environmental policies and regulations and to provide recommendations to improve, clarify and strengthen them. This report summarizes our team's findings from the detailed review into a set of high-level recommendations and implementation plan which are discussed in the following sections.

Policies and regulations were reviewed at two levels of detail. A high level review was completed for 32 environmental policies, bylaws and regulations. A more comprehensive and detailed review was completed for a smaller number of bylaws and regulations that are central to the Municipality's management of the environment. Detailed recommendations for all policies and regulations reviewed are provided in Appendices 1 and 2.

1.1 Comprehensive Bylaw/Regulation Review

The comprehensive review focused on the following bylaws and regulations:

- Environmental setbacks in the Zoning Bylaw 2950
- Development Permit Area 2 – Marine Waterfront
- Development Permit Area 3 – Natural Environment
- Development Permit Area 4 – Natural Hazard
- Relevant sections of Subdivision Bylaw 1851
- Parks & Public Places Regulation Bylaw
- Soil Removal and Deposit Bylaw

For each bylaw and regulation subject to detailed review, the project team considered the following:

1. The intent and objectives of the bylaw or regulation
2. High level recommendations to:
 - a. Bring it to current standards/best practices, including:
 - i. Consistency with current Provincial and Federal regulations and requirements
 - ii. Appropriateness of information requirements
 - b. Improve its effectiveness to achieve the stated intent and objectives, including:
 - i. Effective triggers for the application of the regulations
 - ii. Clear, detailed, and impactful requirements under the regulation
 - iii. Appropriate enforcement mechanisms suited to the Municipality's staffing and resourcing
3. Recommendations to improve specific content and wording in the bylaw or regulation

1.2 High-Level Policy Gap Analysis

In addition to the comprehensive review of key bylaws and regulations, a broader gap analysis was completed for a number of other bylaws, regulations, plans and policies that affect how the municipality

managed the natural environment. Staff identified 25 policies and regulations to include in this review. This gap analysis was completed to determine how the following environmental elements are addressed in each policy:

- Natural Environments
 - Freshwater
 - Terrestrial
 - Marine
- Risk associated with natural areas
- Climate change and energy
- Monitoring and enforcement

During this high-level review, the project team:

1. Evaluated the effectiveness of the policies or regulations to address the environmental elements. Identified gaps, weaknesses and out-of-date components,
2. Provided high level recommendations to address identified deficiencies, and
3. Identified opportunities for leadership by improving and adding environmental policies.

2.0 Key Recommendations

2.1 The Role of Municipalities for Environmental Management

Municipalities are limited in their ability to protect and enhance environmental features. They have jurisdiction over municipal-owned lands but are limited in their role to influence how private lands are managed. Opportunities are often restricted to when development takes place. Municipalities with strong environmental regulations typically include requirements for development permits when proposing projects adjacent to marine foreshore areas, watercourses, and sensitive terrestrial ecosystems. These DPs, when designed well, will ensure development will not impact these areas and can provide the opportunity for the municipality to acquire some areas. The acquisition of sensitive environmental lands allows municipalities to ensure they are best protected over the long term.

Other policies that are effective at protecting the environment focus on the protection of trees. Trees are a fundamental element of most terrestrial natural areas. Protecting them helps to ensure that natural ecosystems are also protected. The protection of trees is usually enforced through a tree bylaw as well as tree protection and replacement requirements within subdivision and zoning bylaws.

2.2 An Assessment of North Cowichan's Current Environmental Policies & Regulations

North Cowichan has a strong foundation of environmental policy. There are however opportunities to strengthen existing policies and introduce new ones to further the Municipality's goals on environmental leadership. The District's Development Permit Areas help to reduce the impact of development on sensitive ecosystems. However, there are changes that, if implemented, would improve these DPAs. There is also a lack of regulation to prevent tree removal during development.

As requirements to environmental protection are strengthened there is a need for resources to review, approve and enforce them. The ability for the Municipality to demonstrate environmental leadership with its regulations is closely tied to its ability to enforce them.

The District emphasizes the protection of environmental values in its Official Community Plan, Local Areas Plans and recent plans like the Parks and Trails Master Plan. The ongoing OCP review will provide a great opportunity for the Municipality to strengthen its vision and values for the management of the natural environment. Initiatives such as the Somenos Marsh Wildlife Strategic Plan are also a great example of collaborative management of a sensitive ecosystem taking place in North Cowichan.

The following updates to existing policies and regulations are recommended to clarify and strengthen North Cowichan's environmental leadership.

Updating DPA Mapping and Development Guidelines

The environmental DPAs provide excellent framework for mitigating the impacts of development. They can be improved by ensuring definitions are consistent and that references to other legislation are up to date. The requirements for the protection and restoration of sensitive areas should be updated. also be added and standards provided for development related impacts. The mapping for these DPs should also be updated. The technology of mapping has greatly improved and allows for features in these DPs and their setbacks to be clearly mapped, providing clarity to staff and landowners¹.

Watercourse Protection

Watercourse protection in North Cowichan meets the minimum requirements under the provincial Riparian Areas Protection Regulation (RAPR). The province requires municipalities take a "meet or beat" approach for riparian areas regulations. Many municipalities choose to provide additional measures for watercourse protection under their own jurisdiction. Most of these municipalities are in the Lower Mainland, providing North Cowichan with the chance to be a leader in this on Vancouver Island. RAPR requires additional measures beyond the Streamside Protection and Enhancement Area (SPEA) to ensure slope stability and stable, healthy riparian trees. Municipalities can, and often do, chose to define setbacks measured back from the top of bank instead of the stream boundary, as a way to pre-emptively consider these measures within the municipal DP or zoning bylaw setback.

The current zoning bylaw in North Cowichan defines the terms watercourse and stream. The term stream matches the definition under RAPR, while the term watercourse captures additional watercourses not protected under RAPR. The use of both terms can be confusing when defined in the zoning bylaw but used in other legislation such as the Natural Environment DP 3. The use of these two terms should be reviewed to determine if North Cowichan intends to only protect streams under RAPR (i.e., streams related to their fish value) or to also protect other watercourses (such as non connected

¹ Environmental Law Centre. (2016). *EDPAs: In Practice and in Caselaw – March 2016*. Prepared for the University of Victoria.

wetlands and ponds) for additional values beyond fish habitat (e.g., stormwater management, amphibian habitat, etc.).

Legislative References & Professional Qualifications Requirements

Many legislative references in North Cowichan's environmental regulations are outdated and reference previous versions of provincial legislation. Detailed recommendations appended to this report identify bylaws that should be updated to match the current legislative requirements (ex. federal Fishers Act, Water Sustainability Act, Riparian Areas Protection Regulation, etc.).

In addition, several regulations refer to using appropriately qualified professionals; however, they do not clearly define which studies should be undertaken by the various types of professionals. Some references are also made to outdated or undefined qualifications. Clearly defining professional qualification requirements would ensure a consistent quality level for submissions made to the municipality. An example of a vague qualification currently used in the District's policy is "coastal professional." This could be clarified to a professional designation such as Professional Engineer, Professional Biologist, etc. It could be further refined with qualifiers such as a Professional Engineer specialising in coastal engineering. Some municipalities require that the professional provide a summary with the submission proving their qualifications and experience.

Restoration Guidelines

Restoration of disturbed areas or areas taken over by invasive plants is critical for ensuring the long term health of urban natural areas. Currently, North Cowichan relies on its Untidy and Unsightly Premises Bylaw to identify and regulate the removal of noxious weeds on private property. There are no requirements in other environmental policies to manage invasive species. The Natural Environment DP 3 states "development activity to avoid encroaching into protected areas"; however, it does not provide direction around what to do if development does encroach, or if there was encroachment prior to development.

Clear restoration guidelines would help homeowners and developers understand what is expected of them to maintain the integrity of natural forested and riparian areas that are within or adjacent to their properties. They would also specify how to compensate for encroachment or development related impacts. Restoration guidelines should include the removal of non-compliant structures, unauthorized fill, invasive species, and garbage, and replanting with native trees and understory vegetation. Restoration plans are developed and submitted by a QEP to ensure they meet the District's expectations.

Maintenance and monitoring are required to ensure restoration sites are successful. Typically, a fee estimate would be developed as part of the restoration plan including the costs of carrying out the restoration plan works, as well as maintenance and monitoring. This fee estimate would then be used to develop a security/bond, which would be released upon successful restoration at the end of the maintenance period. Typically, municipalities require 100% survival of trees, at least 80% survival of

understory species, and a maximum of 5% invasive plant species by the end of the monitoring period (typically 3 years). The property owner is required to hire a QEP to complete the monitoring and determine if the restoration requirements have been met. If not, additional maintenance will be required until they are met in order to return the security. This ensures that the developer covers the costs of the operations and provides the municipality with the funds to address insufficient restoration work if necessary.

2.3 Opportunities for Leadership

This section outlines a few key areas where the Municipality could demonstrate environmental leadership by pursuing new environmental policies or regulation initiatives. The opportunities for leadership identified in this review include the management of invasive species, improvements to the protection and restoration of ecosystems and their connectivity, the protection of trees within the urban containment boundary, and public support and bylaw enforcement.

Invasive Species Management

Many plans and policies refer to the importance of managing invasive species. Currently the District has an invasive species management agreement with the Province who provides an annual grant to fund control measures on public land. The District determines priority species and creates an annual work plan in consultation with provincial Invasive Plant Specialists and stakeholders at regional meetings. Regional meetings ensure the District's approach is consistent with efforts undertaken by neighbouring jurisdictions. The District uses the provincial Invasive Alien Plant Program (IAPP) mapping platform to maintain inventory and treatment data records.

The District's Unsightly Premises Bylaw places the duty on all landowners to control invasive species listed in the BC *Weed Control Act* growing on private property. This is the only regulatory tool available to the municipality to enforce the control of invasive plants on private property. There may be other priority local invasive plant species which are not listed in the BC *Weed Control Act* that the municipality may wish to consider adding to the bylaw. However, enforcement of such a bylaw can be time consuming and costly; generally, municipalities only resort to this approach in the case of the highest risk invasive species which are already subject to municipality-wide treatment programs on public land. Two common examples of such species in the south coast are giant hogweed and knotweed species.

Preventing the introduction and spread of invasive species is the most cost effective and efficient way to minimize negative impacts. There are opportunities for prevention across municipal departments and through increased public awareness. Conducting a risk assessment of the priority species the Municipality has already identified to explore modes of introduction and spread would ensure that the Municipality is doing all it can internally toward prevention and would identify targeted opportunities for increasing public awareness of the problem. The Municipality should continue to work with other local governments to support a regional approach to invasive species management.

Ecosystem Management and Connectivity

Several bylaws and policies refer to the importance of protecting as well as connecting sensitive ecosystems together in North Cowichan. It can be difficult for QEPs to comply with this policy without some landscape level understanding of which areas are most important as core habitat and as movement corridors.

There are steps already underway to develop a Biodiversity Protection Policy. Protecting biodiversity usually includes the protection of a diversity of habitat and ensuring that they are connected together. As a part of this Policy, it is recommended that some spatial mapping be completed that shows habitat types, the value of those areas and critical movement corridors to be protected. There may also be opportunities to collaborate with regional habitat mapping initiatives.

Land Clearing Pre-Development & Tree Protection During Development

There is currently a Landscaping Policy which enables staff to collect securities and require a tree preservation and protection plan as well as arborist supervision for development permits, subdivisions and parks, trails and public rights of way. However, under current regulations land clearing often occurs years before the land is developed. This can lead to unnecessary tree clearing in cases where development does not proceed, or where sites are left bare for long periods of time. This can lead to erosion and the proliferation of invasive plants.

The municipality should consider regulatory provisions to prevent pre-emptive land clearing associated with subdivisions. This could be achieved either through updates to the Subdivision Bylaw, or the adoption of a Tree Protection Bylaw. Additional measures to ensure tree protection and replacement may be warranted if there is community support, particularly within the Urban Containment Boundary.

Based on the community values expressed through the ongoing OCP update process, the municipality may also wish to consider developing a Community Forest Strategy. Such a Strategy could provide the municipality with a clear vision, goals and performance standards for the management of its community forest, including but not limited to considerations for a tree bylaw.

The development of a Tree Protection Bylaw would help manage phased tree removals, tree protection and replacement, especially within the Urban Containment Boundary. However, adequate staffing would be required to administer and enforce such a bylaw. Staff are currently finding enforcement difficult. As such, a successful tree bylaw requires that strong enforcement measures be enabled and funded appropriately. This could include provisions such as the ability to recover the cost of unpaid fees and actions taken under the bylaw as arrears of taxes, as well as funding to pursue legal action under the Offence Act for major bylaw contraventions where owners remain uncooperative.

Public Support & Enforcement

In addition to the adoption or updating of environmental policies and regulations, the District can strengthen its environmental leadership through public education and consultation. Bylaws are an important way to manage the environmental values found across the Municipality. Much of natural assets found in North Cowichan are found on private property. As a result, it is important to ensure that environmental regulations respond to community values. The process of updating or adopting new regulations provides an opportunity for the Municipality to work closely with community members and developers.

In addition, adequate resources including staffing will be required to enable the enforcement of new environmental regulations. Penalties can be used as a deterrent. Bylaw provisions can also require oversight by qualified professional contactors. Public education can also provide a valuable tool to improve implementation outcomes.

3.0 Implementation Plan

Table 1 introduces an implementation plan for eleven high-level recommendations formulated as a result of this policy review. Recommendations are prioritized based on the importance of the updates and the expected level of efforts associated with their implementation. Resourcing considerations are included with regards to staffing needs and external consultant resources which are expected to be required for their implementation.

While good policies and regulations play an important role in the environmental leadership of municipalities, resourcing is also a key consideration to enable their implementation. For instance, research on tree ordinances in the US has identified many criteria for the effective regulation which provides helpful insights of the implementation of environmental regulations². The research points to the importance of regulations to relate to clearly defined goals and basic performance standards, often defined in higher-level policies such as the OCP or management strategies or plans. It also highlights the importance of the implementation process to enable the proper enforcement of regulations with a designated staff member responsible for its implementation, and flexibility in the implementation to allow for site-specific decisions to be made. Finally, the research points to the importance of community support and the alignment of the regulation with community values and priorities as a key factor in the successful implementation of regulations.

Staff have noted ongoing challenges with enforcement of bylaws, particularly as it relates to development and property maintenance. Updated or new regulations should provide staff with adequate provisions to enable their enforcement. The municipality will also need to carefully consider staffing levels to ensure that they are and remain adequate to enable the proper implementation of its regulations.

The ongoing OCP update offers a good opportunity for the Municipality to ensure that policy and regulatory updates align with community values. In addition, the Municipality should ensure that public education is provided to engage and inform community members about updates to existing regulations or new regulations being drafted.

² Bernhardt, E.; Swiecki, T. J. (1991). *Guidelines for developing and evaluating tree ordinances*. Prepared for: Urban Forestry Program, California Department of Forestry and Fire Protection, Sacramento, CA. 76 p. (Download from UFEI site)

Nichols, S., (2007). *Urban Tree Conservation: a White Paper on Local Ordinance Approaches*. Montgomery Tree Committee, Montgomery, Alabama

Table 1. Implementation plan for high-level recommendations.

Actions/Recommendations	Priority (short-, med- or long-term)	Level of Effort (Low, moderate or high)	Resourcing implications (Staff/consultant)
Recommendation 1. Provide consistent definitions across DPs/bylaws/etc. Alternatively, refer to a document where all definitions can be referenced and updated.	S	Low	Staff time
Recommendation 2. Update bylaws to keep definitions, references to, and requirements consistent with current federal and provincial legislation. Examples of legislation that has been updated in recent years includes the federal Fisheries Act; provincial Riparian Areas Protection Regulation; Water Sustainability Act; and Environmental Management Act.	S	Low	Staff time
Recommendation 3. Update and publish mapping to clearly and accurately show DP areas. Use a combination of desktop techniques (i.e., LiDAR and accurate contour data) and ground truthing for best accuracy.	M	High	Staff time; Support from consultant
Recommendation 4. Review DPA guidelines to ensure that broad, difficult to enforce ideas are included in the objectives, with specific requirements under the guidelines. For example, guideline 3.4.2.h of the Natural Environment DPA 3 states “Protect and enhance biodiversity within terrestrial ecosystems”. This is more of a goal than a quantifiable measure.	S	Low to moderate	Staff time; Support from consultant
Recommendation 5. Define professional qualification requirements in existing bylaws and consider consolidating those requirements into the Development Procedure Bylaw’s development approval information. There are inconsistencies across a number of bylaws/DPAs as to required designations.	S	Low	Staff time
Recommendation 6. Review watercourse protection in the municipality: <ul style="list-style-type: none"> Disconnected features (which are not protected by RAPR), are currently protected in the Municipality’s zoning bylaw, however their protection are not clear. The intent of this should be reviewed and guidelines provided to 	M	Moderate	Staff time; Support from consultant

Actions/Recommendations	Priority (short-, med- or long-term)	Level of Effort (Low, moderate or high)	Resourcing implications (Staff/consultant)
<p>developers and QEPs. For example, it's unclear if section 13.1.c of the zoning bylaw is intended to protect amphibian habitat, sources of water for people or wildlife, or for stormwater management.</p> <ul style="list-style-type: none"> Consider increasing the setback requirements for streams. Many municipalities choose to develop additional watercourse setbacks above and beyond the RAPR requirements. Often this includes measuring setbacks from the top of bank instead of the stream boundary. However, this would require additional review and resources at the Municipality's level, as the Municipality would be reviewing QEP reports as opposed to relying on the province. 			
<p>Recommendation 7. Use the Official Community Plan engagement findings to confirm support for new or updated policy that protects environmental values. Consider additional engagement for any policies that are new or contentious.</p>	S/M	Moderate	Staff time; potential support from consultants
<p>Recommendation 8. Develop restoration guidelines for development impacts or encroachment in protected natural areas or riparian setbacks. These should be placed in the Development Permit Area 3 Guidelines and become a requirement of development.</p>	M	Moderate	Staff time; Support from consultants
<p>Recommendation 9. Review the list of "missing" policies and regulations identified in this review to determine which are needed in North Cowichan, and prioritize their development and implementation in a way that best represents the values and needs of the community. For instance:</p> <ul style="list-style-type: none"> Consider developing guiding environmental policies that will provide a framework for bylaw and DP updates. Examples include a Biodiversity Strategy and Community Forest Strategy. 	L	High	Staff time; Support from consultant

Actions/Recommendations	Priority (short-, med- or long-term)	Level of Effort (Low, moderate or high)	Resourcing implications (Staff/consultant)
Recommendation 10. Consider introducing tree protection measures through a tree bylaw and/or the subdivision approval process to prevent unnecessary tree clearing.	M	High	New staff; Support from consultant
Recommendation 11. Review staffing and resourcing needs to improve North Cowichan's capacity to implement, communicate and enforce current bylaws and regulations.	M	Moderate	Staff time; Support from consultant

4.0 Appendix 1 – Comprehensive Bylaw/Regulation Review

4.1 Zoning Bylaw 2950

Intent and objectives

The Zoning Bylaw regulates how land and structures may be used. Zoning may include regulations for building siting, size location and shape. For environmental considerations, it can establish setbacks from sensitive features. The Zoning Bylaw provides a tool to establish and enforce environmental setbacks, while DPAs remain better suited to protect environmental features from damage. Specific to environmental considerations, this Bylaw regulates how water features are protected and includes the environmental DP guidelines.

High level recommendations

Overall, the intent of this Zoning Bylaw is to provide definitions for water features, the required assessment area and to specify and enforce the required setbacks and protection mechanisms for them. The following are broad recommendations to update it and improve its effectiveness:

1. Update all references to Provincial legislation. Currently, this bylaw refers to Riparian Areas Regulation and the Fisheries Act. However, the current legislation is the Riparian Areas Protection Regulation (RAPR) and the Water Sustainability Act (WSA). In addition, there have been several updates to the Environmental Management Act in recent years, particularly with reference to contaminated sites.
2. Choose one term be used and defined in the same way it is in the Provincial policy for water features. There are currently multiple terms used to refer to water features (i.e. stream and watercourse). Definitions should be consistent and be based on the definition in RAPR which uses the term “Stream”.
3. Section 13.1.c states that, in addition to marine setbacks and water features protected under RAPR, there be a 15m setback from “any other watercourse or source of water supply, excluding wells.” This is quite broad and could include a number of smaller non connected features that could hold up development or require a variance. The intent of this statement should be identified, and wording adjusted accordingly.

Specific Recommendations for Improvement

The following are recommended updates and considerations within each section of the zoning bylaw:

Section – 12 - Definitions

- 84 (page 9) – Add reference to the ocean in this definition.
- 121.1 - This definition should be amended to be consistent with that of RAPR:
 - a watercourse or body of water, whether or not usually containing water, and
 - any of the following that is connected by surface flow to a watercourse or body of water referred to in paragraph (a):

- a ditch, whether or not usually containing water;
 - a spring, whether or not usually containing water;
 - a wetland;
- 132 - The definition of watercourse could be removed. There is no definition in the WSA or RAPR for a watercourse even though it is used within the definition of a stream. We recommend using one of these two terms. Stream is most common and is used by RAPR.

Part 4 – General Recommendations - Watercourses 13

- 13.1 (a) – While there is no clear regulation about the distance of new constructions from the ocean, the DFO generally recommends that new construction be 15-30m back from the ocean to prevent impacts to fish. A larger setback would also be prudent considering a changing climate, including sea level rise and increased intensity of storms and associated flooding. We recommend that this setback be extended from 7.5m to 15m. Ideally it would extend to 30m, however, this would likely require additional research and consultation to determine the feasibility and variance requirements.
- 13.1 (b) – The provincial Fish Protection Act no longer exists. Reference to legislation needs updating to the Riparian Areas Protection Regulation (under the Riparian Areas Protection Act) and the Water Sustainability Act. This could also include the federal Fisheries Act which was recently updated and includes standards for the protection of fish and fish habitat.
- 13.1 (c) Review the intent of this regulation. RAPR should protect any features defined as streams, the definition of which includes either containing or connecting to fish habitat. If this section is meant to protect non-connected water features they need to be more clearly defined. Examples of this include ponds and wetlands that exist on their own in the landscape. These do provide high value habitat for wildlife but are not considered important to protect fish by provincial or federal policy.

Part 5 – Zones

- 46 (1) This refers to watercourse and creek. Choose one term for all water features to use throughout.
- RS – 3 58.1 (4) Change reference from Fish Protection Act to RAPR, and change Streamside Protection Area to Streamside Protection and Enhancement Area.

4.2 DPA 2 Marine Waterfront

Intent and objectives

This DP area aims to manage the design and construction of development on the waterfront. It is primarily focused on public access, views, commercial needs and low impact development. One objective directed at environmental protection includes:

- Integrate development with the Site's natural attributes to reduce negative impacts to coastal ecosystems.

High level recommendations

The following are broad recommendations to update it and improve its effectiveness:

1. Consider combining the shoreline content in DP 3 to this DP. The focus of this DP 2 is on the design of built features and access for the public, rather than on natural features. However, one of the objectives is to protect sensitive ecosystems and natural processes. There is overlap between this DP and the shoreline component of DP 3. It is recommended that the guidelines and requirements in DP 3 and DP 2 be combined.
2. The impacts of climate change on sea level rise should be considered in this DP. Mapping was recently completed by the Cowichan Valley Regional District and could inform this review.

Specific Recommendations for Improvement

The following are recommended updates and considerations within each section of the DP:

Section 2.1

- Either define how to identify natural boundary, refer to the zoning bylaw definition or change this to the highest high tide line.

Section 2.4.1

- Include a section that requires restoration opportunities to be identified and pursued.

Section 2.4.8

- Mention natural plant communities and features that provide habitat for wildlife.

4.3 DPA 3 Natural Environment

Intent and objectives

This DP area aims to protect:

- Watercourses that provide fish habitat
- Important wildlife habitat including corridors
- Biodiversity
- Raptors nests
- High value wildlife trees
- Plant communities at risk
- Habitat for species at risk
- Shoreline/intertidal areas
- Groundwater, aquifers and watersheds

High level recommendations

Overall, the intent of this DP is comprehensive and includes most sensitive natural features and functions. The following are broad recommendations to update it and improve its effectiveness:

1. Update references to provincial policy and definitions that have changed since this DP was written.
2. Update terminology to ensure consistent language is used throughout the DP. There is mixed terminology used throughout which can cause interpretation problems (i.e. watercourse vs stream, wildlife tree vs nest tree).
3. Consider adopting wider setbacks for the protection of watercourses. The current riparian setbacks follow the Provincial minimum standards, which some communities feel are too narrow and may not provide the protection that the Municipality is envisioning for all stream corridors.
4. Move the marine shoreline areas guidelines to DPA 2 – Marine Waterfront. Section 3.4.3 provides guidelines to develop along shoreline areas, but moving them to DPA 2 – Marine Waterfront would consolidate all guidelines for both the built and natural environment in one DPA.
5. Provide clear definitions of who is qualified to carry out environmental assessments. In particular, define who qualifies as a QEP (Qualified Environmental Professional), tree risk assessor, and a coastal professional.
6. Update the environmentally sensitive area mapping. Up to date mapping is key to identifying natural areas requiring protection, and areas where development may occur while minimizing the impact on the natural environment. This mapping is easiest to continually update and share with the public when available in an online mapping system.
7. Provide clear guidance for the identification and protection of sensitive habitat and corridors. Relying on QEPs discretion to identify and protect sensitive habitat and corridors for wildlife is vague and unlikely to meet the DP's objective. QEPs work for land developers and can be reluctant to identify habitat areas unless they are clearly defined by the province or municipality.
8. Important "wildlife corridors" (as mentioned in the DP) should be defined and mapped. This could be mapped as a Green Infrastructure Network as part of a Biodiversity Conservation Strategy, or on its own.
9. Consider providing reporting requirements for QEP submissions. This could include guidance around the content and organization of QEP reports. This helps to ensure consistency between applications and with staff reviews.
10. Consider removing the requirement for buffers around protection areas or better define what a buffer is. This section is unclear if it is referring to the setbacks themselves, or a buffer off of the setback that provides a transition area between the protected features and the development. Buffers off of a protected area can be contentious, especially if fencing is to be permanent at this buffer and the area becomes secured as a result. Examples could include: a construction zone requirement 2m outside of the SPEA boundary; tree root protection zones of edge trees based on trunk diameter; edge of invasive species removal and restoration areas.
11. Move the broader DP guidelines to the objectives section. Those guidelines, which are broad in nature, will be more suitable as objectives. The guidelines should only include items that can be clearly defined and achieved by an applicant.

12. Require an arborist report for all trees that are within ten metres of the Protected Areas. The protection of trees is a clear way to ensure natural areas are being protected and restrict encroachment. These edge trees are sensitive to damage from development if works encroach into their critical root zone. Some trees require protection up to 10 m from the trunk in order to maintain healthy root structures. An arborist report will identify required root protection zones where protection measures should be implemented and any existing or potential hazard trees which should be removed. The DP currently refers to hazard trees and calls for the protection of the drip line of trees. Requiring an arborist report if work is proposed adjacent to ESA areas with a clear set of guidelines or terms of reference will enable the Municipality to ensure that retained trees are safely protect and that the applicant avoids creating new hazards.
13. Specify the tree risk assessment qualifications required, and tree risk assessment procedure and risk thresholds for identifying hazard trees in ESA areas.
14. Develop clear restoration requirements for development in or adjacent to natural areas and riparian setbacks, or where unauthorized development or disturbance has occurred in the protected area. This should include the removal of non-compliant structures, invasive species, and garbage, and replanting with native trees and understory vegetation.
15. Review exemptions to ensure all environmental values are being protected through development.

Specific Recommendations for Improvement

The following are recommended updates and considerations within each section of the DP.

Section 3.1

- Review the definition of a stream to ensure it is consistent with provincial definitions. Watercourses/streams are defined differently under different provincial policies (the Water Sustainability Act, WSA, and Riparian Areas Protection Regulation, RAPR). This definition should include what lower value features are included and some parameters for QEPs and applicants. Some smaller features and low value ditches could be excluded. Ensure the terms ‘aquatic systems’, ‘stream’ and ‘watercourse area’ are all defined properly.
- Update wording for where the watercourse guidelines apply to:
 - Include all watercourses, whether they are on the OCP map or not.
 - Remove the wording “only if determined by the municipality.” If a stream exists on or near a property, mapped or not, it should be protected. Unmapped connected streams are still protected under RAPR.
- Change the measurement point for watercourses to the top of bank or, if not existing, the stream boundary. Meet or exceed RAPR requirements for the assessment area.
- Consider combining the requirements for Coastal Areas with DP2. Definition should be clarified for the line to be measured back from. With sea level rise, the term often used now is the highest high tide mark instead of the natural boundary. This line can be difficult to identify where there are influences of wave action and rocky shorelines.

- Update the wording around species at risk. A QEP can't designate a species at risk and can only refer to provincial and federal designations.
- Update the definition of wildlife tree – it is not defined in the Wildlife Act. Change the definition to designate the nest of an eagle, heron, osprey, falcon, or burrowing owl.
- Define a QEP

Section 3.2

- Remove the term “or similar professional”. This leaves an opening to remove trees without proper justification. The determination of hazardous trees should require an assessment by a qualified ISA Tree Risk Assessor.
- Consider removing or amending exemption G, “Subdivision of lands containing a portion of the DPA where all of the following apply”. The current exemption does not require the land be protected through the development process other than through the covenant. This could lead to degradation of the natural environment prior to the covenant or dedication being in place , and does not provide staff with the tools to require its restoration.

Section 3.3

- Strengthen language from “development activity to avoid encroaching into protected areas” to “must not encroach”.
- Change variance requirement of providing equal or greater areas of ecological value to net gain of habitat area. Value is subjective and changes over time, while habitat area is quantifiable.
- Clearly define buffers and the location of fencing and land dedication.
- Expand specifications for monitoring and include requirements to submit summary reports to the municipality.
- Replace the tree crown drip line with a minimum distance and trunk diameter multiplier (ex. 10x diameter at breast height, DBH). Tree crown drip line is often not adequate to protect the critical root zone of trees.
- Specify a threshold to the current tree risk assessment methods for trees to be allowed to be removed from within protection areas, per the International Society of Arboriculture’s Tree Risk Assessment Qualification.
- Specify a required survivability of plants and trees in restoration areas after a set number of years before bonding is released. For example, 100% survival of trees and 80% or 90% survival of understory vegetation is a common requirement in other DPs.
- Require monitoring and removal of invasive species over a specified monitoring period that corresponds with plant survivability (typically 3-5 years). Invasive species must not make up more than 5% of plant species in restored areas .
- Update references to the 17 best management practice documents listed (3.3.3). These should be updated periodically.

Section 3.4

- Provide clear guidance on the no net loss requirement for “environmentally sensitive terrestrial ecosystems.” This is currently not clearly defined and is open to interpretation.
- Provide a clear definition of “endangered Douglas-fir forests” and “Garry Oak meadow ecosystems”
- Consider developing a Green Infrastructure Network for the Municipality to identify priority corridors and habitat patches. It is difficult to require protection of habitat linkages without identifying them as part of a Municipality-wide network.
- Move broad guidelines to the objectives section. Some guidelines are broad and read like objectives (e.g. “protect and enhance biodiversity within terrestrial ecosystems” and “protect ecological values”). As guidelines, it would be difficult to demonstrate how they have been achieved.
- Consider moving the guidelines for shoreline protection to DP 2 – Marine Waterfront.
- Define who is a “qualified coastal professional”.
- Rewrite the Nest Tree Protection Areas section of the DP (3.4.4) and expand it to require bird nest surveys prior to the removal of trees in the bird nesting season (March-August). The intent of this section of the DP appears to be to protect raptors and heron nests, however, all nests are protected under the Wildlife Act, including song birds.
- Require that a raptors/heron nest construction plan be developed by a QEP.

4.4 DPA 4 Natural Hazard

Intent and objectives

This DP area aims to regulate development on steep slopes, floodplains and fire hazard areas. It protects structures and ensures stable building sites and mitigates hazards while preserving environmental features and functions. It also prevents personal injury.

High level recommendations

The following are broad recommendations to update it and improve its effectiveness:

1. The professional requirements and standards should be more specific to the topic. State which professionals can sign off on which reports. As an example, the qualifications are different for assessing tree risk compared to flood hazard or wildfire.
2. Clearly specify which reports and assessments are required in which areas. This DP includes three very different risk types.
3. Add some clarification on the municipality’s position to balance wildfire risk against tree preservation. While steep slope and floodplain requirements help protect environmental values, the Wildfire requirements do not as they promote the removal of conifer trees.
4. Review and update mapping of natural hazard areas. Current mapping is outdated and needs improvement.

Specific Recommendations for Improvement

The following are recommended updates and considerations within each section of the DP:

Exemptions - General

- Define qualified professionals for risk mitigation
- Define the standard to be used to determine a hazardous tree and the qualifications required to determine this (i.e. ISA standards, certified tree risk assessor)
- Remove one of the fence building sections – it is mentioned twice in sections (c) and (g).

General Guidelines

- Specify what reports are needed for the different hazards. The guidelines currently specify that a geotechnical assessment is required. However, some areas may be in floodplain or wildfire areas and do not have steep slopes which would require a geotechnical report.
- Move the requirement for a geotechnical assessment down to Section 4.3.1 – Steep Slope Lands. It does not need to apply to other hazard areas.

General Guidelines - 4.3.3 Floodplain Lands

- Reference Section 11 of the WSA for emergency flood work.
- Consider updating to include pre-determined setbacks, or referring to the zoning bylaw for floodplain setbacks. The current guidelines do not have pre-determined setbacks. They could be provided and changeable by a QEP report as relevant.
- Specify that the setback cannot be reduced to below the minimum standard of the Provincial Riparian Areas Protection Regulation. Confirm that a geotechnical report is what is required for flood control.
- Reword the sentence in (g) iv. to specify that development will not cause filling in beyond the area approved for the development.

4.5 Subdivision Bylaw 1851

Intent and objectives

This bylaw regulates how lands are subdivided. This includes the layout of properties, roads, drainage and other infrastructure. It includes the protection of streams and the ocean, and their setbacks, as well as the provision of lands for walkways and public access to water features and the ocean.

High level recommendations

The following are broad recommendations to update it and improve its effectiveness:

1. This bylaw is intended to protect water features and the ocean as well as their setbacks during subdivision. The terms used for water features should be standardized to be the same as the other municipal policies (i.e. watercourse or stream).

2. Consider including reference to dedication of not only lands for stream setbacks but also sensitive natural areas as defined in DP – 3 Natural Environment. These should be in addition to lands used as urban parks, but could include lands to be used as natural parks.
3. Include reference to tree preservation. Consider introducing a tree bylaw to help prevent tree clearing ahead of the application process.
4. Consider adding a requirement for applicants to submit a tree survey and Tree Management Plan, to be approved ahead of tree clearing.
5. Consider incorporating tree planting standards to the Engineering Standards Road Design standard drawings.

Specific Recommendations for Improvement

The following are recommended updates and considerations within each section of the Subdivision Bylaw.

- 30 - Reword this to use the same terms for water features as the Zoning Bylaw and DPs. Add ocean as one of the water bodies. Change the setback to being measured either from the natural boundary or the riparian/marine setback as per DPs 2 and 3.
- 31 – Reword this to use the same terms for water features as the Zoning Bylaw and DPs.

4.6 Parks & Public Places Regulation Bylaw 3626

Intent and objectives

This Bylaw specifies what activities are permitted within parks and at what hours of the day. It permits homeless people to sleep overnight under certain conditions, and restricts commercial activities without permits and defines the requirements for a park or facility use permit. It also enforces a general set of rules of behavior and conduct. Fire risk is addressed by restricting open fires and ignition sources, including fireworks. Municipality bylaw officers can enforce this bylaw by impounding items that contravene the bylaw, removing people from the park and issuing maximum fines of \$1,000 per day.

High level recommendations

The bylaw seems to adequately address areas of concern including behavior, fire risk, vehicles and overnight camping. No broad recommendations are provided.

Specific Recommendations for Improvement

The following are recommended updates and considerations within each section of the bylaw:

Definitions

- Update the environmentally sensitive areas definition to include the Marine Waterfront DP areas.

General provisions and restrictions

- Replace the word flower with shrub or plant in 2 (b).

4.7 Soil Removal and Deposit Bylaw, 2009

Intent and objectives

This bylaw regulates how soil is removed, transported and deposited. This is to protect soils and their importance to the integrity and health of natural areas, and the agricultural industry. It manages the risk of erosion and sediment transport to environmentally sensitive areas. It prevents changes to natural hydrology and protects the stability of slopes. It also mitigates against dust and noise that could impact residents' health and wellbeing. This bylaw provides additional protection to riparian areas and waterbodies beyond the DP and development permit process.

This bylaw is directed at the movement of large volumes of soil from larger parcels, and from areas within the Agricultural Land Reserve (ALR). Smaller volumes of soil movement outside of the ALR, as well as on lots smaller than 1ha are exempt from the bylaw. If larger amounts of soil are being moved from smaller lots outside of the ALR, it is assumed that its movement would be regulated as part of a development as approved by the Municipality.

High level recommendations

The following are recommended updates and considerations within each section of the bylaw:

1. Review the minimum volume of soil and size of land parcel that must comply with this bylaw. Ensure the bylaw's current size requirements are sufficient to capture all significant soil removal and deposit activities.
2. Consider adding a requirement as part of the permit that soils deposited are free of invasive species. The spread of invasive plant species is a growing concern and is often caused by the movement of soils. There is no soil test for the presence of invasive species. This would be something that staff or QEPs may visibly see in the soil and could then act upon.

Specific Recommendations for Improvement

The following are recommended updates and considerations within each section of the DP:

Section 3

- Add that in addition to a development permit, a DP 3 approval is required and must comply with the Riparian Areas Protection Regulation which defines development as the movement of soil (5).
- Consider specifying a minimum standard for topsoil quality and depth, and more details for replanting with native plants, in addition to currently guidelines that Require topsoil to be placed over the area and it be planted or sown with grass (6).

Section 4

- Consider reducing the exemptions for volumes for soil movement outside of the ALR, which currently exempts soil movement if it is an amount less than a certain volume (300m³ per parcel or 60m³ per acre per year). This is a large amount of soil. We would be interested to hear feedback from staff on these thresholds.
- Consider reducing the size of exempted parcels, instead of the current exemption for parcels <1 ha in size.

Section 13

- The security may be too low to prevent infractions. Consider increasing securities so as to encourage compliance.

5.0 Appendix 2 – High-Level Policy Gap Analysis

The content below is intended to provide an overview of the high-level policy gap analysis for various bylaws, management plans, local area plans, and policies that are relevant to this review.

Bylaws:

1. Blasting Bylaw 3255
2. Building Bylaw 2003
3. Campground Bylaw 2140
4. Fire Protection Bylaw 3340
5. Firearms Bylaw 3077
6. Float Home Standards Bylaw 3015
7. Forest Use Bylaw 3265
8. Mobile Home Parks Bylaw 1775
9. Untidy and Unsightly Premises Bylaw 1991
10. Waterworks Bylaw 3620

Management Plans:

1. Bonsall Creek Watershed Management Plan (2016)
2. Cowichan Estuary Environment Management Plan (1987)
3. Integrated Forest Resources Management Plan (1981)
4. Maple Mountain Management Plan (1992)
5. Somenos Marsh Wildlife Society 5 Year Strategy Plan (2017-2022)

Local Area Plans:

1. Bell McKinnon Local Area Plan (2018)
2. Crofton Community Local Area Plan (2015) & University Village Local Area Plan (2015)
3. Chemainus Town Centre Revitalization Plan (2011)

Policies and High-Level Plans:

1. Climate Action and Energy Plan (CAEP, under review)
2. Development Permit Area 1
3. Energy Step Code Rebate Policy (2020)
4. Parks and Trails Master Plan (2017)
5. Site Adaptive Planning in Urban Rural Interface (2019)
6. Trail Maintenance Policy (2020)

5.1 Bylaws

Blasting Bylaw 3255

The Blasting Bylaw prohibits blasting without a permit. This bylaw requires qualifications and fees to obtain a blasting permit. It specifies blasting restrictions for the timing, proximity to land uses and

weather conditions. It requires that notifications be issued and that access near the site be controlled. It also permits the municipality to access a site to enforce the requirements.

It is recommended that:

- The Blasting Bylaw be updated to add restrictions during high to extreme fire hazard.

Building Bylaw 2003

The Building Bylaw regulates construction in North Cowichan to consider the public interest. It describes building permit requirements and defines the role of the building inspector. The building bylaw does not specifically address climate change or the natural environment. It does have some requirements for water conservation, requiring low water consumption toilets and urinals. Local governments are restricted by the Building Act, which precludes them from establishing separate building standards, except through the BC Energy Step Code.

A timeline for implementing Step 2 of the BC Energy Step Code in North Cowichan was established in August 2020, and is required as of May 2, 2021. This timeline should continue to be developed for additional steps of the code.

Campground Bylaw 2140

The Campground Bylaw provides a framework to regulate campgrounds in North Cowichan. The bylaw states that campgrounds cannot be altered without written approval and a permit by the Building Inspector, and includes what is required for a permit application.

The bylaw is effective at establishing buffers around campsites, and designating minimum setbacks from watercourses. It requires structures to be sited 30 m from watercourses when the 200-yr floodplain is unknown, otherwise the setback is based on the 200-yr floodplain. It also sets water, stormwater, and sewage requirements. The bylaw addresses concerns from flooding, requiring a minimum elevation for structures, and multiple requirements to address the risk of fire; however, it does not address tree risk.

It is recommended that the Campground Bylaw:

- Further defines what should be located within campground buffers (i.e. native vegetation).
- Confirm watercourse setbacks are compliant with RAPR, as they appear to be focused on reducing flood risk to the site vs. protecting the watercourse.
- Provide guidance around overall campground layout, including to avoid sensitive habitat, and include goals for vegetation retention.
- Incorporate tree risk assessment, including hazard trees and identifying windfirm edges.

Fire Protection Bylaw 3340

The Fire Protection Bylaw prohibits land owners from having conditions on site that are considered a fire hazard including the accumulations of combustibles. It ensures the security of burned buildings. This

bylaw regulates incineration on a property and requires all intentional fires to be supervised. It provides restrictions and requirements for open burning and wood burning appliances and requirements for fire pits.

The Fire Protection Bylaw allows the municipality to ensure that forestry and industrial activity does not cause debris accumulations. In addition, it gives the municipality power to enter a property to mitigate fire hazard if the owner fails to. It recognizes and provides permission to the municipality to fight fires on private property, allows the fire department to respond to non-fire related emergencies, and empowers the municipality to order an open burning ban.

It is recommended that:

- The Fire Protection Bylaw be updated to refer to Firesmart standards and the CWPP once adopted as the standards to achieve on properties.
- The identification of fire hazard be better defined so the public can understand what may be considered an infraction. It is currently dependent on the opinion of the local assistant. This could.

Firearms Bylaw 3077

The Firearms Bylaw regulates the use of bows and firearms. It creates designated areas where hunting can occur, including maps of the areas. Overall, this bylaw appears to be effective at limiting hunting to designated areas.

It is recommended that:

- Assuming that the community still supports the use of the designated lands for hunting, then no recommended changes.

Float Home Standards Bylaw 3015

The Float Home Standards Bylaw regulates float home requirements and applies to all areas of land and water within North Cowichan, and extends 1000 feet beyond the foreshore highwater mark. Float homes need a building permit to moor in a marina, and must meet the requirements set out in the bylaw by 2001 (either mooring after that time or meeting specific requirements by then if moored earlier). The home must be buoyant, able to handle winds without sinking or dislodging, comply with electrical and gas safety requirements.

The bylaw requires a sewer connection when available or approved toilet system to ensure the waste is not released into the environment, which is likely sufficient to inhibit dumping and protect water quality from float homes. The bylaw allows for penalty fees, which likely improves enforcement.

It is recommended that:

- The location of float homes is selected to avoid sensitive foreshore habitat.

Forest Use Bylaw 3265

This Forest Use Bylaw applies to the municipal forest reserve and other municipal lands used for forest purposes. It prohibits certain forest uses and damaging activities, and serves to protect the natural areas from disturbances that have not been approved and permitted under the bylaw.

Overall, this bylaw appears to be effective at addressing the relevant environmental components considered for this review. It protects against impacts to the forest in the reserve and other municipal lands used for forestry. It prevents open fires, which is critical to prevent wildfires. Finally, it protects the integrity of natural forests, which is critical to mitigate against climate change impacts, and it allows for fines to be issued under the Offence Act.

The effectiveness of the monitoring and enforcement for this bylaw could be a challenge for the large, forested areas it regulates. A review could be done to determine how often infractions are committed, how many fines are issued and if there are enough resources for monitoring and enforcement.

Mobile Home Parks Bylaw 1775

The Mobile Home Parks regulates the parking of mobile homes and creation of mobile home parks. The development of mobile home parks requires consideration of proposed water supply, sewage disposal, wastewater disposal and garbage disposal. Maps included in the development process must show watercourses and steep slopes & banks, and consider flooding and erosion in the development.

The bylaw is likely moderately effective at minimizing impact to the natural environment. It minimizes pollution and waste, but does not require vegetation retention or placing parking pads away from sensitive areas. It addresses many risks associated with the natural environment, requiring vertical and horizontal setbacks from water features and addressing fire risk reduction. It does not include setbacks off of steep slopes, but this is covered under DPA 4.

It is recommended that the Mobile Homes Parks Bylaw:

- Provide guidance around overall park layout, including to avoid sensitive habitat, goals for vegetation retention, and buffer requirements between parking pads.
- Incorporate tree risk assessment, including hazard trees and identifying windfirm edges.

Untidy and Unsightly Premises Bylaw 1991

The Untidy and Unsightly Premises Bylaw addresses provincially designated noxious weeds, as defined under the Weed Control Act. It requires noxious weeds are cleared and are not allowed to accumulate on private property. However, using the term “noxious weeds” may exclude many regionally significant invasive plant species.

The bylaw provides North Cowichan with the tools to ensure noxious weeds are removed from private property at the owner’s expense. However, the bylaw does not address public property, invasive species

(not all of which are included under noxious weeds), newly introduced species that have the potential to become invasive, or restoration requirements.

It is recommended that:

- The municipality expands the scope of the bylaw, or develop a separate bylaw, that includes invasive species rather than just noxious weeds, with specifics on how these are designated. This would be an opportunity for North Cowichan to develop a list with the most relevant invasive species to North Cowichan, focusing and prioritizing invasive species and noxious weed management. This could be done in consultation with the Environmental Advisory Committee.
- Proper disposal of invasive species and noxious weeds be addressed. Section 3 regarding dumping could be updated to include the dumping of invasive species, as many can spread through illegal dumping of garden waste.
- A policy of Early Detection Rapid Response (EDRR) be initiated to detect and manage new infestations and new invasive species.
- The municipality undertakes a mapping exercise of public lands to map the extent of invasive species, providing a baseline of existing infestations.
- North Cowichan considers developing an Invasive Species Management Plan (ISMP), which would use the baseline mapping to develop a plan to manage and prioritize treatment of invasive species in North Cowichan.
- Restoration requirements be developed. Invasive species are likely to recolonize an area after removal if the area is not replanted with native plants. Good start to native plants here: https://www.northcowichan.ca/EN/main/departments/environmental-services/native-plants/Native_Drought_Tolerant_Gardening.html

Waterworks 3620

The Waterworks Bylaw regulates water access, usage and pricing. It requires water meters be installed on new and upgraded connections, and sets out water conservation measures.

The bylaw is effective at addressing the component of the natural environment it aims to – water. It addresses water conservation measures and requires metering going forward on all new builds and retrofits. The bylaw allows the municipality to enforce non-compliance with water conservation measures and apply fines.

It is recommended that:

- North Cowichan consider updating the fee schedule bylaw to charge for use. The bylaw is set up to charge for use, but the fees bylaw appears to charge by use only when over an "allowed" amount. Pricing by use on a sliding scale can encourage conservation.

5.2 Management Plans

Bonsall Creek Watershed Management Plan (2016)

This plan provided a description of the hydrology, aquatic ecology and land use in the Bonsall Creek watershed, which covers a large area of North Cowichan. The plan recognises restoration efforts and the importance of stewardship groups for watershed management, and a discussion on climate change impacts.

This is comprehensive report that includes balanced discussion of conservation and land use trade offs. Actions items to manage the watershed are clear and prioritised with justification.

It is recommended that:

- As the plan is implemented and updated in the future, it includes some analysis of adjacent terrestrial conditions and their impacts on the watershed.

Cowichan Estuary Environmental Management Plan (1987)

This report summarizes impacts to and recommends actions to mitigate impacts from industry to the Cowichan river estuary. It is a high value estuary for salmon and shorebird habitat. It recognizes agreements with major industrial companies to mitigate their impacts in this area. This focusses largely on log storage leases. Areas are designated for use in the estuary including industry/commercial, agriculture, habitat and conservation and recreation. A project review process is specified to ensure new uses are reviewed and approved. The estuary is located just south of North Cowichan outside of its boundaries, but discusses industrial activities within the municipality.

This management plan is several decades old, and as a result it references old agreements and legislation such as the Environment Management Act. Some of the industrial parties no longer exist, while new ones are likely active in the estuary.

It is recommended that:

- The municipality work with the province and other stakeholders to update the Management Plan.

Integrated Forest Resources Management Plan (1981)

This plan from 1981 focuses on the timber reserves and sustainable management of the municipal forest reserve. It focusses on timber inventory, growth and yield and silviculture planning to 2020. The forest reserve covers 25% of the land base, and timber extraction in the forest has become increasingly controversial.

An Interim and Long-Term Forest Management Plan for the Municipal Forest Reserve are currently being developed and include a public consultation process currently underway. The plan update aims to balance uses, including timber harvesting, recreation values and ecological stewardship.

There is an interim and Long-Term Forest Management Plan currently being developed for the Municipal Forest Reserve. As part of these updates it is recommended that:

- Forest planning concepts be updated to more current practices.
- The implications of wildfire risk be included as a consideration during planning and operations.

Maple Mountain Management Plan (1992)

This report summarizes findings from public consultation which explored uses of this forest area apart from traditional forestry and timber extraction. It provides a summary of each resource use and the feedback from the consultation process. Apart from forest management, the highest value resource uses were identified by the public as aesthetics, hiking and recreation activities. Sensitive forest communities were identified for preservation, including Gary oak ecosystems. Alternative lower impact harvesting methods were recommended.

The report provides a good summary of public opinion in 1992. Public perception of forestry and non timber resources values can be expected to have changed over the past 30 years. In addition, it doesn't recognize risks associated with forested areas such as wildfire, tree hazard or the changes in forests resulting from climate change. Mountain biking is also a fast growing sport that is popular in this area and may warrant consideration for the management of the forested area (as documented on mountain bike trail sites including "Trailforks").

While this provides valuable insight into the vision of the community in the 1990's, it may no longer provide much guidance around the current community. Recreational aspects of this plan are covered in the Parks and Trails Master Plan, which should likely be the primary guiding document around parks and recreation in this area.

Somenos Marsh Wildlife Society 5 Year Strategy Plan (2017-2022)

The 5 Year Strategic Plan provides a clear vision and guiding principles for the rehabilitation, protection and management of the Somenos Marsh Conservation Area and the Somenos Marsh Wildlife Society. It sets out guidance for the operation of the Society and to recognize its key relationships in the achievement of its mission. The goals, objectives and actions set out important priorities for the restoration, research and monitoring in the Conservation Area.

The strategic plan builds on the 2001 Management Plan which was developed by Ducks Unlimited and the Somenos Steering Committee. The strategic plan is well-organized, and the continued management of the area by the Society and the committee is a great example of collaborative efforts including First Nations to manage a sensitive ecosystem.

5.3 Local Area Plans

There are four official Local Area Plans (LAPs) in North Cowichan: The Bell McKinnon LAP (2018), the Crofton Community LAP (2015), the University Village LAP and the Chemainus Town Centre Revitalization Plan (2011). North Cowichan's LAPs provide a sense of the values of each neighbourhood, and some of their environmental protection goals, as well as good policies to protect and enhance the natural environment, particularly through the identification and protection of environmentally sensitive areas and the setting of related targets.

The most recent Bell McKinnon LAP provides a good example. It includes principles to integrate ecological design and develop a blue-green infrastructure network in the community. It sets explicit targets and metrics to guide the implementation of its goals and principles, including canopy cover and effective impervious areas targets, and provides recommendations to improve energy efficiency and develop a connected network of green space.

5.4 Policies & Plans

Climate Action and Energy Plan (currently under review)

This plan recognizes the changes in the climate and the municipality's commitment to reduce their green house gas emissions. It provides a summary of existing and expected energy consumption and provides a plan to conserve energy, reduce emissions and to address the expected impacts of climate change.

The plan includes a commitment to the BC Climate Action Charter which includes becoming climate neutral with respect to municipal operations by 2012. This plan was developed after this year in 2013. It recommends that the OCP adopt a target of reducing emission to 33% under 2007 levels by 2025. It identified the majority of emissions (76%) coming from transportation. Most recommended actions focus on changes to transportation as well as making development more energy efficient and switching to more sustainable energy sources.

The discussion of climate change impacts include those that affect the natural environment such as wildfire, sea level rise, storms, drought and temperature extremes. These impacts are prioritised and current approaches to manage the risks are summarised. No detailed recommendations are made for strategies to mitigate the risk of climate change on the natural environment. The only action that relates directly to the natural environment includes increasing North Cowichan's tree cover. Options for an urban forest strategy and tree bylaw are discussed as well as incentives to plant trees on private property.

Updates are underway to improve greenhouse gas modeling, the municipal emissions reduction goals, review and reschedule projects, and develop an implementation and monitoring framework.

It is recommended that the plan update:

- Prioritises the recommendation to develop an urban forest strategy and tree bylaw. Adopt targets for tree canopy cover by land use type.
- Includes more detailed actions to address impacts on the natural environment such as sea level rise, drought, temperatures, wildfire, storms, forest pest and disease and invasive species.

Development Permit Area 1

Development Permit Area 1 - General regulates development to meet five objectives: the site choice and efficient land use, mobility, site design and landscaping, infrastructure and servicing impacts, and building form and character. The DP encourages site level planning to preserve environmentally and archeologically significant lands and to avoid hazard lands. It also encourages development in designated growth centres as well as the retention of existing landforms, biodiversity and vegetation.

While DP 1 includes key environmental objectives, it does not define specific goals or requirements to achieve the objectives. This lack of details can keep things flexible, but also makes enforcement difficult for the municipality. It also touches on wind hazard, while other hazards are covered under DP 4 – Hazard Lands.

It is recommended that:

- Ensure the wind hazard provisions are compliant with DP 4 – Hazard Lands.
- More specific environmental requirements be introduced related to the stated environmental objectives, as the environmental DPA 3 doesn't apply to the entire municipality. These could include requirements such as developing away from ESAs, identifying targets for pervious surfaces, protecting a % of natural areas in all new greenfield development, etc.
- The Municipality consider connectivity from a species movement perspective as well as from a mobility perspective. These frameworks can be complimentary.
- More guidance be provided on GHG reduction design strategies, or reference to the Step Code.

Energy Step Code Rebate Policy

The Energy Step Code Rebate Policy is a council policy that encourages voluntary participation in the BC Energy Step Code in advance of mandatory requirements. It provides rebates associated with implementation of the BC Energy Step Code, increasing the rebate with increasing efficiencies or "steps".

The rebate provides incentives to improve energy efficiencies for "Part 9" buildings (i.e. single-family homes). However, these incentives are too low to cover the costs associated with meeting the requirements and the associated reporting to prove that the code requirements have been met. It will likely subsidize houses that were planning on meeting the requirements but are unlikely to be high enough to encourage houses that were not already looking into energy efficiencies. This policy is also only directed at single-family homes and does not support energy use reductions in multi-family homes.

It is recommended that the Municipality:

- Consider increasing the rebates to better cover the costs associated with meeting the requirements and expanding it to multi-family homes.
- Develop and publicise a timeline to implement the BC Energy Step Code in North Cowichan. Step 2 will be implemented as of May 1, 2021. It is expected that step 3 will be mandatory in the BC Building Code in 2022. The Municipality should consider implementing further Step requirements in the future, and exploring the possibility of implementing higher step requirements for new development through the rezoning process.

Parks and Trails Master Plan

The Parks and Trails Master Plan guides the development and management of municipal parks and trails. It includes a goal to conserve and restore the function of natural habitat and ecosystems, and to contribute to the connectivity of those areas within the region with the goal of providing continuous access.

The Master Plan sets out good guidance to protect and restore the municipality's existing green network of environmentally sensitive areas, wetlands, riparian and river corridors, steep slopes and forest patches. It includes actions to manage invasive species in municipal parks and along trails.

It is recommended that:

- The Master Plan be updated over time to keep the green network map up-to-date, for example to maintain its consistency with OCP map 7 (Environmentally Sensitive Areas).

Site adaptive planning in urban rural interface (2019)

This Council Policy identifies specific properties as being within the Urban-Rural Interface Area, which are likely to be proposed for future development. It approves a more detailed analysis process for these lands during a development application to ensure environmental, hazard and local character values are addressed. It requires staff to pursue a planning process called "demonstrative site adaptive planning analysis" for development applications on these designated lands.

The Council Policy does not include specifics or references for what is required to be included in this planning analysis, and as a result may be too broad to be enforceable in its current form.

It is recommended that:

- The Council Policy be updated to add guidelines to be followed for the demonstrative site adaptive planning analysis. The guidelines should reference specific concerns to be addressed, i.e. wildfire risk, windthrow and tree risk, as well as flooding and sea level rise.

Trail Maintenance Policy 2020

The Trail Maintenance Policy Describes the trails to be maintained within the municipal boundaries and the level of maintenance to which they are to be sustained at. The policy identifies and prioritizes trail

maintenance based on cost, safety, budgets, personnel, and the environment. It describes the different trail types, including use, trail material and height. Maintenance activities includes inspections, clearing, remediation, re-routing, decommissioning and issue tracking.

The policy effectively manages and prioritizes trail maintenance, and protects natural resources within the immediate vicinity of trails. It sets specific roles, responsibilities and timelines for implementation. However, the policy does not define inspections or safety standards (i.e. who is inspecting for what). In addition, Priority D trails are not reviewed. Currently no trails are identified as Priority D in the Policy; however, this should be revisited if trails are designated Priority D in the future.

It is recommended that:

- Inspection and safety standard requirements are described in the policy or in a supplemental implementation document to ensure the intended standards are being met.
- The municipality considers identifying the required qualifications to carry out the assessment (i.e. if they need to be a QEP such as a Registered Professional Forester, or an ISA Certified Arborist, and a Certified Tree Risk Assessor, etc.)

From: [REDACTED] FIPPA s. 22(1)
Sent: Tuesday, December 15, 2020 9:55 AM
To: Council
Subject: Green Circular Economy Eco-Industrial Business Park for Vancouver Island

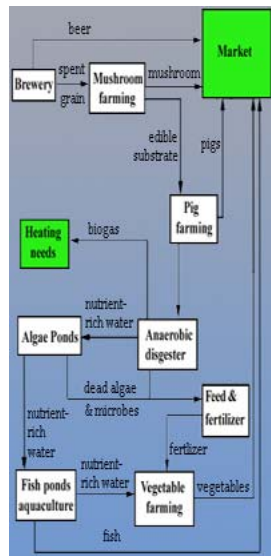
Dear Mayor and North Cowichan Councillors,

Vancouver Island has a pressing need for a green industrial space where innovation and the practice of a circular economy can be fostered. Currently there is a distinct shortage of available Industrial land. The Municipality of North Cowichan (MNC) could be the landholder that benefits from the revenues of such an Eco-Industrial Business Park (EIP). MNC would enter into lease agreements with business owners and provide areas where new innovation and future synergies can grow. A separate committee would review lease applicants and make recommendations to MNC. Lessons and modeling can be taken from the EIP in Kalundborg, Denmark which has been in operation since 1972 and successful projects that have already been implemented elsewhere in Canada - notably the Burnside Business Park in Halifax. I have attached studies by the city of Moncton and a Dartmouth paper outlying EIPs and their benefits. It is well past time, and also very timely in the time of the potential of a federally supported Green Recovery, to have our own Vancouver Island centred model established here. Let's get started and support those that are already innovating locally and initiate a North Cowichan EIP vision to showcase success in sustainable industrial practices on Vancouver Island.

Best,

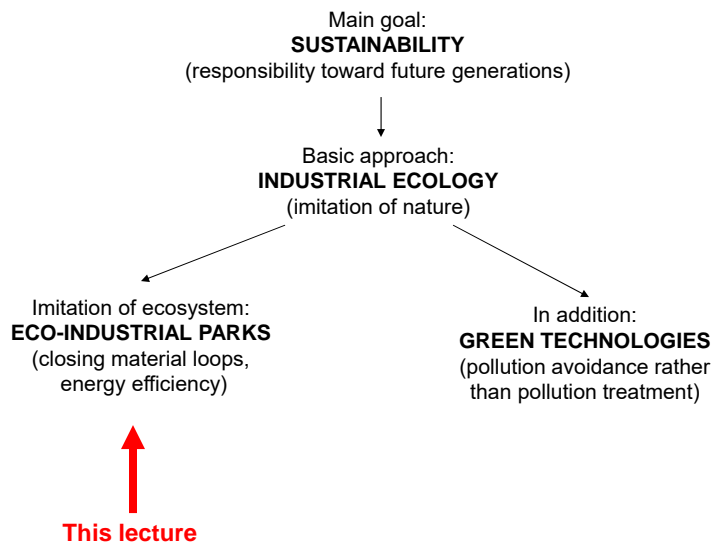
[REDACTED] FIPPA s. 22(1)
North Cowichan Resident / Small Business Owner and Supporter

Kalundborg Symbiosis - www.symbiosis.dk/en/



A first tool of Industrial Ecology: ECO-INDUSTRIAL PARKS

How do they work – What do they accomplish
Examples – Case studies



What is an EIP?



Kalundborg, Denmark

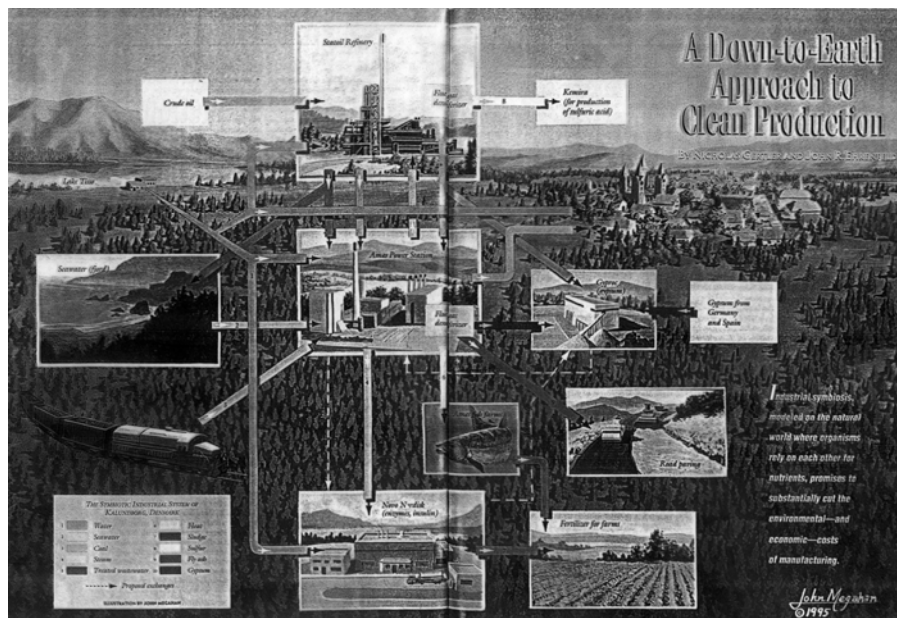
An eco-industrial park involves a **network of firms and organizations**, working together to improve their environmental and economic performance. Some planners and researchers of EIPs have used the term "industrial ecosystem" to describe the type of **symbiotic relationships** that develop amongst participating firms.

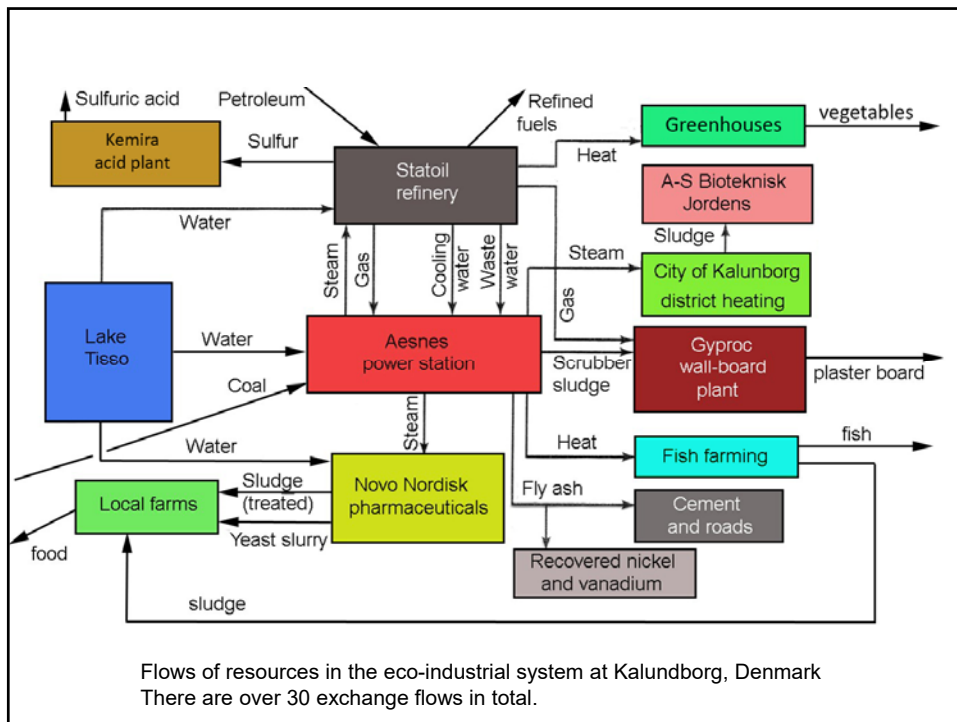
Specifically, Indigo's EPA research project defined eco-industrial parks as follows:

"An eco-industrial park is a community of manufacturing and service businesses seeking enhanced environmental and economic performance through collaboration in managing environmental and resource issues, including energy, water, and materials. By working together, the community of businesses seeks a collective benefit that is greater than the sum of the individual benefits each company would realize if it optimized its individual performance only."

The goal of an EIP is to improve the economic performance of the participating companies while minimizing their environmental impact."

Town of Kalundborg in Denmark – A historical first and the canonical example





Kalundborg Savings & Profits:

Water

The companies have reduced the overall consumption by 25% by recycling the water and by letting it circulate between the individual partners. A total of 1.9 million m³ of groundwater and 1 million m³ of surface water are saved on a yearly basis.

Oil

The Asnæs Power Station has reduced its oil consumption by 30,000 tons per year by using Statoil flue gas, corresponding to a 570-tonne reduction of sulfur dioxide emission per year. Novo Nordisk A/S is saving 19,000 tons of oil per year by using gases from Statoil.

Ash

The combustion of coal and orimulsion® (bitumen-based fuel) at Asnæs Power Station results in approximately 80,000 tons of ash, which are used in the construction and cement industries for the manufacturing of cement or the extraction of nickel and vanadium.

Gypsum

Every year BPB Gyproc A/S receives up to 80,000 tons of gypsum from Asnæs Power Station. This figure corresponds to the large majority of the company's annual consumption. The gypsum substitutes the natural gypsum used in the production of plasterboards.

NovoGro®

NovoGro® from Novozymes A/S substitutes the use of lime and part of the commercial fertilizer on approximately 20,000 hectares of farmland.

Wastes Avoided through Interchanges		
Location	Waste	Avoided
Asnaes (landfill)	Fly ash and clinker	200,000 tons
Asnaes (landfill)	Scrubber sludge	80,000 tons
Statoil (Air)	Sulfur (as Hydrogen Sulfide)	2,800 tons
Novo Nordisk (Landfill or sea)	Water treatment sludge	1 million cubic meters
General (air)	sulfur dioxide	1,500-2,500 tons
General (air)	Carbon Dioxide	130,000 tons

Results at Kalundborg:

Economic

Total investment of about \$60 million (during period 1979-1993)

Annual revenues of about \$12 million starting in mid-1990s, now around \$15 million

Average payback time of 5 years

Accumulated revenues as of 1993: around \$310 million (according to Wikipedia)

Environmental savings

19 thousand tons of oil

30 thousand tons of coal

1 million m³ of lake water

2.9 million m³ of groundwater

Reduced emissions

130 thousand tons of CO₂ (out of 4 million tons)

3700 tons of SO₂ (out of 29000 tons)

Reuse of waste products

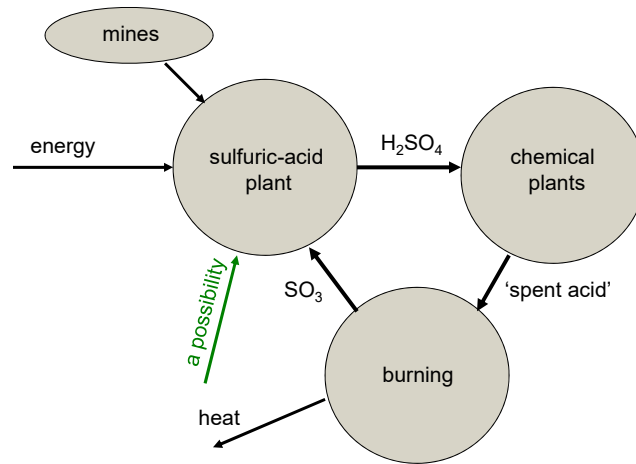
135 tons of fly ash

2800 tons of sulfur

80000 tons of gypsum

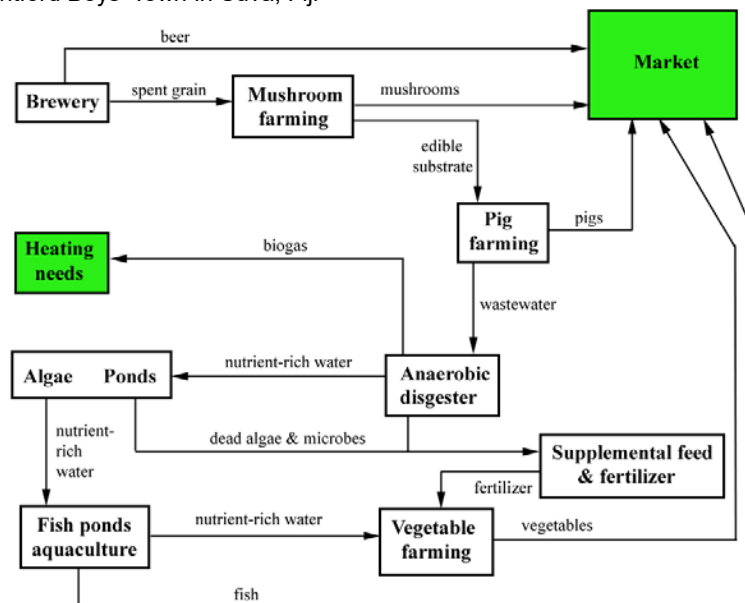
800 thousand tons of nitrogen in sludge

A simple but effective arrangement in the so-called Houston Ship Canal



(From O'Rourke, Connelly & Koshland, 1996)

Flow resources in the integrated biosystem of Montford Boys' Town in Suva, Fiji



U.S. EPA (<http://www.epa.gov/jtr/topics/eipex.htm>)
Eco-Industrial and Resource Recovery Parks

1. Resource Recovery Park

A group of reuse, recycling, and composting processing, manufacturing, and retail businesses receiving and selling materials and products in one location.

2. Zero-Emission Park

A group of co-located businesses working together to reduce or eliminate emissions and wastes.

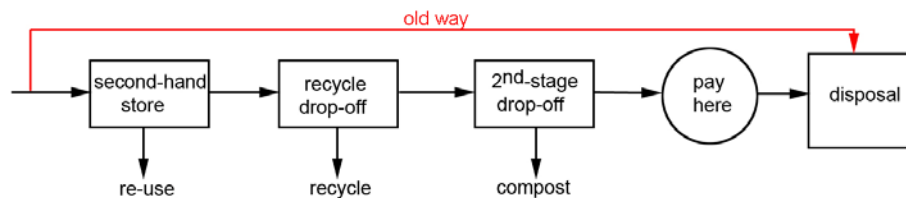
3. Virtual Eco-Park

A group of businesses that are geographically separate, but still working together to minimize their impact on the environment.

Example of a Resource Recovery Park:
Monterey Regional Waste Management District Regional Environmental Park
in Marina, California

Participating establishments:

- Permitted sanitary landfill
- Public drop-off recycling station
- "Last Chance Mercantile" resale facility
- Landfill gas power project
- Materials recovery facility (MRF)
- C&D recycling operation
- Composting operations
- Soils blending facility



**Zero-Emission Park: Example
Chaparral Steel-TXI, in Midlothian TX**

Participating Establishments:

Steel mill
TXI Cement Division (Texas Industries, Inc.)
Automobile shredding facility

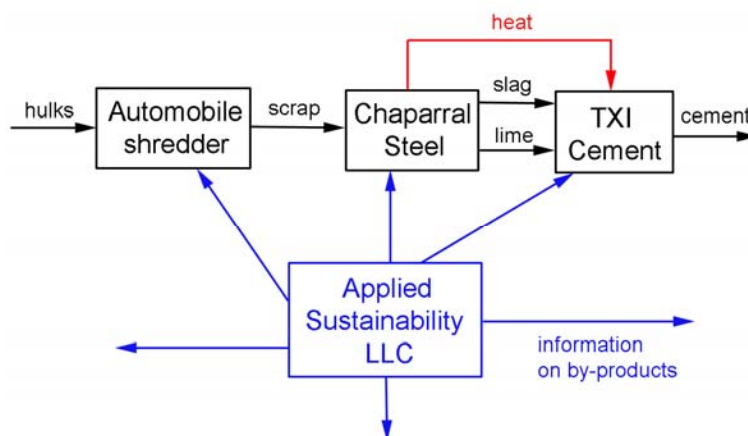
Chaparral Steel and TXI Cement Division, two Midlothian, Texas manufacturing facilities owned by the same company, established the foundation of a zero-emissions park by forming a partnership to use Chaparral's steel slag in the cement kiln to produce high-quality Portland cement.

The process allows the cement company to skip two energy-intensive steps. First, the process uses steel slag that has already been subjected to the high temperatures of the steel furnace, supplying the heat of formation of the slag's principal compound, dicalcium silicate, the building block for Portland cement. Second, by using lime that has already been calcined by Chaparral, TXI is able to skip a step that would have expended considerable energy and generated carbon dioxide.

This by-product sharing arrangement aims to eliminate waste by developing links between Chaparral, TXI Cement, and a nearby automobile shredding facility that provides scrap steel to Chaparral for new production. The end goal is to create enough linkages such that everything the steel mill produces will, in synergy with adjacent enterprises, be a useful product.

The Chaparral-TXI partnership also spurred the creation of a new company, **Applied Sustainability LLC**, which assists businesses in identifying by-product sharing opportunities.

Here is how Chapparral Steel and TXI Cement work together thanks to Applied Sustainability, LLC



By adding slag to the cement manufacturing process, cement production has jumped 10% and energy consumption has dropped 10%, accompanied by a comparable reduction in greenhouse gas emissions.

Virtual Eco-Park: Example
The Brownsville Project, in Brownsville, Texas

Potential Participating Establishments:
To be determined

The Brownsville Project takes a regional approach to exchanging materials and byproducts. As currently envisioned, the project will include not only industrial facilities, but also small businesses and agricultural partners.

A database of companies in Brownsville and neighboring **Matamoros, Mexico**, has been developed and analyzed to identify potential materials exchange opportunities among companies. Cost-based data was added to the database, and a marketing plan will be developed to evaluate and recruit participants.

The Texas Department of Commerce and the Brownsville community have provided initial funding, and project leaders are working to secure long-term support. In particular, state officials will be working closely with project leaders to ensure that permitting procedures do not become a barrier to development.

Burnside Park in Dartmouth, Nova Scotia, Canada

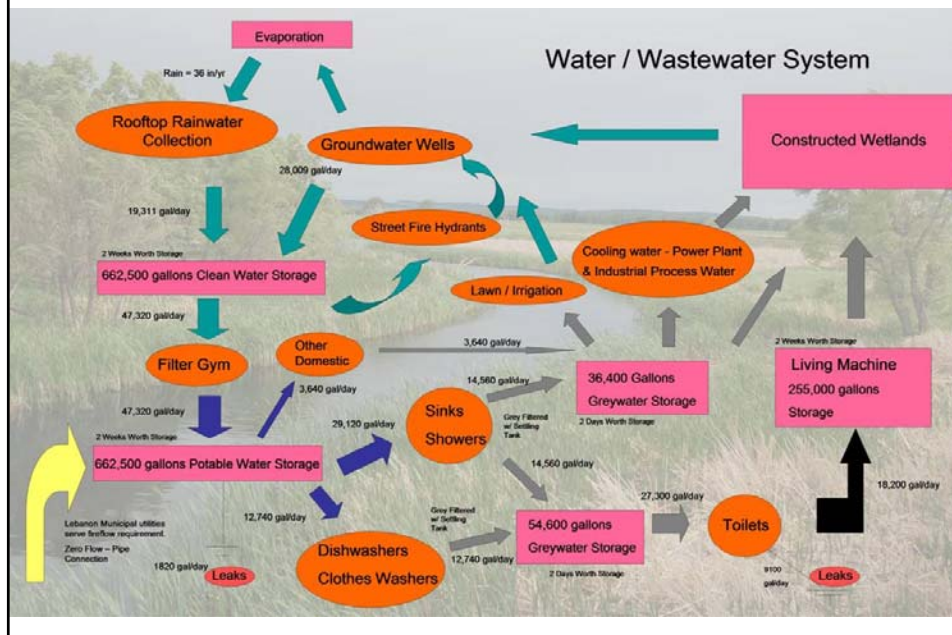


Burnside Park, formerly known as **Dartmouth Industrial Park**, is a major commercial and industrial development located in the community of Burnside in the Halifax region of Nova Scotia.

It encompasses about 3,400 acres (1,376 hectares) of land running up the hill from the Bedford Basin and was developed as the former City of Dartmouth's industrial park following the completion of a bridge in 1970. Businesses include manufacturing, electronics, transportation, retail, and several types of services.

Current employment estimates state that over 1,000 businesses together employ around 17,000 people.

Water cascading and recycling in an eco-community



Components of EIP design

EIPs have a rich menu of design options, including site design, park infrastructure, individual facilities, and shared support services.

Natural Systems – An industrial park should fit into its natural setting in a way that minimizes environmental impacts while cutting operating costs.

Example: The Herman Miller design plant in Phoenix illustrates the use of native plant reforestation and the creation of wetlands to minimize landscape maintenance, purify storm water run-off, and provide climate protection for the building.

Example: Use of local solar and/or wind energy

Energy – More efficient use of energy is a major strategy for cutting costs and reducing burdens on the environment.

Example: Steam or heated water flowing from one plant to another (energy cascading), or to homes in the area.

Material Flows – In an eco-park, companies perceive wastes as lost opportunities that ideally are potential products to be re-used internally or marketed to someone else.

The park infrastructure may include the means for moving by-products from one plant to another, warehousing by-products for shipment to external customers, and common toxic waste processing facilities. One emerging strategy for EIP planning involves anchoring the park around resource recovery companies that are recruited to the location or started from scratch.

Example: Brewery, mushroom farming, pig raising and vegetable farming in Fiji

Water Flows – Processed water from one plant may be re-used by another (water cascading), passing through a pre-treatment plant as needed. The park infrastructure may include mains for several grades of water (depending on the needs of the companies) and provisions for collecting and using storm water run off.

Park Management and Support Services – Management supports the exchange of by-products among companies and helps them adapt to changes in the mix of companies (such as a supplier or customer moving out) through its recruitment responsibility. It may maintain links into regional by-product exchanges and a site-wide telecommunications system.

The park may also include shared support services such as a training center, cafeteria, day care center, office for purchasing common supplies, or a transportation logistics office.

Benefits of Eco-Industrial Parks

1. Monetary benefits to companies:

- ↓ Production costs (purchasing unwanted by-products from others at bargain prices; selling its own by-products)
- ↓ Energy consumption (less transportation)
- ↓ Waste management (on-site, or even being able to sell what would otherwise be waste)
- ↓ Costs of compliance
- ↓ Cost of some R&D (shared with other companies)

2. Environmental benefits:

- ↓ Demand on natural resources
- ↓ Waste (in all forms: solid waste, air emissions, wastewater)
- ↓ Chances of accidents in transportation (pipes instead of trucks)

3. Societal benefits:

- Better economy → more jobs
- Cheap heating (in both park and residential neighborhoods)
- Cleaner air, cleaner water → better health
- ↓ Demand on sewer system, landfill etc.



The City of Hamilton's Sustainable Development through Eco-Industrial Parks

Joy Gnanapragasam

Supervisor: Dr. Gail Krantzberg

September 18th, 2013

Master of Engineering and Public Policy

McMaster University

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1.0 INTRODUCTION

There is immense pressure placed upon the ecosystem and biosphere to encompass and support the rising global population and an exponential increase in consumption levels. As a result, the world is facing numerous challenges such as global warming, high levels of air pollution, economic crisis, poverty and global loss of bio-diversity.¹ To meet the needs of a growing world population within the planet's ecological means, Canada and other industrialized nations will be required to reduce material throughput, energy use, and environmental degradation by over ninety percent by 2040.² Therefore, there has been a global drive towards sustainable development as a means of reconciling human development with the earth's ecological systems.³ A synergy between the social dimensions, environmental stewardship, and economical efficiency, also known as the three pillars of sustainability is required when considering sustainability. Advancement of sustainable development will be a means in safeguarding the future. Therefore, the key goals of public policy and decision-making in Canada and around the globe have centered on sustainable development.⁴

Since the mid-90s, municipalities have taken on the challenge of developing practices that will ensure the long-term sustainability of their communities.³ The City of Hamilton is a diverse city which includes a booming industrial sector and a large community encompassed by a vast natural environment. Hamilton has been focused on implementing sustainable development within the city as seen by its VISION 2020. The VISION is a city-wide strategy that looks to implement sustainable development throughout the economic, social, and environmental sectors of the city. However, the problem experienced by the City of Hamilton along with many global governments is that sustainable development may not meet the outlined goals within the time

requirement of the year 2020. The strategies outlined in VISION 2020 do not examine the synergistic relationship that exists between solutions; rather, it focuses solely on resolving the issues of each pillar separately.

Therefore, to obtain sustainable synergy, many have turned towards incorporating Eco-Industrial Parks (EIP) into sustainable development. EIP were initiated as a community of companies exchanged and utilized the by-products and energy of each other. The exchanges were originally created to minimize the cost of product disposal but as more exchanges were introduced, the environmental benefits also came to light and this solution became even more favourable. This research paper will focus on examining the phenomenon of Eco-Industrial Parks in detail by using case studies to illustrate how it is a viable method that can be used to assist the Hamilton region in becoming more sustainable.

2.0 Background

2.1 What is an Eco-Industrial Park?

Ecology is the study of the relationships among and between species and their physical-chemical environments. Three important features of ecology are the unique habitats which species depend on, the communities that species form by grouping together and lastly, the ecosystem.⁷ An ecosystem is defined as the interactions between the assembly of species, habitats, communities, and the physical and chemical components; which will then interact and create a stable ecological system.⁷ The stability of the ecosystem depends heavily on interconnectedness of the species. As an ecological system gradually matures, the connections within the ecosystem begin to expand.⁸ Industrial systems tend to emphasize independence and competitiveness of enterprises, yet they are embroiled in webs and chains of customers and

suppliers which is similar to the chains and webs in a natural ecosystem.⁸ Industries become dependent upon natural resources such land, building materials, water and hydrocarbons for energy supply. In other words, industries within an industrial ecological setting must be dependent on one another to survive.⁷

The field of study on Eco-Industrial Parks (EIP) is still quite young. In the early 1960s, the idea began to surface about a novel approach to environmentally sustainable economic development.⁸ It is difficult to specifically define an eco-industrial park as each one is unique in specific aspects.⁹ Originally, an eco-industrial park was simply defined as a community of companies located within a single region that made use of each other's energy and by-products.¹⁰ The modern concept of EIP tried to mirror the cyclical process of the ecosystem which included raw material extraction, manufacturing, product use, and waste disposal.^{8,10} In this context, industries were viewed as webs of consumers, scavengers, and producers.⁸ A symbiotic relationship between the industries was encouraged in hopes of achieving the ultimate goal of reusing, repairing, remanufacturing, recovering and recycling products and the by-products.¹¹ By integrating both the principles of environmental stewardship and sustainable design along with the original premises of an EIP, the modern EIP can be defined by the following:

*“A community of businesses that cooperate with each other and with the local community to efficiently share resources (information, materials, water, energy, infrastructure and natural habitat), leading to economic and environmental quality gains, and equitable enhancement of human resources for the business and local community”.*¹¹

2.2 Eco-Industrial Park Cyclical Loop Systems

To obtain sustainable synergy, EIP must follow the cyclical loop system, from a *Type I* to *Type III* system, of industrial ecology.¹² A *Type I* system is presented as a linear system, where an

unlimited amount of resources enters the system while products and waste leaves the system.

The very early stages of industrial development contained similar characteristics of the *Type I* System.¹² However, as industrial development progresses, it cannot continue to adhere to the linear path of a *Type I* System as the concept can only be applied to an input of unlimited resources that feeds the system and unlimited space to discard waste leaving the system.¹³ One of the primary reasons many have turned towards EIP is due to the diminishing resources and a lack of space to deposit waste and used products.¹⁰

Therefore as industry keeps developing, it will enter a *Type II* System. This System is characterized by the input of limited resources, the limited amount of waste leaving the system, and a partnership to exchange energy and material between components within an ecosystem. A *Type II* System is representative of a developed industrial system incorporating sophisticated technology and a certain degree of waste recycling and pollution prevention.^{12,13} Current industrial systems including EIP fall under this partially closed loop system where the systems recycle and reuse materials and waste in order to reduce their resource inputs and waste outputs.¹³

The equilibrium of ecological systems is represented by a *Type III* System, where the energy and wastes are constantly reused and recycled by the other components of the process with the system. This is a completely closed loop system in which the only input would be solar energy.¹³ A *Type III* system is the ultimate goal of industrial development where the waste outputs would continually be reused and recycled thereby representing the ultimate sustainable process.^{12,13}

The problem is that an EIP will never be able to efficiently achieve the totally closed cyclical loop of a *Type III* System because it may result in the costs exceeding the benefits.¹³

Theoretically, manufactured products must leave the system eventually, diminishing the quantity of material circling within the system. Hence, the EIP system will be in need of new material inputs.¹³ The success of EIP will not simply be a function of its environmental record, but rather, its' ability to compete in the marketplace.¹⁰ As a result, the cost will always be a crucial underlying factor.¹⁰ The goal of EIP is not to mirror the cyclical use of resources in a natural eco-system, but instead to come as close as possible to being a closed-loop system with near-complete recycling of all materials.¹³

2.3 Approach systems to develop an Eco-Industrialized Park

When developing EIP, two main systems approaches must be considered: the engineered systems approach and the self-organized systems approach.

The engineered systems approach relies heavily on detailed analysis of data, resources and energy flows. The approach assumes that once the optimal profit- maximizing interaction is calculated, participants will adopt the process accordingly.¹⁴

The self-organized systems approach believes that facilitating organic growth while excluding an overall master design of exchanges and connections between participants will yield better results. In this approach, participants have ownership over the process and are able to develop a system will suit their unique needs and priorities.¹⁵

The difficulty with an engineered systems approach is that it does not account for the flexibility and unpredictability of individual participants within an EIP.¹⁵ For example, current EIP's may

contain hundreds of participants and exchanges, and a detailed analysis to calculate the most optimal design for all involved can be difficult if the goals and criteria for each individual participants is different from each other.¹⁴ Continued changes to the environment, participants and technology are also difficult to calculate and control. This approach is best used when the main criteria and goals can be controlled. The best case scenario for an Engineered Systems approach is when developing an EIP from the absolute beginning when the EIP consists of only land. The land will be developed with industries, material/waste exchanges, and participants that fit within the specific EIP model set by the engineered criteria and goals.¹⁴ Since many EIP and possible EIP sites consists of pre-existing participants, the self-organized systems approach has been found to be the most successful systems approach. It is founded on the basis that each participant within the EIP will make their own connections and in turn, design their own solutions to problems they are presented with.¹⁵

3.0 Eco-Industrial Parks Around the Globe

The concept of EIP is fairly young, materializing only about three decades ago. However, the idea was well received and currently EIP are numbering at 12600 sites in different locations worldwide.¹⁶ Each site is unique and was designed and developed through collaboration of the industries and communities involved within the EIP. Many areas in developed countries along with remote areas in developing countries have encompassed the EIP concept in hopes of moving towards a sustainable future.⁹ The following sections below will describe the concept behind few of the EIP found globally.

3.1 Kalundborg Eco-Industrial Park

3.1.1 Kalundborg Eco-Industrial Flow Loop

The Kalundborg Eco-Industrial Park was the first successfully-functioning recycling network. Kalundborg is a small city in Denmark with a population of 20,000 residents.¹⁶ The Kalundborg EIP was conceptually designed when the five main industrial companies came together in the 1972 under the premises of reducing costs by creating methods of producing income from the unwanted by-products.¹⁷ Eventually, the industries and communities involved in the Kalundborg EIP began to incorporate an environmental agenda into the project, while only beginning to examine the environmental benefits created through the reduction of energy and waste outputs.¹⁷ The five core industrial participants include Asnaes Power Station which is Denmark's Largest coal-fired power plant; Europe's largest plasterboard manufacturer, Gyproc; Novo Nordisk pharmaceuticals plant which produces pharmaceuticals including 40% of the world's insulin supply; Denmark's largest oil refinery, Statoil; and lastly, the municipality of Kalundborg, which distributes heating, electricity and water to the local community.¹⁸ The main idea was that the by-products from one company can be reused as a form of low-cost product by another company, thereby exchanging materials and energy.¹⁷

The Kalundborg Eco-Industrial Park was designed to operate in the manner described by the flow diagram in **Figure 1** below. The Asnaes Power Station collects fresh water from Lake Tisso as an input and supplies residual steam to Statoil refinery.¹⁹ Asnaes, in exchange, gains waste refinery gas from Statoil Refinery, which it then burns to produce and generate electricity and steam for the company. The surplus electricity and steam is sent to the Kalundborg community which serves about 4500 homes, the local fish farm and the Novo Nordish Plant. The Asnaes

Power Plant also produces other waste by-products such as 170,000 tonnes of fly ash per year which is received by a cement company or cement manufacturing and road building.¹⁹ 1.5 million cubic meters of excess sludge from Novo Nordisk pharmaceutical process and the fish farm is delivered to local farmers for use as fertilizer. Gyproc purchases 80,000 metric tons of Asnaes' excess fly ash at a large discount and uses it to create gypsum, a material used in the plasterboard manufacturing system, hence, meeting two-thirds of its gypsum requirement.¹⁹

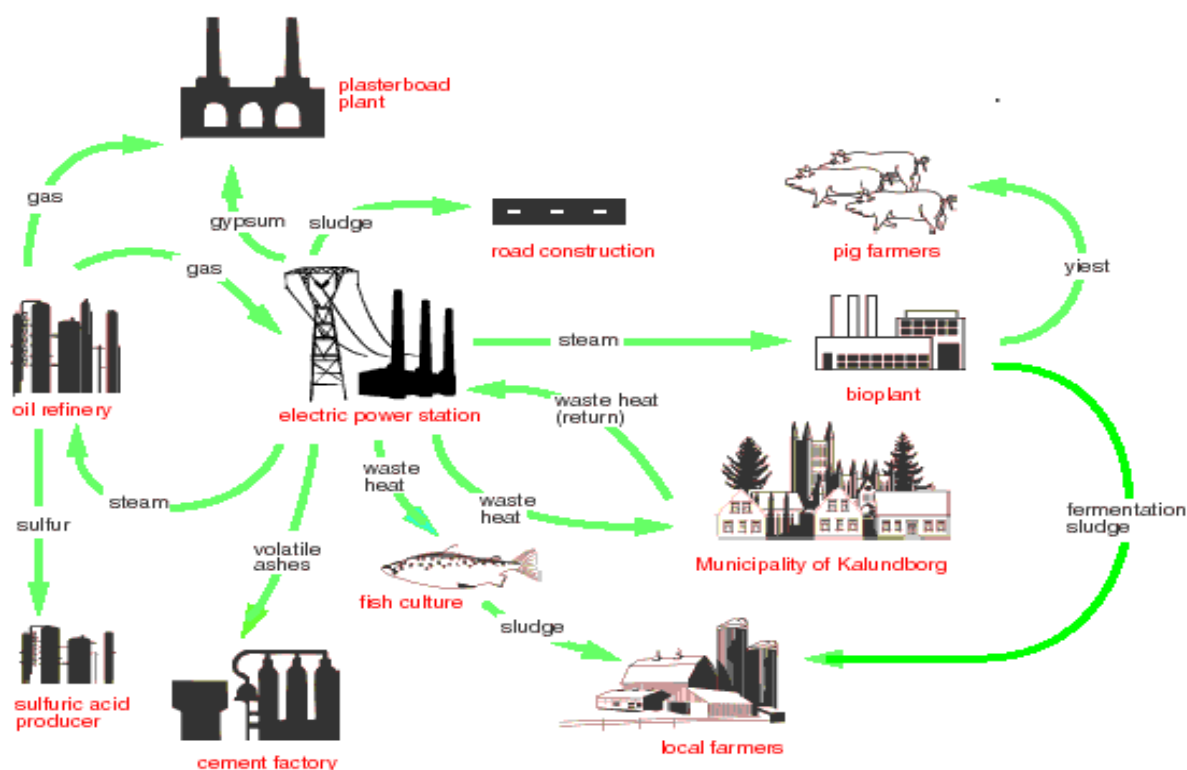


Figure 1 : Kalundborg Eco-Industrial Park¹⁹

3.1.2 Benefits

The economical and environmental benefits of the Kalundborg EIP project are abundant. The park allowed the participants to improve resource efficiency such as Gyproc experience with a reduction in its oil consumption by 90 to 95 percent when switching to the excess gas supplied

by Statoil Refinery.²⁰ 95 percent of the total supply of water to the Asnaes plant was due to water reuse and exchange within the EIP.²⁰ In 2004, it was calculated that the EIP has saved about 3 million m³ of water annually through reuse and recycling.²¹ 30,000 tons of straw is converted into 5.4 million liters of ethanol. A savings and reduction in the use of materials were also experienced including saving 150,000 tons of Gypsum.²¹ The area encompassing the Kalundborg EIP has also witnessed a significant decrease in pollution when compared to other industrial intensified cities in Europe. At the early stages of the EIP concept in 1995, about 3 million tonnes a year of material and energy were exchanged between the industries.²⁰ The participants experienced a total of \$15 million in savings annually along with continued investments which currently correlates to savings of about \$300 million dollars US and a revenue of approximately \$120 million dollars US per year.²⁰ From its inception in the late 1970s with the energy and material exchange between the five core participants, it has currently grown to over 30 exchanges between more than 18 small and large businesses in the Kalundborg area.¹⁹

3.1.3 Lessons from Kalundborg Eco-Industrial Park

Kalundborg's success has helped spark interest within the global industry about the economical, environmental and overall sustainable benefits of EIP.²¹ The executives behind the Kalundborg EIP have always argued against public planners critiquing that Kalundborg can be copied and improved upon. Kalundborg executives believe that others interested in developing EIPs should not look towards Kalundborg as a model in which they could replicate the exact industries and industrial exchanges and pipes fittings.²¹ Rather, they refer to it as model in how participants should collaborate together naturally to create a successful EIP that has a unique identity of its own. As explained previously, Kalundborg EIP was not originally created as a result of

environmental planning nor was it from the participant's interest in environmental protection.²²

Instead, it was meant to lower costs through accessing cheaper materials and energy and to reduce waste treatment and disposal costs.

Many do not realize that the Kalundborg EIP is not a cyclical closed loop system as described earlier but rather a *Type 2* loop system which is not fully self-sufficient.^{12,16} For example, the 200 tons of fish produced within the fish farm in Kalundborg are exported to French markets annually.¹⁶ Gyroc still imports a third of virgin gypsum, which is a significant amount, from distant countries such as Germany and Spain. Of the 1.2 million cubic meters of wastewater discharged, only 9000 cubic meters is reused at the Asneas Power Plant while the rest is still disposed.¹⁶ Kalundborg is continually improving their processes annually on the merits of lowering operational costs whilst subsequently improving environmental protection.²²

Experts have concluded that the success of Kalundborg lies upon its self-organized engineering approach which begins with the notion that all contracts are negotiated on a bilateral basis.²⁰ Kalundborg was created based on private conversations in the 1960s and 70s. Statoil needed fresh water for its process and therefore, it created an exchange (tube) connecting the company to Lake Tisso in 1961.¹⁷ In 1972, Statoil and Gyproc built an exchange between the two companies to transfer the surplus gas from Statoil's production. In the next year, Anseas Power Plant built exchanges between Lake Tisso and Statoil to address their water and wastewater needs.¹⁷ Slowly, Kalundborg Park kept growing. Each contract and exchange was the result from the conclusion between both participants involved, the main aim to create and expand this project was for economic reasons rather than how environmentally attractive it was.¹⁶ The government once tried to force the Kalundborg EIP to consider environmental

protection as a focal point in decision making and it resulted in a loss of revenue for the participants involved due to the strict environmental criteria set by the government. Each participant complies in hopes of minimizing the risks.¹⁶ Lastly, each company evaluates its own deals independently. Participants within the EIP do not to create a system-wide evaluation of performance nor does it impose standards for others because they believe it has been most successful and efficient when participants set their own standards and goals.¹⁶

3.2 Burnside Cleaner Production Centre

Based on the success of the Kalundborg Eco-Industrial Park, many developed countries began projects to implement the concept of EIP into their industrial sectors. The United States believed in benefits of EIPs and was quickly driven to implement concept within its industrial sectors.²¹ Currently, the United States has hundreds of EIP developed or in the stages of development. Canada has recently begun to adopt the idea of EIP into their sustainable agenda and have discovered 40 sites around Canada which would be suitable for this type of development.¹⁰ Canada has gained EIP success in a few sites such as Burnside Eco-Industrial Park in Nova Scotia as well as the Bruce Energy Centre in Trenton, Ontario and in Sarnia, Ontario.

With the help of the provincial and federal governments, the Burnside Cleaner Production Centre was created in 1995 to assist in establishing industrial ecological exchanges and linkages within an industrial park in Burnside, Nova Scotia. The role of the Cleaner Production Centre was to facilitate, promote, and assist 1,200 local businesses with the concept of sustainability.²³ The Centre included services such as assistance for searching for suitable technologies, energy and material conservation as well as improving resource use efficiency for participants in the Burnside EIP. Waste audits were used for facilitating reduction in packaging waste and lastly, in

order to assist in identifying energy and waste exchanges between companies.²³ The Burnside Cleaner Production Centre is a practical solution that has assisted in creating EIP linkages. A packaging firm was able to reuse the surplus of polystyrene from a computer company.

There are 25 printing firms located within the Burnside EIP and steps are being taken to create a silver recovery program for the printing industry through collaborative resource grouping.²⁴ A company within the park collects recycled corrugated cardboard and will send it to be processed into liner board. 19 firms in the Burnside EIP distribute, manufacture, or retail chemicals and thus, a chemical recycling program has been created between the firms. The Centre helped in creating a paint swap program between the 21 firms currently using paint in their processes in hopes of reducing the 5038 litres of paint discarded annually.²³ The Centre is in the process of identifying linkages to create a programs suited towards the reuse and recycling of toner cartridges, furniture refurbishing and the re-inking of ribbon.²³

The EIP in Sarnia, Ontario is an industrial exchange program between oil refineries, petrochemical companies, a synthetic rubber plant, and a steam electrical generation station. The Bruce Energy Centre in Ontario is a small eco-industrial park centered around a nuclear power station to use its waste heat and steam generation for processes such as distillation and dehydration.¹⁶

3.3 Hamilton's Airport Employment Growth District Eco-Industrial Park

The Airport Employment Growth District (AEGD) encompasses 1,340 hectares of land surrounding the John C. Munro Hamilton Airport.²⁵ It is a City led initiative to develop the employment opportunities within Hamilton and to support further population growth in accordance with the concept of an eco-industrial park.²⁵ The AEGD area was chosen due to

Growth Related Integrated Development Study (GRIDS) conducted in conjunction with the City of Hamilton Water and Waste Water Master Plan.²⁵ The study set out the population and employment targets and listed the major water and wastewater infrastructure throughout the City up to the year 2031. According to GRIDS one major area of employment growth was the existing agricultural lands surrounding the John C. Munro Hamilton Airport.²⁶ The report estimates that the AEGD site will provide approximately 27,700 jobs and about 660 net hectares of new employment land by 2031.²⁶

The AEGD project is adopting an engineered system approach in that it is encompassing a small area that has not been thoroughly developed thereby easily allowing the City to develop the EIP within the City's sustainable parameters and guidelines.^{14,25} For example in terms of water conservation it was calculated that for the expected employment criteria, the average water demand 260L/emp/day, the average daily water flow is 260L/emp/day and the overall water demand for the AEGD Secondary Plan Area is approximately 22ML/d.²⁵ The plan went to further calculate that the airport will passenger will see a flux of 9.5 Million Passengers/Year and the daily water consumption per passenger is 30-33L/passenger.²⁵ Developers will have to design methods in which to obtain specific sustainable water goals by using either water conserving technology such as low flush toilets, collecting and using rainwater, or creating a water exchange system.²⁵

The Master Plan further outlines more principles and criteria for other aspects of the EIP. For example, for industry within the AEGD, it will consist of light industry, warehousing, repair, wholesale trade, office, distribution, transportation, communications, and utilities.^{25,27} It will have minimum standards for urban design. Controlled outdoor storage, accessory uses such as

smaller offices and retail and ancillary support for commercial schools, health services, and financial establishments.²⁵ For airport related businesses, businesses must require airside access such as freight forwarders, regional integrator operations, and onsite custom brakes.^{25,27} Some urban park guidelines to follow are to integrate nature into public spaces by creating natural use as buffers, open space and trail systems. Provide a variety of public spaces and walkable places throughout the employment district that provide employees an opportunity to come together and to use native species in landscaping.^{25,27}

Another aspect of the AEGD Master Plan is to include elements of sustainability into the AEGD. Transportation networks must include public roads and lane designs that can reduce congestion, pedestrian/bicycle paths, carpool lots, green corridors, and future transit routes connecting to future rapid transit.²⁵ It must also require reduced parking areas with sustainable features such as permeable pavement and landscaping. The AEGD plan must incorporate a minimum of 25 % efficiency improvement over the Model National Energy Code for Buildings.²⁵ Water and wastewater management requirements include the use of drought resistant low-maintenance landscaping for 50% of site and the use of rain/moisture sensors, programmer irrigation sensors, and rain captures.²⁵ Some important suitable elements in regards to construction is that a minimum of 75% of all building materials made within 800 km of project site and a minimum of 10% of building materials must contain recycled content.²⁷ For economic sustainability, it is important to promote synergy between waste producers and waste users and promotion of the importance energy, water, utilities and material exchanges among business. As of 2013, the AEGD Master Plan has been completed and approved. In the next few decades, it will be interesting to witness the unique development of the AEGD Eco-Industrial Park.

4.0 Benefits and Barriers of Eco-Industrial Park

4.1 Benefits

The EIP began as a method of reducing costs related to material and output waste for industries.

Gradually as EIP began to develop, it began to incorporate elements that were beneficial to environmental and societal sustainability. Table 1 below lists some of the benefits of EIP.

Table 1: Benefits of Eco-Industrial Parks

Community	Environment	Industry
Expanded local business opportunities	Larger tax base	Wide range of potential cost savings;
Larger tax base	Community pride	Revenue generation
Community pride	Reduced waste disposal costs	Promotional/marketing opportunities
Improved health for employees and community	Improved environmental Health	Improved opportunities for new investment
Improved environmental Health	Improved environment and Habitat	Costs savings through regulatory flexibility.
Improved environment and Habitat	Enhanced quality of life in areas near eco-industrial development	Improved environmental efficiency
Enhanced quality of life in areas near eco-industrial development	Improved aesthetics	Access to financing

4.2 Barriers of EIP

A general barrier experienced within the EIP structure is that it may prove to be an obstacle in furthering technological evolution and continued reliance on toxic chemicals.¹⁰ If companies are experiencing the same economical profits and environmental benefits with the outdated technology included in the process, there will not be any pressure to improve the technology or the technological standards in place.^{9,12} If companies within the EIP structure can easily discard

or exchange hazardous materials, avoiding deposit costs, the company may be reluctant to switch from hazardous to non-hazardous.

Inter-firm dependency is a barrier that can have a very negative effect upon the EIP structure.^{9,15}

As explained previously, participants are interconnected and rely on each other within an EIP therefore if one participant were to leave or closed down; those dependent upon that particular participant will be in risk of losing a critical supply or market.

Strict environmental regulations are creating many barriers in product exchanges. Once a product has a certain characteristics, it is classified as waste and is subjected to a number of restrictions and administration procedures.¹⁶ Therefore many find it difficult to reuse or recycle hazardous waste between companies due to strict regulations. Some municipalities, especially the City of Hamilton, have very strict zoning laws which hinder many proposed developmental projects. Regulation harmonization is rarely practised thereby making it difficult to exchange materials. Laws and regulation differ between municipalities; therefore one municipality may have less stringent laws and regulations than another, making it more difficult to carry over concepts from one EIP to another.¹⁶

In some municipalities development of energy related programs have been blocked by government-owned monopolies. There are steps being taken to deregulate the utility sector in Ontario which may result in new energy based EIP projects moving towards implementation.

5.0 Canadian Strategies and Policy Framework

The Canadian government must play a large role to successfully implement the concept of eco-industrial parks into Canada.¹⁰ Governments have the ability to push guide towards a desired

direction using both policy and technology. Governments in developed countries have currently been moving towards sustainable development due mostly to public outcry about rapid environmental degradation; therefore governments can create policies, laws, regulations and programs that can guide the residents towards a transition towards a sustainable future.⁹

Since the success of the Kalundborg EIP, the United States government has begun to adopt the EIP model into its societal framework through creating awareness and incentive programs, laws and policies that specifically target EIP development.¹⁶ This has allowed for the implementation of over one hundred EIPs within the United States and been a large driving factor behind plans for many more.¹⁰ The Canadian government has begun to understand the importance of the sustainable benefits provided by EIP and have now taken steps to begin implementing EIP's into society. Currently Canada does not have any specific strategies and policies directed towards EIP but the existing sustainable strategies and policies can be adopted to suit the needs of EIP development.

5.1 Canadian Strategies

5.1.1 Securing Our Future Together

The government strategy, Securing Our Future Together, was focused on promoting innovation, improving science and technology, resource use efficiency, research on toxic substances, action on climate change, and investments in infrastructure.²⁷ The strategy was instrumental in providing funding towards research and development of sustainability and creating many sustainable programs.²⁷ The limitations of this plan, however, was that the sole responsibility and accountability of sustainable development was put upon the shoulders of departments and agencies where they took ownership of creating their own sustainable development strategies.²⁸

It was found there was lack of long-term focus due to an absence of an over-arching sustainable development strategy. The performance indicators created for the strategy were not accurate or comprehensive enough. The goals set by each department and agency had been too vague and unfocused, thereby failing to make any positive headway. Lastly, there was a lack of information on the progress of initiatives and programs due to the inadequate monitoring and development.²⁸

5.1.2 Federal Sustainable Development Strategy

Building upon past federal strategy failures, Parliament developed and passed the Federal Sustainable Development Act (FSDA) in 2008. The act required the Government of Canada to develop a Federal Sustainable Development Strategy (FSDS) that would create a framework to make environmental decisions more transparent to Parliament and also supports continuous improvements of the management of sustainable development. The FSDS framework has improved on established upon the following key elements:

- An integrated governmental venture incorporating the federal, provincial and municipal governments
- A link between sustainable development planning and reporting and the Government's core expenditure planning and reporting system,
- Create an effective compliance committee that can oversee and keep track of the progress of the strategy

Responding to past limitations the FSDS clearly states the Government's long term vision, targets, plans and goals for environmental sustainability which are categorized under four main priority themes: Reducing environmental footprint, Addressing climate change and clean air, protecting nature, and maintaining water quality and availability.²⁹

Under the FSDA the Government has also created the Canadian Environmental Sustainability Indicators (CESI) initiative, a program to monitor whether the FSDA is in compliance with its goals.^{29,30} The CESI chooses indicators based on the policy relevance represented by the FSDS goals and targets, whether the indicators meets the needs of the public and decision-makers, provides solid and consistent sound methodology and lastly data availability. The CESI is slated to measure the FSDS progress every three years.³⁰

Currently, the FSDS strategy has been successful in abiding by the goals and principles set by the strategy. Under the FSDS climate change goals for reducing greenhouse gas emission levels, it has developed a clean energy and climate change strategy that harmonizes with that of the United States.²⁹ Created new regulations requiring 5% of renewable content in gasoline and diesel fuel and frequent publishing of regulations for greenhouse gas emissions such that it aligns with the 2020 automobile emissions reductions targets of the United States.²⁹ The FSDS strategy is working on meeting its air pollution goal by moving forward with the Clean Air Regulatory Agenda, moving industry from voluntary compliance to regulations, and continuing to consult with provinces, territories, industries and Canadians to set and reach targets for reducing air pollutants and greenhouse gas emission.^{29,30}

5.1.3 Vision 2020 Hamilton

In 1992, the City of Hamilton adopted VISION 2020, a strategy which decided what the City of Hamilton would look like in the year 2020.³¹ Every five years, the VISION has been updated and the final goal of VISION 2020 was established which describes Hamilton as a fully functioning sustainable community. The VISION 2020 consists of goals, strategies, and compliance measurements that will help in shaping the sustainable future of Hamilton.³¹ VISION 2020

sustainable principles were built upon the following areas of focus such as ecological preservation, reducing and managing waste, reducing energy consumption, improving the quality of water resources, improving air quality, sustainable transportation, and community well-being.³¹ VISION 2020 went on to further state specific goals for the suggested areas of focus. For example, for the local economy of Hamilton, the VISION has set a goal to increase the number of non-polluting businesses and organization and those who produce sustainable products that reduce and prevent pollution.³² To improve the quality of water, the VISION has set a goal to identify and virtually eliminate all sources of potential chemical contamination.³² Another goal is to reduce the consumption of non-renewable energy and eliminate the excessive and wasteful use of energy. One of the principle goals of the VISION is to increase public awareness and participation to accomplish the outlined goals.³²

VISION 2020 has been the backdrop for the recent Airport Employment Growth District project, where goals such as reducing energy and water conservation, preserving natural areas and corridors, and improving the local economy correlate with many of the goals and principles of the VISION.^{25,32} VISION 2020 has been awarded numerous awards and accommodations such as the National Guide to Sustainable Municipal Infrastructure. The VISION has aided in the development of many sustainable projects and ventures and been the fundamental factor in championing Hamilton towards a sustainable future.²⁵

5.2 Governmental Sustainability and Incentive Programs

As mentioned previously, there are currently no programs that specifically support EIP development but the programs that are available can be adapted to suit the main primary

priorities of EIP. The federal, provincial and municipal governments provide the public with a variety of programs that will help in understanding and developing sustainability.

5.2.1 Infrastructure Programs

The Industrial Incubation Program in Nova Scotia provides rent subsidies to assist new manufacturing and processing companies.³³ Industrial mall managers can use this program to attract industries that use each other's by-products with the incentive of rent subsidies provided by the provincial department of Public Works and Transportation.

The NOHFC Community Infrastructure Capital Assistance Program dealing with infrastructure development provides a subsidy for costs relating to design, sight planning, engineering and construction costs for site improvement, materials, equipment, and labour.³⁴ This incentive program exists through partnerships of the private sector, other levels of government, non-profit education, municipal and other organizations.³⁴ EIPs could be created through the collaboration between the incentive programs and many partnerships associated with the program.

The City of Hamilton's Environmental Remediation and Site Enhancement (ERASE) plan is designed to encourage and promote Brownfield development.³⁵ The ERASE Study grant is available for Brownfield development. The City pays up to one-half the cost of a Phase II or Phase III Environmental Site Assessment. Maximum city allows is \$15000 per study period and \$20000 per property. The grant is calculated as 80% of the increase in the municipal portion of property taxes and is paid on annual basis for up to 10 years, commencing once the redevelopment is complete.³⁵

5.2.2 Energy and Waste Programs

The Government of Canada has provided many tax incentives and programs that encourages businesses to reduce energy, waste, and to use insurable energy. The Ontario provincial government provides rebate incentives on sustainable technology such as electric vehicle, energy efficient lighting, low-flush toilets, and energy/water conserving household appliances. The Ontario Ministry of Energy and Infrastructure provide the Home Energy Savings program where residents can sustainably upgrade their property to reduce their energy and waste consumption and a rebate of up to \$10,000 dollars may be provided. Large rebate and tax incentives are provided to industries that undergo a green retrofit to reduce energy and waste consumption. Therefore EIP concepts can be implemented in that processes where they could create energy exchanges between industries to meet the energy incentive requirements for the retrofit.

The Canadian Industry Program for Energy Conservation (CIPEC) along with a Partnership with Natural Resources Canada help organization cut costs, improve energy efficiency, and reduce greenhouse gases.³⁸ They have cost-shared assistance programs, of up to \$25000, available for implementation pilots, process integration studies and computational fluid dynamic studies. They have access to industry networking which includes fifty trade sectors.³⁸ The industry networking opportunity can be utilized to form exchanges and linkages between many industries in different sectors. Lastly, the CIPEC provides energy management workshops and technical information.³⁸

5.2.3 Environmental Programs

Recent policies and programs adopted by the federal and provincial governments can encourage the formation of EIPs. The environmental programs can help create an exchange between the natural environment and the community in order to foster community well-being.

Many projects are currently underway and are targeted at conserving the ecosystem within the City of Hamilton. The Dundas EcoPark Campaign is project that is trying to protect and restore the natural habitat encompassing 4,700 acres. It will protect over 1,500 species of birds, trees, and wildlife and help in restoring and maintaining meadows, healthy forests, waterways, and hiking trails.³⁹ The preservation and protection of the local natural environment can attract future residents and business as well as strengthening community well-being and pride.³⁹ Industries, businesses and the local community can include the natural environment within their EIP design, using the local environment as an aesthetic exchange.

The Province of Ontario recently included a recycling fee to electronic products in hopes of reducing electronic waste.⁴⁰ The fee would subsidize the cost of electronic recycling and the electronic waste would be sent to adequate recycling facilities where 98 % of the electronic waste is recycled.⁴⁰ The problem with the fee was that the public was unaware and were still discarding the electronic waste into municipal landfills. Therefore the Province could create an innovative solution that encompasses EIP concepts where they begin to promote the flow of material exchange of electronics between the community by promoting trade websites like Kijiji and Ebay. The consumers can sell and trade products online thereby promoting the reuse of electronics. Another idea is creating a material exchange loop between local companies that are

willing to collect the electronic waste from consumers for the reusable components within the electronics.

5.2.4 Research and Development Programs

Research and development programs are instrumental in developing new technologies and process. There is a wide range of federal and provincial programs available dealing with agriculture, energy water, waste by-products and manufacturing. Many small grants from \$15,000 to large loans of \$500,000 are available.

The Securing our Future Together Strategy, assisted in establishing the Canada Foundation for Innovation which was created to stimulate further research in industrial ecology. The Foundation was given \$800 million dollars to assist in research and development investments focusing their support towards research in Canadian universities and hospitals.⁴¹

Recently, a team of Environmental Studies university students completed a research project on the industrial ecological opportunities and barriers in Toronto's Portland District. The study was beneficial in discovering that a number of companies within the area were already engaging in EIP exchanges and linkages and the study concluded that there were unrealized potential industrial ecological linkages within the district. They team also found that some barriers in creating linkages were due to confidentiality issues where companies were hesitant in providing third parties with information about their inputs and outputs. The study found that there was a lack of mechanisms needed to promote information exchange about the benefits of EIP. The students found that promoting the economic benefits of the EIP concept was far more successful than appealing to the environmental benefits. Lastly, they found that there was a lack in knowledge among companies about the different types of businesses located in other areas of the

district and many were unaware of the possible linkages that existed. Similar research studies can be conducted where the results can be helpful in the development of future EIPs.

6.0 Conclusion

The development of eco-industrial parks in the City of Hamilton is one important strategy to fulfill the Hamilton VISION 2020 in developing Hamilton into a fully sustainable community.³¹ EIP encompasses the principles of sustainability in that the final goal is to bring the park as close as possible to being closed-loop equilibrium between the economy, society and the natural environment.¹³ EIPs do not work inside traditional sustainability parameters in that it usually does not focus on environmental stewardship as its fundamental goal. EIPs were originally developed for economical benefit due to high waste-byproduct disposal costs. As linkages were formed through exchanges of waste by-products, unknowingly environmental benefits were also experienced. EIP linkages usually begin with a sole purpose, but gradually each link will begin to encompass all three pillars of sustainability.

Developing an EIP in Hamilton may seem like a difficult task due to its enormous size and the large number of different industries, natural environments and communities. EIPs do not have to be large in size or contain numerous amounts of linkages. The Bruce Energy Centre in Ontario is a small eco-industrial park containing a few linkages that reuses the by-product outputs between the processes within the nuclear plant.⁴² Kalundborg Eco-Industrial Park consists of a maximum of 18 participants, 30 exchanges and covers a relatively small area.¹⁷ Hence, a possible EIP development idea for Hamilton could be to create smaller EIPs, like the Airport Employment Growth District Eco-Industrial Park, around the Hamilton area. Hamilton can adopt the self-organized systems approach used in the development of EIPs to ease the transition

into sustainability. The approach gives control to the participants within the EIP to develop their own linkages suited to meet their needs. Kalundborg EIP began with a single exchange between Statoil Refinery and Lake Tisso due to Statoil's need for a fresh water supply.¹⁷ Gradually, the EIP grew larger in size due to a growth in the number of linkages between the industries.¹⁸ By identifying and organizing possible linkages between industries in Hamilton, it has the possibility of gradually developing into an EIP overtime. An engineered systems approach can also be administered in Hamilton's many newly developing areas. The engineering systems approach is most successful in newly developing areas where detailed criteria is utilized to design the industries and communities within the EIP. For example, the AEGD Eco-Industrial Park was created using the engineering systems approach and followed the restrictions of the detailed criteria set by the developers, such as not allowing the development of large industries in order to allow the EIP to thrive.^{14,25}

Newly developing EIPs are beginning to build their parks upon social and environmental linkages as opposed to linkages driven by economic benefits. The Fugisawa Factory Eco-Industrial Park is built upon the concepts of environmental stewardship.⁴³ This EIP is located on the site of an old Panasonic Plant consisting of 1000 homes, a few stores, healthcare facilities and public green spaces.⁴³ Panasonic wanted to create a sustainable Smart Town where the primary goal of the EIP is to reduce CO2 emissions by 70% and cut household water usage by 30%.⁴⁴ To achieve these goals, the EIP is building the homes and commercial buildings that contain the latest energy conserving technology, where energy savings per home will be about 70% and 20% in public spaces in the town.⁴⁴ A sustainable transportation network will be created that will eliminate the need for vehicles inside the Park. To increase community well-

being, they have created nature trails connecting homes and the commercial district.⁴⁴ Similarly, EIP projects in Hamilton can be centered on environmental and social exchanges. Hamilton contains a vast amount of natural environment and respective projects like the Dundas EcoPark Campaign which can assist in creating links between the environment, the local community and industries that can benefit all involved while adhering to environmental stewardship.

Once linkages are identified and strengthened, the EIP has the ability to develop and flourish on its own. The difficulty lies in creating the linkages due to a lack of support tools available.

Information about EIP needs to be distributed to the Hamilton community in order to make the public aware of the benefits. An informed public can be a great driving force in support of EIP development in Hamilton. Strengthening existing partnerships with the government, private, public organizations and civil society groups for ideological and financial support is a valuable step that should continue to be prioritized in EIP development. Plausible steps must be taken to create a central figurehead that will look after and help with further EIP development similar to the role played by the Burnside Cleaner Production Centre located in Burnside Eco-Industrial Park.²³ The Centre's primary role is to promote and facilitate with EIP development through providing programs help the public in identifying and facilitating waste and energy linkages between firms. There needs to be municipal policies, strategies, and programs created specifically for EIP development as it continues to become more difficult for the public to innovatively adopt sustainable strategies and programs to suit EIP development. A good starting point for EIP development in Hamilton would be to include EIP development into the next review of VISION 2020. Although the government conducts both external and internal evaluation reports, key findings of these reports should be made available to the public to

demonstrate accountability and optimal use of resources. Evaluation mechanisms should include establishing baseline data, interim assessments as well as evaluations of specific policy and program outcomes. Feedback from community members and third-party should also be well-received. By undertaking both small and large scale in-depth longitudinal research projects, this municipal government can become better informed of local, context-specific conditions and base their practices and policies on evidence-based, cost-effective interventions. It will then be able to disseminate the information that it gains from the situational analysis to the local, national and international communities to identify the opportunities for improvement and gaps in services.

EIP is a viable method which can lead the City of Hamilton towards a sustainable future. It is one of the few methods that truly encompasses the sustainability motto of creating a synergy between the economy, society, and the natural ecosystem. EIP has proven to be very successful in the past as seen through the case examples. Lastly, it is the one of the very few methods available at this moment to handle the global crisis that is fast approaching.

7.0 References

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